

PLACER MINING IN ALASKA IN 1929.

By

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INTRODUCTION

This is the first of a series of annual reports on placer mining to be published by the Territorial Mining Department of Alaska. In 1922, the writer, as placer mining engineer for the U.S. Bureau of Mines, began an investigation of placer mining conditions and a study of placer mining methods and costs in Alaska. Three seasons were spent in the field in connection with this work, including visits to all the more interesting and important districts as well as to most of the fifty and more other distinct placer mining localities. The report was completed by the end of 1924, but did not become available for distribution until 1927, when it was published as U.S. Bureau of Mines Bulletin No. 259, "Placer Mining Methods and Costs in Alaska"(1).

(1) Obtainable from the Superintendent of Documents, Washington, D.C., Price 55 cents per copy.

This Bulletin is a comprehensive work on Alaska placer mining conditions, the mining methods employed, and costs, and is of interest and aid to placer miners, engineers, and all others interested in the industry.

After the completion of this work, placer mining investigations were continued by the writer during 1925 and 1926, the latter year under the Alaska Branch of the U.S. Geological Survey. All of this work was done under a cooperative arrangement between the Territory of Alaska and the Federal department as of the time above mentioned. Annual reports were written each year, 1922 to 1926 inclusive, to give early publication to the results of the current season's work through the Annual Report of the Mine Inspector (B.D. Stewart) of Alaska. These annual reports gave a general review of the placer mining industry in Alaska and a review of the placer operations and developments conducted in the various districts during that year. The 1922 and 1923 reports were so published, but due to lack of funds for such a purpose, the three later reports remain unpublished.

No similar investigative work has been done since 1926, until this year, when by an Act passed by the Legislature of the Territory of Alaska, funds were appropriated to establish and maintain a Territorial Mining Department. One of the duties of this department is to conduct mining investigations and give whatever aid to the prospectors, mine operators, and the industry in general, as conditions permit. N. L. Wimmeler assisted by Irving Reed were then engaged to carry on with the placer mining work.

It is only possible to visit a relatively few of the many different placer districts each season although airplane travel has greatly facilitated this work due to its great saving in time in getting to and from the distant or more isolated localities. Through the kind and necessary cooperation of many of the operators and others interested in this work, reliable information has been obtained on the operations and developments in most of the districts that could not be visited during the current season. In addition to the information obtained by this season's work and from the sources later acknowledged, there remains considerable interesting information on developments and operations obtained and recorded in the three unpublished annual reports mentioned which will in part be herein recorded.

It is the aim of the present report to bring the work up to date and make it as complete and comprehensive as conditions permit. In a report of this kind, details are considered necessary to make the information useful. Therefore details concerning the more interesting and important operations are given. Certain statements may be made which are in no way made to be critical but to point out some of the difficulties which may have been encountered in bringing the operation to its present stage. Sug-

gestions may also be made concerning possible improvement, it however being realized, that such suggestions may not always be practical for adoption at that particular operation but worthy of consideration when the method is considered for adoption elsewhere. A vast amount of information is available, much of it, however, being of a confidential nature. Permission has in many instances been granted to publish such information, while in other instances it must be withheld. It is regrettable that so much interesting and valuable data can not be made available to the public, but this department, like the U.S. Bureau of Mines and the U.S. Geological Survey, highly regards and closely guards such confidences for without them and the cooperation of the operators, a study of the true condition of the industry would be impossible. Until the past few years it has been possible to make early estimates of the total annual placer gold production and of many of the various districts which usually compared very closely to the official statistics obtainable some time later. Changes in the means of transportation of the gold, and its first shipment to various localities far distant from its source, in many cases by airplane, now make it more difficult to derive such early estimates. Hence such estimates that may be given in this report can be considered only as relative and preliminary and will no doubt require revision when the official statis-

tics become available. It is not the duty of this department to procure and compile production statistics. It is the duty and right of the Alaska Branch of the U.S. Geological Survey to do this and these data are therefore used when available and are here acknowledged. These official statistics are however not available for the current year at this time. The geology of the placers in the many districts have been studied and mapped by the geologists of the U.S. Geological Survey and reported upon in the many bulletins and technical papers published by that body since the industry started in Alaska, and to which the reader is referred.

The writer's field season included visits to placer operations near Juneau, and in the Porcupine or Skagway precinct. The trip to the Forty Mile precinct was made via Skagway, Dawson and Yukon Territory. Leaving from Dawson the Forty Mile precinct was visited. The following precincts were then visited in the order named: Eagle, Circle, Fairbanks, Tolovana, Hot Springs, the Yentna district of the Talkeetna precinct, and the Hope-Sunrise districts of the Kenai precinct. The field work of Irving Reed included the Koyukuk precinct and most of the precincts of the Seward Peninsula. The reports on these precincts under the "Review" include the information obtained by Mr. Reed.

The writer regrets it is not practical to record here the names of the many mine operators and other Alaskans who have given so much valuable assistance. Their cooperation is greatly appreciated for without it this work would be greatly handicapped. Their wonderful courtesy and hospitality in the field is most gratifying. Acknowledgment is here made to all, especially to all the operators and officials of companies whose operations were visited during the season. Special acknowledgment is made to the present Legislature of the Territory of Alaska, the members of which so whole-heartedly and generously supported this work, to B.D. Stewart of the U.S. Bureau of Mines, the Geological Survey, and the Territorial Mining Department, to Irving Reed, Earl Pilgrim and R. L. Stewart of the Territorial Mining Department; to Paul Hopkins of the U.S. Bureau of Mines at Fairbanks; to the U.S. Customs, the Alaska Railroad, the Alaska Road Commission, the Bureau of Public Roads, the various steamship companies and the Alaskan mining companies, having offices in the States; to W. J. Rendell, and Ed Holbrook of Dawson, Y.T., Jno. Powers, Jack Hillard and Chas. Ott of Eagle; Geo. Wesch, G.E. Jennings, A. Conrad of Fairbanks; Wm. Danielson of Chandalar; Warren and Farrell of Mason Creek and Ruby, Jno. Duncan of Rampart, Chas. A. Fowler, Jno. Urland and Harry Scott of Flat, Jno. E. Carlson and J.C. Duff of Cantwell; John O. Wahlgren of Chickaloon, and

to the many others who so kindly provided information.

PLACER MINING CONDITIONS IN 1929:

Climatic conditions during 1929 were exceptionally favorable for placer mining in that an abnormal water supply was available in most of the mining precincts. The winter and late spring snowfalls were in general much heavier than during average years so that most of the operations had a good supply of water during the early part of the season. Hardly before this supply began to diminish, rains set in and in most of the precincts, especially in the interior, the season was an unusually wet one. In some of the precincts there was little change from the average climatic or operative conditions, although a little more than the average precipitation was reported by the operators on the Seward Peninsula. This fall was in general also mild permitting many of the operations to continue later than usual. This favorable water season could however not be foreseen so that some operations were not prepared to make the most of it. A number of operations reported exceptionally extensive and thick "glacier" ice as having formed over their ground during the previous winter and the spring by the overflowing of the creeks and which delayed getting their operations underway. Several operations also met disastrous results by floods although there appears to have been less trouble from this cause than during some of

the other years. The dredging operations derived benefit from the improved water supply mainly in their stripping and thawing operations, although most of the thawing was done with pumped water. The hydraulic and the mechanical operations were particularly favored. However in the Nizina, Girdwood and other Coastal districts where many of the streams supplying water to the hydraulic operations are fed by glaciers, there was little, if any, change in the water supply which is usually ample irrespective of abnormal climatic conditions. The Interior precincts as well as some located elsewhere in Northern Alaska usually have a quite base-levelled and dissected topography which, in most instances, prohibits the obtaining of ample and steady water supplies under pressure suitable for hydraulicking or which can be made available at reasonable cost. As a result the hydraulic and some of the other operations in these precincts are seriously handicapped during a dry season and for the greater part of such a season must resort to storing water in small reservoirs or in enlarged ditches, releasing and using it intermittently. The frequency and duration of such use or "splashes" varies widely with the supply. Many of these operations this year had an extended period of water supply under a steady flow, however, regardless of the general wet season, the inter-

mittent use of water was still necessary to a varying degree.

PRODUCTION:

The total value of the mineral output of Alaska within a period of 49 years, 1880 to 1928, inclusive, is \$599,435,000, of which \$384,566,000 is the value of the gold and silver. Of this amount, the placers have produced \$250,008,000 in gold and \$1,204,000 in silver. More than 97 percent of this placer output has been made since 1898. In 1927, the placers produced \$2,982,000 in gold⁽²⁾,

(2) Statistics from Mineral Resources of Alaska; U.S. Geological Survey.

plus \$13,200 in silver. This was the lowest annual placer production made in many years and is a little less than the gold and silver produced by the lode mines in Alaska during that year. Since then some new dredges have been placed in operation in the Fairbanks precinct, and while several other Alaskan dredges ceased operation about that time, the total placer output in 1928⁽²⁾ was valued at \$3,347,000. in gold and \$14,000. in silver.

Complete statistics on the total placer gold output for 1929 are not yet available although early statistics show it to have been about \$4,000,000 plus about \$18,000 in silver. The Cape Nome and Fairbanks precincts

continued to be the largest producers being the principal dredging centers. The output of Seward Peninsula in 1929 was more than \$600,000 greater than that of the previous year. The Iditarod-Otter precinct made a very creditable production. Increases were also made in the Forty Mile, Circle, McCarthy and several other precincts where no dredges were in operation, the production being made principally by the hydraulic mines. In many of the other precincts, however, there has been a decrease in both the number of operations conducted and the gold production, so that the placer gold output by other mining methods than dredging remained about the same or may have been a little more than in 1928.

Predictions as to the future placer gold output can only be made with reservations. The total annual output by the dredges next season will no doubt be considerably larger due mainly to the increased scale of operation in the Fairbanks precinct. While several new dredging developments are under consideration, these can not be given serious consideration as possible producers for the next year or more. Production by hydraulic or other placer mining methods will, as a whole, probably decrease, for while new installations are under consideration a number of the old operations are passing while others have little or no opportunity of improving past performance. It must be realiz-

ed that the known placers of Alaska have been practically depleted of their higher grade ground, leaving the lower grade for present and subsequent mining. Much of this lower grade ground has already been mined, while most of the remaining ground which offers possibilities for profitable operation is now being worked or investigated. As transportation, economic and other conditions improve, the remaining areas will afford possibilities although their development and subsequent operation will be brought about more slowly than the operations now underway deplete their present holdings. A creditable placer gold production will be made by Alaskan operations for many years to come and no one familiar with Alaska can say there is not a good opportunity for the discovery of new placers, although it does not seem reasonable to expect future discoveries of such extent and importance as the Nome and Fairbanks fields. Discoveries such as the Tolovana district, the last discovery of importance made in Alaska, are more within the range of possibility.

Besides the gold and its silver recovered by the placer mines, a creditable production of tin concentrate and platinum is made. While Alaska does not rank among the important tin producing countries it has produced most of the tin credited to the United States. According

to the U.S. Geological Survey⁽³⁾ Alaska has produced during

(3) Mineral Resources of Alaska, 1927, P. 54.

the period 1902-1927, 1696 tons of tin ore or concentrate, with a metal content of 1051 tons, valued at \$1,007,000. The production in 1927, was 37.5 tons of concentrate containing 26.7 tons of tin as metal, valued at \$34,000. In 1928, the production of tin concentrate was more than 80 tons, containing 41 tons of tin as metal, this probably being equalled or exceeded in 1929. Further details on tin occurrences and mining are given under separate heading.

The U.S. Geological Survey reports⁽⁴⁾ a production

(4) Mineral Resources of Alaska, 1923, P. 31.

of platinum by Alaska of 2,599.9 crude ounces, or 2,488.42 fine ounces, valued at \$285,084, during the period of 1916-1923. While the occurrence of platinum has been noted at numerous localities in Alaska, its commercial production has until the last few years been limited mainly to the gold placer operations on Dime Creek in the Koyuk precinct and Bear Creek in the Fairhaven precinct, on Seward Peninsula, Boob Creek in the Tolstoi-Innoko precinct and Slate Creek in the Chistochina, Chitina precinct. For awhile, however, a small production was made as a by-product from ore mined at the Salt Chuck mine in the Ketchikan precinct,

the platinum, palladium and allied metals occurring in association with copper minerals. Platinum bearing formation is also reported at the head of Dime Creek.

The finding of platinum in encouraging quantities in the Arolic River or Quinhagak area in the Goodnews Bay-Bethel precinct was reported a few years ago, and a small amount has been recovered along with gold on several of the small tributaries. A year or so later, platinum bearing placers were discovered in a new area in the Goodnews Bay district, lying to the south of Goodnews Bay between that Bay and Chagvan Bay. This new area is reported to have produced 130 crude ounces of platinum in 1928, and with more operations underway in 1929, a considerable increase was made. The main production has come from Fox Gulch, Platinum, and Clara Creeks, and others were prospected this year. The platinum bearing placers here carry little or no gold wherein they differ from other occurrences. Further details on this area are given in this report under the Goodnews Bay district in the Bethel precinct.

Besides at the above mentioned localities, platinum has been found in small quantities in placers at several localities in the Copper River region, on Alfred Creek in the Nelchina, Metal Creek in the Kenai, the Kahiltna River and other streams in the Yentna and Susitna districts, Granite Creek in the Ruby district, several streams in the

Wade-Hampton precinct, Penny River in the Cape Nome precinct, the beach placers of Kodiak Island, and elsewhere.

GOLD DREDGING:

Thirty gold dredges were operated in Alaska during 1929; 12 of these being on the Seward Peninsula, 10 in the Fairbanks precinct, 6 in the Otter and Innoko precincts, one in the Hot Springs precinct, and one in the Bethel precinct in the lower Kuskokwim region. An average of 1300 men were employed in connection with these dredges, in dredge operation, ground preparation, and all other related work. More than 900 of these men were employed by the various dredging interests in the Fairbanks precinct.

The gold output of these dredges in 1929 is not definitely known at this time although it was a considerable increase over that of 1928, and around 70 per cent of the total placer gold output for the year. According to the U.S. Geological Survey, 26 dredges were operated in Alaska in 1928 producing gold valued at about \$2,178,000 or over 65 per cent of the year's total placer gold output.

The gold dredges operated during 1929, are listed in the following table which also gives some of their pertinent details. More detailed accounts are given in the report by mining precincts.

Two new dredges were constructed during 1929, but did not start operation until late in fall. These are

SOLID DREDGES OPERATED IN ALASKA

| <u>DREDGE OR COMPANY</u> | <u>LOCATION</u> | <u>TYPE</u> |
|---------------------------------------|-------------------|-----------------|
| <u>SEWARD PENINSULA</u> | | |
| <u>CAPE NOME PRECINCT:</u> | | |
| Bangor Dredging Corp. | Anvil Creek | Stacker |
| Dry Creek Dredging Co. | Dry Creek | Flume |
| Hammon Con. Goldfids. Co. No.1. | Third Beach | Stacker |
| " " " " No.2. | Monroeville Beach | " |
| " " " " No.3. | Third Beach | " |
| Goldsmith Dredging Co. | Solomon R. | Flume |
| (1) Lomen Reindeer & Trading Co. | Osborne Cr. | Stacker |
| <u>COUNCIL PRECINCT:</u> | | |
| (2) Casadepaga Mining Co. Inc. | Casadepaga R. | Flume |
| (3) North Star Dredging Co. | Ophir Cr. | Flume |
| (4) Ophir Gold Dredging Co. | " " | Stacker |
| <u>KOYUK PRECINCT:</u> | | |
| (5) Porter & Pfaffle | Dime Cr. | Flume |
| <u>FAIRHAVEN PRECINCT:</u> | | |
| Keewalik Mining Co. No. 1. | Candle Cr. | Flume |
| <u>YUKON BASIN</u> | | |
| <u>FAIRBANKS PRECINCT:</u> | | |
| Chatham Gold Dredging Co. | Chatnam Cr. | Flume |
| Fairbanks Exploration Co. No.2. | Goldstream Cr. | Stacker |
| " " " " No.6. | " " | " |
| " " " " No.8. | Gilmore " | " |
| " " " " No.3. | Cleary " | " |
| " " " " No.5. | " " | " |
| Fairbanks Gold Dredging Co. No.1. | Fairbanks Cr. | " |
| " " " " " No.2. | " " | " |
| Nome Creek Dredging Co. | Nome Cr. | " |
| Tanana Valley Gold Dredging Co. | Fish Cr. | " |
| <u>OTTER PRECINCT:</u> | | |
| Northern Alaska Dredging Co. | Otter Cr. | Combination (8) |
| Riley Investment Co. | " " | " " |
| <u>INNOKO PRECINCT:</u> | | |
| Flume Dredge Co. | Little Cr. | Flume |
| " " " | Yankee Cr. | " |
| (6) Gibbs & Peck | Janet Cr. | " |
| (7) Hans Erickson (Innoko Dredge Co.) | Janet Cr. | Combination (9) |

KUSKOKWIM REGIONBETHEL PRECINCT:

New York Alaska Gold Dredging Co.

Bear Cr.

Combination (9)

- 1 - Reconstructed - formerly on Solomon River - Shaking screens - diesel-electric shoreplant.
- 2 - Formerly operated lower down Casadepaga River by Casadepaga Mining Co. Inc. (C. Peck)
- 3 - Former dredge of Northern Light Mining Co. on same creek.
- 4 - Former No. 1 dredge of Wild Goose Mining Co. on same creek - 160 H.P. Gasoline engine or hydro-electric 140 H.P.
- 5 - Formerly the Lime Creek Dredging Co.
- 6 - Formerly combination type dredge of Guinan & Ames on Glacier and Ganes Creeks.
- 7 - Dredge owned by Innoko Dredging Co. operated under lease by Hans Erickson.
- 8 - Combination Type - Revolving screen, one flume, and a conveyor.
- 9 - " " " " Revolving screen, two flumes, and a conveyor.
- 10 - C.C. - open or link connected bucket line; C.C. - close connected.

1929.

| BUCKET LINE NO. TYPE D.P.T. (10) | DIGGER DEPTH BELOW WATER FEET | P O W E R | |
|--|-------------------------------------|------------|-------------|
| | | TOTAL H.P. | KIND |
| 1/2 C.C. | 25 | 140 | Semi-diesel |
| C.C. | 15 | 80 | " " |
| C.C. | 60 | 580 | Electricity |
| C.C. | 40 | 580 | " |
| C.C. | 60 | 590 | " |
| 1/2 C.C. | 12 | 120 | Diesel |
| C.C. | 20 | 200 | Electricity |
| /2 O.L. | 12 | 60 | Distillate |
| /2 O.L. | 15 | 70 | " |
| /2 C.C. | 21 | 140-160 | (4) |
| /2 O.L. | 15 | 25 | Distillate |
| /2 C.C. | 15 | 100 | " |
| /2 C.C. | 14 | 80 | Steam |
| C.C. | 46 | 728 | Electricity |
| C.C. | 56 | 470 | " |
| C.C. | 28 | 405 | " |
| C.C. | 60 | 728 | " |
| C.C. | 56 | 470 | " |
| C.C. | 35 | 150 | Diesel |
| C.C. | 28 | 150 | " |
| C.C. | 15 | 190 | Electricity |
| C.C. | 30 | 270 | " |
| /2 C.C. | 15 | 110 | Diesel |
| /2 C.C. | 15 | 125 | " |
| /2 O.L. | 12 | 60 | Diesel |
| /2 O.L. | 12 | 60 | " |
| O.L. | 15 | 80 | Semi-diesel |
| /2 C.C. | 15 | 150 | Steam |
| 1/2 C.C. | 15 | 120 | Diesel |
| C.C. | 20 | 150 | Diesel |

| | | | | |
|-----|------|----|-----|--------|
| 1/2 | C.C. | 15 | 120 | Diesel |
|-----|------|----|-----|--------|

| | | | | |
|--|------|----|-----|--------|
| | C.C. | 20 | 150 | Diesel |
|--|------|----|-----|--------|

dredges No. 5 and No. 6 of the Fairbanks Exploration Co. All of the dredges operated in the Fairbanks precinct in 1928 were active in 1929; and all of those operated elsewhere in the Interior, Kuskokwim, and the Seward Peninsula in 1928, were active in 1929 with but two or three exceptions. In 1929, there were, however, several dredges operated which were idle the previous season.

In 1926, five new dredging operations began; they were the Tanana Valley Gold Dredging Co., Ltd., the Nome Creek Dredging Co., the New York Alaska Gold Dredging Co., the Goldsmith Dredging Co., and the Solomon Valley Dredging Co. In 1927, the American Creek Dredging Co. started operations with a new dredge, and the No. 2 dredge of the Fairbanks Gold Dredging Co. was almost entirely reconstructed, modernized and placed in operation. In 1928, the three new large dredges, Nos. 2, 3 and 8, of the Fairbanks Exploration Company began digging. All of these dredges were active in 1929, except the Solomon Valley Dredging Co. dredge which ceased operation several years ago but which may resume again in 1930. The old "Three Friends" dredge, after more than 20 years of successful operation on Solomon River, during which period it underwent numerous changes mainly in power equipment and operators and which was last worked on Solomon River in 1926 by Scott, Newberg & McCarthy under

lease from the Lomen Reindeer & Trading Co., was later moved and reconstructed on Osborne Creek where it was operated this season by the Lomen Reindeer & Trading Co.

The Casadepaga Mining Co., Inc. dredge, formerly operated lower down on the Casadepaga River, changed ownership and was moved up this river near the mouth of Ruby Creek where it was at work this season. The Goldsmith dredge was dismantled, moved down the Solomon River back to below the mouth of Coal Creek, equipped with a larger hull and resumed digging. The North Star Dredging Co. operated the former Northern Light Mining Co. dredge. The Porter and Pfafle dredge was formerly operated as the Dime Creek Dredging Co. Gibbs & Peck took over the former Guinan & Ames dredge on Ganes Creek, and after but 32 days of operation were shut down for the balance of the season by a broken engine shaft. Hans Erickson operated the dredge of the Innoko Dredging Co., on Ganes Creek under lease, for 22 days, this operation lacking the required fuel for longer continuance. The Chatham dredge after digging to the upper limit of the pay on Chatham Creek this spring was shut down, moved back to the mouth of this creek and was again digging within a very short time.

The old Anderson dredge long idle on Hastings Creek was acquired and moved to lower Hastings Creek by the Hastings Creek Dredging Co. where it was reconstructed and

and placed in condition for future operation. The Shovel Creek Dredge was idle and pending this season's prospecting results, will resume in 1930. The old Sunset dredge is also being moved to Dese Creek, Port Clarence precinct, where it is planned to operate it next season. Pending this season's prospecting, the dredge of the Behring Dredging Co., idle on the Kougarok River, may be acquired and operated on Henry Creek, and the Solomon Valley Dredging Co. dredge may resume operation on lower Solomon River, next season.

Of the dredges operated in 1929, it has been reliably reported that the Bangor Dredging Corp'n. completed the dredging of all its available ground on Anvil Creek this season and is looking for a new location for its dredge. It is also reported this is probably the last season of operation for the dredge of the New York Alaska Gold Dredging Co., on Bear Creek. Two or three other dredges active this season may not resume next year although at this time no definite decision as to this has been made.

Of the dredges active in 1926, there are the following which were not operated three years later, in 1929, -- Dexter Creek, Hammon Consolidated No. 4 on Snake River, Shovel Creek, Solomon Valley, Crooked Creek,

Keewalik No. 2 on Candle Creek, and the Behring dredge on Kougarok River, all of these on the Seward Peninsula; The Berry dredge in the Circle precinct, the Candle Creek dredge in the Mt. McKinley precinct, and the Cache Creek dredge in the Talkeetna precinct.

Prospecting by drilling or shaft sinking and other investigative work to determine the dredging possibilities was done at numerous localities during the year. While there are no doubt numerous instances that are not recorded here, the following will indicate the keen search being made. Drilling and prospecting is being done on the Shungnak River and vicinity in the Noatak-Kobuk precinct. Similar work was done on the Seward Peninsula, on the Humboldt River, on Boston Creek, Henry Creek, and elsewhere. In the Interior, considerable prospecting was done on Deadwood Creek in the Circle precinct, on lower Nome Creek in the Fairbanks precinct, on Sullivan Creek and vicinity in the Hot Springs precinct, on Grant Creek in the Fort Gibbon-Gold Hill precinct. Further prospecting was conducted on Chicken Creek in the Forty Mile precinct, Coal Creek in the Woodchopper area of the Circle precinct, and Indian River in the Koyukuk precinct. Kokomo Creek in the Fairbanks precinct is under consideration. The Yukon Flats at the mouth of the

Chandalar River were given a preliminary investigation as well as a number of other localities. Big Minook River in the Rampart precinct was investigated again this year and it is reported its possibilities for dredging will probably be definitely determined next season.

The largest and most important placer operation in Alaska is that of the Fairbanks Exploration Co., in the Fairbanks precinct. This company began dredging operations with three large modern dredges in 1928 and before the end of the 1929 season had constructed and placed in operation two more dredges. Electric power for the dredges and other uses is supplied by a steam turbine electric plant located at Fairbanks. The extensive Davidson ditch system, the Kokomo ditch and numerous other smaller local ditches of the company were all in use supplying the water for the many and large stripping operations. Extensive areas of ground ahead of all of the dredges have been thawed with water, the water for thawing purposes being supplied by pumping. During this season, this company employed a maximum number of about 900 men. With a large yardage of ground prepared ahead of the dredges, and with five dredges ready to again resume operations next season, the extensive dredging development and construction program of this company begun five years ago, has now been completed and full scale operation will

be conducted in the future.

COST OF DREDGING:

Placer mining is a real and serious business and must so be considered, and like any other business under consideration, must receive the systematic and careful investigation of experienced men before it can be safely passed upon and undertaken. The bonanza days are past, the former rich well defined pay streaks have been mined, leaving the lower grade ground to be subsequently mined by improved and more modern methods. As strange as it may seem, systematic prospecting and its proper interpretation are so often disregarded. Sufficient and proper prospecting must be done not only to ascertain the value of the ground per unit, the total available yardage and its gross gold content, but also to obtain information as to its physical characteristics. All conditions having a bearing on the operation of the property and the cost of winning its precious metal content must be investigated and determined before the merits of the property can be ascertained and the proper method and equipment for mining the ground determined. All of these features then govern the expenditure that would be justified in acquiring and equipping the property, and whereby the gross returns will pay all expenses, retire the investment plus interest, and leave a net profit commensurable with the

undertaking or satisfactory to those interested.

Placers free of perpetual frost have and are being dredged in Alaska in most instances at an operating cost of 15 to 25 cents per cubic yard. At a few properties where conditions were more generally favorable, dredge operating costs as low as 10 cents have been reported, while in isolated localities or under adverse conditions the higher figure has often been exceeded. Under certain favorable conditions, the operating cost for dredging may even be less than 10 cents per cubic yard. Where the ground is frozen, the cost of thawing is an added expense plus the cost of such irregularities in operation as may be contentent with such conditions. The same holds where the ground must first be stripped of muck or other overburden.

The operating cost alone may seem high but even so it is by no means the total cost. One of the large items of the total cost which is often not given sufficient consideration, if any, before or after the property is equipped and operating, is the expenditure and interest charge up to the time operation begins, and the amortization or return of capital and interest thereon invested in the dredge, equipment and other things. The short operating season of three to six months, which excepts the southern and south coastal areas where no dredg-

ing is now being done, and other conditions affecting operation in most parts of Alaska, especially limit the volume of placer that can be mined during a season. The charges to be made for this invested capital may range from as low as a few cents per cubic yard in special cases, to as much or more than the operating cost. There are few dredging or other placer properties known in Alaska that are of sufficient size or richness, or possess other essential features, to support a large capital charge. Some of the dredging companies and other placer operations are in a good position in this respect. Some have nominal capital expense, some having been able to purchase and install on their property a good used dredge or other equipment at a very reasonable cost, often with ditches and other improvements provided on the property by former operators. Such equipment is often a means to an end for while it may not be so well adapted or as economical to operate as new or better adapted equipment might be, this may be justified when the limitations of the property are considered.

There are a number of cases where the low tenor of the placer would not permit further profitable dredging if continued by the company. One of these is a case where a small dredge was subsequently purchased at a small cost by a partnership of experienced dredgemen. Being familiar

with the ground and making some changes on the dredge and putting in their full efforts in operating it, they have been able to pay all costs, return the capital and net a small profit. In another case, the lease of a 5 cu.ft. electrically operated dredge, equipment, and the ground, was acquired by another partnership on a reasonable royalty basis. This operation was able to keep going in ground averaging 10 to 12 cents per cubic yard, although it was admitted that should any extensive repairs or replacements have become necessary, it would have meant the finish. Quite a number of hydraulic, drift, and other kinds of placer operations are being conducted in various parts of Alaska under somewhat similar arrangements, although very few such operations could be profitably carried on unless acquired at a reasonable price or under a reasonable royalty arrangement.

HYDRAULIC MINING:

Hydraulic mining was as usual conducted in practically all of the placer mining precincts, this form of mining being especially favored this year with increased water supply due to the exceptionally wet weather conditions. Hydraulic mining in the Interior precincts is generally limited to small scale operation as the topographic and climatic conditions are generally adverse to obtaining large, reliable water supplies under high pressure.

Many of these mines, especially those located above the main general drainage level, must rely mainly upon the water provided by the melting snows and the rain fall, and the drainage or catchment basins are usually small, so in consequence, the water must either be impounded and used intermittently, or else the operation must shut down during periods of drought or low water supply. The low stream gradients encountered in mining in the creek bottoms and river beds usually necessitate the stacking of the tailing. This stacking of tailing is usually done with a giant using water under pressure, and it is often the case that the available water supply at times requires the alternate use of the water by the field and stacker giants. This means that the field giant or giants at work washing down and transporting the material to the sluice are busy usually less than half of the time that would be available if continuous use of water in the field or pit was permissible. Consequently where water is used for stacking, just so much less material can be put into the sluice boxes. Disregarding any time that may be lost due to lack of water, the time during which the water is in actual use at most of the hydraulic mines in Alaska amounts to only 50 to 60 per cent of the available time, the balance being spent in moving, setting up, cleaning up, boulder handling and disposal, and other jobs, while in the

meantime the giants are generally running their water to waste. Where only one shift is worked, less than 25 per cent of the shift is often spent in moving gravel. Such physical and operating conditions and the low water duty obtained account for the relative small yardage of material sluiced by these mines. More systematic use of the available water should be practiced at many of the operations and often some change in method or set-up will result in a considerable increase in the use of the water and consequently the amount of material moved.

Hydraulic mining on bench or high channel deposits is usually done by first opening the pit by piping out a main sluice to bedrock in which the boxes are set, although in deep ground a block may be opened by driving an adit from the rim back into the deposit, a raise then being driven to the surface, these then being enlarged or opened. Until the pit has been sufficiently enlarged to permit the giants to be set on bedrock in the pit, they are set on the bank and the material is driven to and into the sluices. After the pit is opened the material is piped down from the face by nozzling against or "sideswiping" it, undercutting and caving it, and if bedrock gradient is high and ample water under pressure and bank-head water is used, the broken down material is transported from the face. Bedrock sluices, steel lined sluices, etc.,

are often used to aid transportation of the material to the boxes. Even so it is generally necessary to get behind and drive the material, or pipe it into the head of the boxes. In shallow ground the giants are usually set on top of the banks, or later, depending on the system followed, the giants are set in the pit on cleaned bedrock. Where the ground is frozen a higher water duty is obtained in breaking down the material, if as large a face can be opened up, dissected and exposed as conditions permit. Then as the material along the face thaws it is nozzled off at intervals governed by the rate of thawing. Steady piping against a frozen face of material is poor practice as the nozzle water breaks down but little material until after it has thawed. Nozzling should therefore be planned to be carried on continuously but so timed that no portion of the face is piped against after the material that has thawed since the last application of the water has been removed. The undercutting of frozen banks is generally not efficient practice for the undercut frozen face does not cave readily and when it does it generally breaks down in large masses, aiding but little, if any, more often making conditions even more difficult.

The principal advantages of hydraulicking elevated benches or channels are that the bedrock gradient is

usually greater or a better sluice box grade can be obtained, and better facilities for boulder and tailing disposal are available than when creek deposits are mined. Natural dump room for tailing is then also generally ample. In many cases, however, mining at such elevations may not permit the bringing in and use of ample bank-head or ground - sluice water, or water under as high pressure as required for good performance.

Hydraulic mining as practiced in Alaska, excluding the bench methods mentioned or where hydraulic elevators are used can be divided into three general methods. First, piping the material into the head of the boxes, a method which is in most common use being best adapted to average conditions and possessing the major advantage that all of the water used in the pit is behind the material and drives it ahead and this water is all devoted to sluicing, so that a comparatively small water supply will often do good work. Second, piping the material over the side of the boxes, and third a combination of these two methods. These are special methods used to meet certain adverse and limiting conditions encountered in mining creek placers and are also applicable to certain bench deposits. They are adopted mainly to provide a higher sluice box grade or overcome to some extent the low bedrock gradient, or to permit a more continuous use of the water. In the

later case this is done mainly in providing conditions whereby there is less delay in moving and setting up, clearing the pit of boulders, etc. Some of the methods provide safety measures in case of flood or other unforeseen possible trouble of this nature. With some of these methods a large quantity of ground-slucice water is required, or the supply of water under pressure must be larger than when piping into the head. The second method can be divided into three general classes based upon the position of the sluice boxes in relation to the surface of the bedrock, as follows: (a) The boxes are all set in bedrock with their tops below its surface; (b) the boxes are set in or on bedrock, the upper boxes on or above bedrock surface; (c) some or all of the boxes are on or elevated above bedrock. These special methods are known as the "Circle", "Eagle", "Nizina", etc., according to the district or creek where first developed and used. These are fully described in U.S. Bureau of Mines Bulletin No. 259, and some are described in this report under the "Review by Mining Precincts."

A few of the hydraulic mines where the water supply is small or limited, stack the tailing with cabledway excavators, scrapers, or some other mechanical means, in order that all of the pressure water available can be used in the pit. An operation on Pedro Creek in

the Fairbanks precinct, stacks the tailings with a cable-way excavator. Formerly this stacking was done with a giant. Now this steam operated excavator operated by one man who also fires the boiler, etc., stacks all the tailing, permitting whatever water is available to be used entirely for moving gravel. This operator states this method of mechanically stacking the tailing has made a profitable operation out of one which conditions would otherwise not support. At an operation in the Porcupine district, in the Skagway precinct, the gravel is broken down and transported by giant and by-pass water to a sump from where the heavy rocks are scraped to waste up and over a grizzly set at the head and over the top of the sluice, while the fine material passes through the grizzly and sluice to another sump where it is elevated by hydraulic elevator to the sluice boxes. This operation is the only one of its type now being conducted in Alaska. The creek gravels in a narrow rock-rimmed canyon are being mined, the considerable quantity of creek water being by-passed along one side of the creek bed through a large by-pass flume which practically overhangs one side of the mining pit. The operation is unique and as a whole is well adapted to the existing conditions.

Mechanical means of boulder disposal are used by a large number of operations although at most of the

smaller operations this work is done by manual methods or by a horse drawn stone boat. The mechanical methods include the operation of wooden or steel stone boats, nets, chains, or other devices operated by water wheel driven or steam driven hoists, to gin poles, sheaves on the banks, or overhead cableway and carriers. The overhead cableway and carrier is best applied where the ground is deep or other conditions exist where a large volume of material can be reached from one set-up as the time and cost of moving and setting up this rig is considerable.

There is a considerable increase in the adoption of combined methods such as the use of mechanical means combined with the use of water under pressure. The adoption of such methods may be due to the limited water supply or due to some peculiar characteristic of the ground. Thus at Walker Fork, in the Forty Mile precinct, the gravels, which average about 8 feet in depth, have the lower two feet overlying the soft clayey decomposed bedrock of tight clayey wash which contains much of the gold. The character of this clayey gravel is adverse to thorough disintegration by any economical method other than hydraulic means. This operation, therefore, has a steam driven dragline excavator which digs and delivers to the sluices set along the bank of the pit, all

of the upper gravel it can reach. The gravels out of its reach are driven over to it by the hydraulic giants. Finally all of the clayey gravel and bedrock is piped up, thoroughly washed and disintegrated, driven over to the excavator, which digs and delivers it to the sluice boxes in proper shape for efficiency gold recovery. The use of the excavator has more than doubled the quantity of ground that could be mined by the usual hydraulic methods with the limited water supply available here, the low gradient of the creek, and other disadvantageous conditions. An operation on Happy Creek in the Iditarod-Otter precinct is reported as combining hydraulic methods with a small gasoline driven combination drag-line-shovel machine. As reported, it is used for stacking tailing and when the water supply is low it digs and delivers material to the sluice boxes.

The largest hydraulic operations are conducted on the Seward Peninsula, and in the Valdez Creek, Porcupine, Nizina, Cooks Inlet region and other coastal districts in Southern Alaska, where conditions are generally more favorable for obtaining better water supplies. There are, however, also a number of fair-sized operations conducted in the Forty Mile, Circle, Talkeetna and other precincts. A large number of small scale hydraulic operations are underway, in fact, some hydraulicking is done in practically

every district. The largest hydraulic elevator operation is that of A. Cordovada on the Inmachuck River in the Fairhaven precinct, Seward Peninsula. Less than a half dozen hydraulic elevators are now used by Alaskan operations. A number of new small hydraulic plants were installed during the season and others are to follow next spring.

Conditions under which hydraulic mining is conducted are so variable that the cost of such mining varies greatly. Alaskan costs normally range from 25 to 50 cents per cubic yard of material sluiced. This includes the cost of all seasonal preparatory work, labor and board, maintenance of ditching, general supplies, and other operating expenses, but excludes royalty, overhead or capital charges. If an ample water supply is available and other conditions are generally favorable, costs below 25 cents can be realized, while under adverse conditions they may reach 75 cents to \$1.00 per cubic yard. Some hydraulicking has been done, particularly on the benches for around 10 cents but here conditions were exceptional. There are instances recorded, as back of Juneau where some years ago the operating cost was around 6 cents per cubic yard, but here exceptional conditions prevailed at that time. In general, it can be stated that the operating cost over a period of years will seldom average less than

20 cents per cubic yard for hydraulicking the average bench deposits and 25 to 35 cents at the creek operations, and only then when conditions are more favorable than usual. The cost of hydraulic mining at any particular operation is otherwise largely governed by the water supply, therefore, a comparatively low cost may be realized during a season favorable for water, while during a dry season the cost may be two or three times higher.

DRIIFT MINING:

Drift mining has ceased to be much of a factor in the placer gold production as most of the profitable ground adaptable to this method has been mined, or acquired by dredging interests. It is, however, still being carried on in many of the precincts, principally in the Fairbanks, Hot Springs, Ruby and others in the Interior, and on the Seward Peninsula, although on a greatly reduced scale, most of it being the "sniping" of small pillars, blocks, or side pay, left by former operations. This remaining ground is usually too low grade or limited in quantity to permit a consequential profit to be made in mining it by this method. After the dredging interests at Nome and Fairbanks get further along with their dredging there will probably be left behind some ground not adapted for dredging, some of which would subsequently be drift mined. Drift mining in most parts of the Seward

Peninsula is greatly handicapped by lack of fuel and timber, fuel oil, or at times high priced coal, being used mainly for steaming purposes around Nome. In the Fairhaven precinct on the Imachuck River, prospecting operations are still being conducted in the deep lava capped gravel deposits although as far as learned, no extensive rich gravels have as yet been found or mined although considerable encouragement is reported. During the past few years several drift operations experimented with underground scrapers and other mechanical means in an effort to reduce labor and other costs. On Eldorado Creek, the gravels were drilled, blasted and sluiced without the customary previous steam thawing, etc. The method was a success as far as its application went as the low percentage and character of the frost in the gravel permitted this procedure, and the gravels were successfully sluiced without the usual thawing. The operation, however, was a financial failure. This season another company has taken over this ground and is experimenting by hydraulicking down the face, sluicing the material underground and hoisting the tailings out of the shaft to waste. Considerable new equipment, and a diesel power plant to generate electric power for driving the underground pump which provides the water for hydraulicking,

has been installed. There is considerable merit to this plan and if present experiments work out as anticipated by the operators, a large new block of ground will be properly opened up and the method applied on a full working scale. Basically, the method does not add much in new features to similar methods tried in the earlier days, although modern equipment is available and many improvements in procedure are being made. The unusual character of the pay gravel and its ice content make this ground about as favorable for the application of this method as could be found. The results will be awaited with great interest.

Drifting operations are again being conducted on a small scale on the old Tammany bench or channel in the Valdez Creek district. This channel while formerly drifted, was later mined by hydraulicking by the McKinley Gold Placers, Inc., an exceptionally large fine hydraulic plant being installed but not successfully operated. The deposit is unique averaging 100 to 110 feet in depth, V shaped, and but 40 to 60 feet wide at bedrock. It contains a great many large boulders, is free of permanent frost and its principal gold content is distributed in the lower 6 to 10 feet of gravel. This lower gravel is again being profitably mined, under conditions much different than

those usually encountered by other drift mining operations in Alaska.

MECHANICAL METHODS OTHER THAN DREDGING:

A few small Bagley scraper and slip scraper operations are still conducted in Alaska, mainly in several of the Interior precincts, although these scrapers have generally passed the period of their economic usefulness in placer mining. Mechanical methods are being used to good advantage for stacking tailing or for other purposes in connection with hydraulicking. The most notable cableway excavator operation in recent years was conducted in 1926 by the Allen Mining Co. at the mouth of Daniels Creek at Bluff on the Seward Peninsula where the present beach placer lying mainly beneath the level of the sea was mined, however, not profitably. A cableway excavator plant was also installed in the Wade Hampton precinct in 1926 and operated. Several cableway excavator plants are under advisement for installation next spring. A dragline excavator was operated this season on Willow Creek in the Otter precinct and one was operated in connection with hydraulicking on Walkers Fork in the Forty Mile precinct. A well known Alaskan operator moved his dragline excavator from Fairbanks to Thistle Creek in the Yukon Territory this season for operation there.

The cableway and the dragline excavator are better adapted for placer mining under Alaskan conditions than other mechanical means other than dredging, the dragline excavator possessing many advantages over the cableway. Each has its field for operation and their adoption is governed by many conditions. To insure their economical and efficient operation under Alaskan conditions, the depth of gravel to be dug by the excavator should generally not exceed 8 to 10 feet after stripping of overburden, the material to be excavated should be free of sticky clay or clayey gold-bearing material that will not disintegrate and wash freely, there should be a minimum of large boulders, the gravel must be thawed, and bedrock should be relatively uniform in character and easy to dig and clean up. It is also essential that conditions permit keeping the working pit drained of water, preferably by natural drainage.

The excavator bucket is controlled by chains and cables and therefore cannot be held rigid and its path governed as in the case of the rigid bucket line of a dredge. Unless the pit is kept drained so that the position or the path of the excavator bucket can be seen, a considerable portion of the richest material, especially where the main gold concentration is at or near the bedrock surface, is most likely to be left behind, nor can

the bedrock be properly dug and cleaned up. The use of an excavator in digging loose running material under water, as in the case of the sea beach placer, has additional difficulties for it is not only impractical to deliver fully loaded buckets, but the auriferous material is diluted and reduced in tenor by much barren material washed into the cut by the action of the surf.

These excavators can dig and deliver their load to the sluice boxes without requiring additional conveying machinery, they require but a small crew of men, comparatively little power, and the cost for repairs and maintenance is low. The cableway excavator has the disadvantage of requiring a quite extensive set-up for each pit and lacks the mobility and digging ability of the dragline excavator.

The dragline excavator, being a self contained machine, can be readily moved from place to place and quickly resume operation, dig its load, swing and deliver the material directly to the sluice boxes. The sluice boxes are placed along the top of the pit bank or elsewhere being elevated on timber frames to a height within dumping reach but sufficient to provide the necessary grade and tailing dump. The sluices are best arranged if placed on frames equipped with flange wheels so they can be pulled ahead along a track with each step-up of the excavator.

A dragline excavator should be equipped with booms 60 feet or more in length in order to enable it to dig a good sized pit, and deliver and dump at a good height. In general, this size of machine is better adapted to placer mining than the smaller ones. Caterpillar traction greatly improves the handling of the machine in moving although the skid and roller arrangement has a considerable advantage in first cost. The cost of an excavator with a 60 foot boom and a $1\frac{1}{2}$ cubic yard bucket, complete and installed at the property, is less than that of a light $2\frac{1}{2}$ cubic foot bucket flume dredge. It also can dig as much or more ground per day, and at about the same operating cost, as a dredge of this kind and size. It is, however, not contended that the dragline excavator should supplant the dredge for each has its merits and its limitations.

Under the conditions above mentioned, these excavators adapt themselves very well to the mining of the smaller isolated areas of pay gravel left by former operations in many of the precincts, and to areas lacking sufficient size and other features to justify the installation of a dredge. There are numerous creeks in Alaska where small gold dredges have dug only the naturally thawed and more favorable gravels of the creek bed. Some of the frozen or partly frozen ground, or the points or slightly elevated ground across the bends of the main pay channel,

have often been passed by. While the economic possibilities of such remaining ground must still be determined, the excavator has a prospective field there.

MANUAL METHODS:

Several small operations are still being conducted in the Interior where after the auriferous gravel has been stripped of overburden and reduced in volume, it is shoveled into wheelbarrows, wheeled to a centrally located loading station, dumped into a self dumping carrier bucket and, with the aid of a small steam hoist, is hoisted to and pulled along an overhead cable to the sluices into which it is automatically dumped. Compared to the method of shoveling directly into the sluices, this method permits the working of a larger pit, it speeds up the work, and permits the sluices to be placed where suitable grade and dump room can be provided. At its best, however, its use is limited to the higher grade ground.

Dams equipped with automatically controlled gates for impounding water and periodically releasing it, a method termed "booming" or "splashing," is used at a large number of the small placer operations mainly in the Interior or where only small water supplies are available. As a method of mining, it is used for ground-sluicing or washing away the overburden and reducing the volume of gravel to be subsequently shoveled into the sluice boxes. It has

broad application for stripping purposes as the quick release of a considerable quantity of water has exceptional carrying power being able to carry along very much heavier material and more than could otherwise be done. At some of these operations the gravel is washed down almost to bedrock, especially if bedrock is rough, there then remains only a small quantity to be shoveled in. Where water of this kind is used the gold must be coarse, as fine gold would, under such conditions, be mostly carried on and lost. The splashing or intermittent use of water is under no conditions conducive to efficient gold saving for with each rush of water the riffles are stirred up, gold is dislodged and carried on, until after a number of successive splashes it eventually is worked to the end and out of the boxes.

Numerous small operations using mainly manual methods are still conducted in practically every district and such methods will always be popular to the individual or to miners who are satisfied in working a small piece of ground according to their own desires and means. While the returns are usually only a few hundred dollars, more or less, per operation per season, the capital requirements are very small and it creates an independency that many of the old miners wish even though the financial remuneration is generally small. A little sea beach mining at Nome, Kodiak and

Lituya Bay is occasionally done by a few men who generally do this after heavy storms when the beach material has been reconcentrated producing new spots or thin layers of gold bearing material which is rocked, shoveled into long toms, surfwashers, or small sluice boxes.

THAWING WITH WATER:

The placers on Seward Peninsula, in the Interior, and northern Alaska are usually solidly frozen when covered with a deep sod and muck overburden, or when 10 to 12 feet or more in depth. Exceptions however exist, for though the development of bedrock drainage by natural or artificial means, thawed channels or areas may have developed. The exposed shallow gravels in creek or river beds generally thaw to bedrock each season. At some of the dredging operations, as well as other kinds of placer operations, where the shallow gravels are overlain by sod and muck and are permanently or seasonally frozen, in part at least, this covering of overburden is generally first removed by stripping with water so as to expose the frozen gravels which then naturally thaw, although a proper bedrock drainage must be established to insure complete thawing. Even so, such thawing may not be satisfactory or practical if the depth of the gravel is more than 8 to 10 feet. The thawing of shallow gravels where a proper bedrock drainage has been established can be greatly facilitated by the applica-

tion of water to their surface, this water working its way downward and along the gravel bed eventually reaching the drainage. The natural thawing of shallow gravels however presents difficulties for unless conditions are suitable irregular frozen "horses" may develop, the thaw may not reach bedrock, and the time required to complete the thawing of a sufficient area may be too long for practical purposes. Again where shallow exposed gravels are thawed and not mined during that season the frost of the following winter again freezes them, often to bedrock. Seasonal frost conditions, while troublesome during the first half of the season, usually disappear, to a large extent at least, during the later half, if the conditions exist as above mentioned.

The deeper placers require preparation prior to dredging and generally being covered with deep muck or other overburden, this is first removed by stripping with water. Where this covering is only a few feet in thickness and in some instances deeper it may not be removed before thawing, but where an ample water supply is available, and other conditions permit it, the best practice is to remove as much of it as possible. This muck is of variable character and where there is much ice present in it thawing is rapid, but average muck or overburden containing silt, sand, clay, etc., thaws slowly. The thawed material is removed from time to time, usual-

ly with water under pressure in order to expose the frozen face. The creek or water gradient limits the depth to which stripping can proceed, and as there are areas where the top of gravel may be considerably below the drainage level some of the overburden must consequently be left in place.

Before these deeper frozen gravels can be dredged they must be thawed and this thawing is now all done with water at natural temperatures which is delivered to the ground under pressure through thawing points under conditions best adapted to that particular ground and the available water supply. Were it not for the successful development and application of this method of thawing, most of the perpetually frozen placers would be beyond economic consideration for dredging.

In the earlier days of dredging in the North, the frozen gravels were thawed with steam fed through points. This was usually an expensive process and the results were often unsatisfactory. The application of steam to frozen gravel results in a thaw taking the form of an inverted cone, the minimum thawed area at times being little more than a point in bedrock. Consequently unless the steam points were closely spaced and the ground well steamed, a small conically shaped body of frozen gravel often remained between the thawing points and bedrock thawing was like a patchwork. As most of the gold concentration is generally in the lower gravels, at, or in the bedrock, that portion

of the deposit requires complete thawing. In thawing with water through points the greatest area of the thaw is at the bottom, the thaw roughly taking the form of a cylinder. Thus the maximum thawing occurs where most required.

The ideal conditions for thawing with water include an ample and otherwise suitable water supply under proper pressure, and a gravel of homeogenous character, free of large boulders, clay strata, thawed channels or irregular thawed patches. Under such conditions, the water as it leaves the thawing points, thaws and loosens the ground around the point. As thawing proceeds and the cylinder of thawed ground enlarges, the water keeps working its way to the outer edge of periphery of the thawed cylinder, circulating upward along its frozen boundary. In actual practice however thawed channels, strata, or other irregular features are often encountered or may develop, and the water seeking the easiest line of flow will follow such courses. Water from one point may then work its way to other points before rising to the surface, or may escape by underground drainage channels, thereby leaving intervening spots or "horses" of frozen ground which the water has been unable to reach. Features of this kind must be recognized and determined and where such unthawed places develop or exist additional or intermediate thawing points are set in them.

The practice of thawing frozen ground ahead of dredging varies according to the character and depth of the ground, the water supply, scale of operation and other conditions. Each field or even local area may have peculiarities requiring special procedure. There is much diversity in the method of driving the points, the spacing of points, the temperature and pressure of the water, the water supply, the time required to complete the thaw, etc.

Various devices are used for driving the points, the design of the points differ, etc., although the thawing equipment at any particular operation has generally been standardized. The driving of the points is generally a large factor, being slow and costly work, especially in difficult driving ground. For this reason, the spacing of the points may be increased, the time required to complete a thaw being thereby increased. Much experimental work has been done toward developing and improving the practice. Several of the dredging companies in the Fairbanks precinct recently conducted experiments in driving points with air driven machine drills of the Jackhammer type, a specially designed point and a combined water head, swivel, and drive head attachment being used. While the speed of driving could be much increased, the method has apparently limited practical application. The cost of additional equipment, air, and its delivery into the field, etc., are large factors against its

adoption.

To thaw with water at low cost, the ground should be favorable to permit the easy driving or setting of the points and the efficient use of the water, etc., an ample supply of water under suitable pressure must be available at a low cost; and the operation must be systematically and efficiently handled to obtain satisfactory results. To insure an ample and steady water supply the larger operations pump and reuse the water for thawing, at other operations a ditch provides the entire supply while at others pumping is done to supplement the ditch supply or visa versa. Pumping and the reuse of water requires a reservoir for its collection and settling, and good screens to keep foreign material from entering the pumps as such material causes pump trouble and going through with the water may clog the points and otherwise interfere with the circulation.

The satisfactory results obtained by this method of thawing is reflected in the many millions of cubic yards that have been so thawed and dredged. However, due to certain conditions some of which may be encountered in any of the fields, thawing results cannot be considered as being perfect or can they be made so within economic limits. Under favorable conditions, and if deemed advisable because of the additional cost and the time required, a thorough thaw could no doubt be obtained, but under most conditions,

some incompletely thawed areas containing some small irregular frozen blocks or "horses" may remain. While such remaining unthawed ground is more difficult and costly to dig and may lower the gold recovery therefrom, such conditions are reducible to a minimum and are not a serious factor provided the thawing has been properly conducted and supervised.

The cost of thawing with water under natural temperatures varies according to conditions and procedure. In general, it ranges from 7 to 12 cents per cubic yard. In some instances it may be 15 cents, while one interior operation that has been using the method for many years under favorable conditions other than for water, reports a cost of 5 cents. These costs do not include that of stripping which, where done, ranges from about 3 to 10 cents per cubic yard of material removed. As not all of the area may be frozen, as in several instances where only about half of it requires thawing, the cost of thawing per cubic yard dredged becomes very nominal.

The thawing procedure on the Klondyke River in the Dawson area of Yukon Territory is in some respects quite different from the usual practice. The Klondyke River area is extensive and the three 16 cu. ft. electrically driven dredges operated there are considerable distances apart. The depth of the ground and the conditions vary. In and along the immediate river bed and between some of the bends, the gravel is mostly exposed and excepting seasonal frost is generally

unfrozen. Otherwise, a few feet of moss and soil cover the gravels, there being no muck overburden. Much of this ground is naturally thawed to depths of 5 to 25 feet, or has some thawed horizons with frozen gravel between, while some of it is solidly frozen. The gravel is medium in size, mostly loose and washed and with considerable sand and practically no clay although there is usually a red colored pay gravel, more or less cemented, which overlies the schist bedrock. The total depth of the ground here is 35 to 40 feet. The unusual nature of the ground has lead to the method of putting down drill holes at 75 foot centers. As some thawed horizons are usually present these holes must be cased. The casing is put down in the usual way until frozen ground is reached, a steam point then being put down ahead and that ground so thawed, casing is then advanced, etc., until it is finally landed on bedrock or at the desired horizon. The thawing point, which is an open end pipe 2 inches in diameter with a water connection at the top, is inserted within the casing to the desired position. The casing is then pulled leaving the point in place. A number of units are underway, but at the one visited, water was supplied by a 10 inch pump belt driven by a 100 H.P. motor. The water pressure at the cross-heads at this thawing unit was stated to be 35 lbs. but a higher pressure was considered better as the ground took much water. At another locality where more sand is present

a higher pressure is used. A thaw requires at least 60 days and 100 days is considered as better and average practice. The cost of thawing on the Klondyke River is stated to be about 2 cents per cubic yard. The combined thawing and dredging costs on this river in 1928 are reported to have been 8 to 10 cents per cubic yard. These exceptionally low costs can be attributed to the favorable conditions and the low power cost of $1\frac{1}{2}$ cents per K.W.K. charged to the pumps, dredges, etc.

Most of the ground thawed for dredging in Alaska is at Nome, on the Seward Peninsula, and on Cleary, Goldstream and Gilmore Creeks in the Fairbanks precinct. The equipment and general procedure at these localities is practically identical although the ground conditions differ somewhat. The ground at Nome contains more clay and locally has features not encountered at Fairbanks where there is usually a deeper covering of muck, more fine silt and the gravel is generally tighter. Extensive stripping operations are conducted at Fairbanks while at Nome this is not done. At Nome a ditch water supply supplemented by pumping whenever necessary provides the water for thawing, while at Fairbanks all water for thawing is pumped, each pump being of a 14 inch discharge, and direct connected to a 200 H.P. synchronous motor. The water returning from the thawing area is settled and reused. The depth and char-

acter of the ground at both localities varies, the maximum depth thawed and dredged being 85 feet ranging from that to 30 feet at Nome, and to shallowest depths on upper Goldstream and Gilmore Creeks at Fairbanks.

In ground not deeper than 45 feet, $3/4$ inch points are driven at 16 foot centers by a one man operated special driving device. These points are made of extra heavy hydraulic steel pipe, the lower end having welded to it a special steel bit, either straight or cross, equipped with water outlets, the upper end of the point being fitted with water connections. All threads and sleeve connections on the points are of special design. The time required to complete a thaw varies, but ranges from 30 to 45 days according to the conditions and locality.

In ground deeper than 45 feet, drill holes are put down without casing, at 32 foot centers. Into these drill holes are inserted the $1\frac{1}{2}$ inch thawing points. These points are of standard pipe, the lower end being used with full opening, the upper end with a water connection. All pipe and fittings are of standard size and thread. The time required to complete a thaw with these points and spacing ranges from 100 to 150 days and more.

The degree or advance of thawing is investigated by taking temperature readings at various horizons at regular intervals with a resistance thermometer. In order to take

such readings special temperature points are set to bed-rock at certain places. These records are plotted and as thawing proceeds a constant average temperature above freezing is eventually obtained when the thoroughness of the thawing within a certain area can be closely determined.

The reader is referred to the "Review by Mining Precincts" for thawing details at other operations.

TIN MINING:

The occurrence of tin mineral in placers has been found at many localities in Alaska although its commercial production has been confined mainly to gold placer operations in the Cape Prince of Wales and the Cape York areas in the Port Clarence precinct on Seward Peninsula; to the Hot Springs precinct, and to a small extent to the Ruby district of the Nulato precinct, in the Interior. Tin bearing lodes have been found in the vicinity of Lost River, Cape Mt., Potatoe Mt., Ear Mt., and elsewhere on the Seward Peninsula, and considerable development in these first two localities has been done in the past especially at Lost River. Interest was renewed at Lost River in 1928 when the National Tin Co. took an option on this property and did considerable new development including the sinking of a new shaft. This work was suspended this spring for reasons not known.

Stream tin, cassiterite, is found in many of the streams heading in or near the granitic areas on Seward pen-

insula at the localities above mentioned, also at Brooks Mt., ^HHot Springs Mt. and elsewhere. Two dredges were successfully operated on Buck Creek some years ago, recovering considerable tin as well as gold, and some tin was also recovered by two gold dredges formerly operated on the ^KAniKovik River in the same precinct. In recent years the principal tin production has been and is being made by the open-cut placer operation conducted by Geo. Waldhelm on Goodwin Gulch at the head of Goodwin Creek which drains into Lopp Lagoon. The production of exceptionally high grade tin concentrate by this operation is noteworthy, ranging as high as 74.8 per cent in tin, a shipment of 10 tons of this grade being made to Singapore in 1926. Several smaller operations are also reported this year as recovering tin, one being on this same creek, and one on Cape Creek. Humboldt River, which heads in Hot Springs Mt., also carries tin concentrate along with gold, this locality being this year investigated for dredging.

Tin has for a number of years been an important by-product of the gold placer operations conducted in the Hot Springs precinct in the Interior on Sullivan Creek, Cache Creek, and others in the Tofty area, and a number of creeks in the Woodchopper area. The original source of this tin is no doubt in or in close proximity to the granitic intrusive mass constituting and bordering the pre-

sent Roughtop Mt., although numerous endeavors to discover tin bearing lode in this vicinity have proven futile. This tin concentrate is very different from any found elsewhere, occurring in the placer as cassiterite in a siliceous matrix, in the form of rounded grains, pebbles and boulders ranging from fine sand to pieces more than fifty pounds in weight. One low grade boulder is reported to have been found in one of the drift mines which was practically as wide as the drift. The concentrates as shipped contain an average tin metal content ranging from 51 to 55 per cent. Certain areas have been quite rich in tin but the average tin content of ~~all~~ of the ^{ground} ~~gravel~~s mined was ^{probably} not over one pound of tin concentrate to the cubic yard, and therefore too low grade to support profitable mining for the tin content alone. The early miners complained about a heavy material which interfered with the sluicing of the gravels, forked it out on the dump and permitted the rest to go with the tailing, not recognizing it and its value until informed some time later that it was tin mineral. Sullivan Creek and vicinity was investigated for dredging by an English Company which completed its investigations this spring and then abandoned the field as not being suitable for dredging or company operation. The Hot Springs precinct has produced a very creditable amount of tin but with the decline in operations, its ~~entire~~ production is now but a few tons

of concentrate per year.

Placer tin is found on a number of creeks in the Ruby district of the Nulato precinct, and small quantities have been produced here in the past as a by-product of gold placer operations on Greenstone, Big, Birch, Midnight, Long, Ruby, Spruce, Monument, Trail, Poorman, and other Creeks. The occurrence in most instances has however been found to be spotty, and locally not extensive, and although widespread, there has been little found to indicate tin possibilities of importance. The tin occurrence on Big Creek was investigated by interests several years ago, but as reported, the main concentration was quite low grade and occurred near the head of this creek and Cox Gulch, an upper tributary. This tin concentrate is mainly in crystalline form with sharp edges showing but little transport from its bedrock source. Three to four tons of gray tin concentrate are reported to have been produced at Birch Creek and shipped to Singapore a year ago. A gold-tin prospect was located here last year which is reported to have shown a gold content sufficiently high to support profitable drift mining, and between 1 to 2 lbs. of tin concentrate per cubic yard. The tin concentrate recovered was high grade and one piece is stated to have weighed 12 pounds. This ground averages 60 feet in depth, there being 20 feet of muck and 40 feet of gravel. These holdings

are to be drilled next season.

Renewed interest was given to the tin occurrence in the Fort Gibbon-Gold Hill precinct a few years ago when considerable locating was done on Moran and other creeks in that locality, and again last year when a new tin discovery was reported to have been made near Calland. The occurrence of tin in this area has long been known through former gold placer mining and prospecting. The Calland discovery was renewal of interest in the formerly known tin occurrence on Illinois, Golden Creek, its tributary, and Moran Creek. A hand drill was rushed into the area but its operation was soon suspended. At different times, reports have been received where prospects in this locality have shown a considerable quantity of high grade crystalline tin concentrate, and also gold. The occurrence may be spotty or limited to small areas but past reports would indicate it to be worthy of further investigation.

The occurrence of tin mineral has been reported at many of the gold placer operations, but with the exceptions as noted, has not been found in sufficient quantity to permit commercial production. Some of these localities are Deadwood, Miller and other creeks in the Circle precinct, Jack Wade and other creeks in the Forty Mile precinct, Porcupine Creek in the Skagway precinct, and Cache Creek and others in the Talkeetna precinct.

The occurrence on Jack Wade and several of the other creeks is of wood tin which occurs in small grains and pebbles having a layer or ring structure resembling that of wood. A simple test for tin is to boil the specimen in diluted sulphuric acid along with some metallic zinc. If the specimen is cassiterite or tin oxide it will be coated with metallic tin which resembles silver or platinum in color.

While the price of tin metal has taken a decided drop this year, being quoted at $39\frac{1}{2}$ cents per pound on December 11, the future will command considerably higher prices. The tin bearing areas of the world are well known and are being rapidly depleted while no new areas of importance have been discovered. Much interest is therefore taken in the finding of new placer or lode tin bearing deposits. It is apparent that most of the known tin bearing placers in Alaska, which can support profitable production, have or are now being mined. The lode origin of this placer tin has been found in but few instances and there seems to be considerable opportunity for doing this. The vicinity of the contact of granitic intrusives with limestone, slate and other rocks of that series, is the most favorable area to prospect for tin lode, with the streams and gulches cutting along or across such contacts or areas, for tin bearing placer. Alaskan conditions in the known tin bearing localities are however not generally such as would permit its mining unless the deposit contained a high grade

tin content, or sufficient gold or other valuable minerals to permit the recovery of the tin as a by-product, as the cost of producing, shipping and marketing the tin concentrates from Alaskan deposits, especially those in isolated localities, will amount to more than half their value at present prices. The concentrates should also permit dress- to a high degree of purity to insure better returns from the shipment.

NEW PLACER DISCOVERIES AND PROSPECTING:

The last important discovery of placer made in Alaska was in the Livengood area in the Tolovana precinct in 1915. While much prospecting has since been done the greater part has been limited to the areas long known and mined. The result has been the finding of small areas of pay ground, very limited in extent and of but little consequence. In the earlier days much prospecting was done over the territory in many instances gold being found, but at that time or locality, was not considered as being present in sufficient quantity to support profitable mining. In many cases, one shaft or even a dozen shafts failing to locate gold or pay on a creek cutting a well mineralized area was considered sufficient to suspend work and condemn that locality. These are areas to be reprospected. A number of the important producing districts were at first prospected and condemned by all but a few of the prospectors, who after many attempts to locate pay, finally put down a shaft

at the right place and found it. Thus was the existence of a number of the placer fields practically overlooked but only through the faith and persistence of a lone prospector, or a few of the more sturdy hearted ones, were they finally discovered, be it by accident, luck, or knowledge.

Prospecting in Alaska, especially in its greater area, means plenty of hard work and discomfort, and ground conditions are generally especially difficult. The discovery of extensive areas of new virgin shallow stream gravels which will support profitable mining is unlikely. The deeper gravels are usually covered with deep moss, muck and other overburden, and if gold should be present its main concentration is usually at or near bedrock. A prospect shaft must be put down to bedrock in search of the presence of gold. Where the ground is solidly frozen and there is fuel available this is not so difficult but in deep ground it is costly and requires much time. There is much ground that is thawed, or only partly frozen, so that water is present and shaft sinking may not be permissible. Drilling is the only practical way to prospect such ground. This has been done at ^{many} many localities where drills are available but there are many isolated places considered to possess good possibilities where it is difficult to take in a drilling outfit or the cost of such an undertaking is beyond the means

of the average prospector.

No placer discoveries indicating important possibilities have been reported as having been made in 1929, although a number of "discoveries" were again made in a number of the known placer producing areas. The discovery of platinum, made a few years ago in a new area south of Goodnews Bay, has shown interesting and encouraging development and production but its extent and importance are still to be determined. Much interest is also being shown in the Noatak-Kobuk precinct to the northeast of the Seward Peninsula and ^hwhile the placers in that locality have been known and mined to some extent for many years attention is again drawn to them by the drilling and prospecting now being done mainly on the Shungnak River and vicinity where extensive areas of unfrozen gravels are reported as affording possibilities for large scale dredging and hydraulicking operation.

An increased interest is being taken in prospecting and more prospectors were out in the field during 1929 than for many years. This can, to some extent, be attributed to renewed interest created by extensive development and operation of several large placer mining companies, and to several interesting and important discoveries of lode. The Prospectors Transportation Aid Act passed by the Legislature of Alaska in 1927, has, however, apparently been the

main reason for increased prospecting as it has made it possible for many to undertake such work. Most of the more important discoveries of lode and placer made during 1928 and 1929 have been made by prospectors aided by this Act. By the conditions of this Act a bonafide prospector who is a citizen of the United States and an inhabitant of the Territory of Alaska for at least one year prior to the date of his application can apply to the Commissioner of Transportation for Prospectors at Juneau, Alaska, or to authorized agents, and receive the necessary blanks. These must be filled in by the prospector who must also secure the endorsement of two tax payers and submit them to the Commissioner. Acceptance entitles said prospector to the cost of transportation of himself and prospecting outfit, not exceeding \$150 per calendar year.

It is of special interest to note that a considerable number of prospectors are again going into isolated localities in search of virgin fields. One party composed of six men equipped with pack horses and outfit started north from the Yukon River this summer on a prospecting trip. This is the first prospecting party of this size to go into the field for many years. While numerous localities in known placer areas are being drilled, or by shaft sinking or other means are being investigated for dredging or other possibil-

ities ~~such~~^{such} work should be considered as development, rather than prospecting as generally interpreted.

LABOR:

Labor employed by the placer operations is paid a high wage, which however is justified as it is usually engaged only three to five months of the year. The ^{scale} scale of wages varies according to the locality and the conditions, usually ranging from \$5 to \$6 per 8 or 10 hour shift. In a few instances higher wages are paid and in all cases board is also provided in addition, or an allowance is made. Including board, which costs the operator from \$1 to \$4 per day per man depending upon the location and conditions, the cost of general labor ranges from \$6 to \$12 per day. Wages for skilled or special labor are 50 cents to \$1 and more per day higher than for general labor. At some operations, more particularly at the smaller and more isolated ones, 11 to 12 shifts may be worked.

There has been plenty of labor available in most of the camps and while considerable "outside" labor has been attracted to the larger and more active camps, most of it is provided by the local miners and residents. At Fairbanks, many of the former placer operators and miners in that and other districts have been employed by a large company there during the development and construction period. The number

of operations in these districts has therefore decreased although with the completion of this work, many of these men will again go back to mining on their own resources.

Labor is a large item of the cost of mining. The operations in the isolated areas are often placed in a difficult position, for while the number of men employed may be small, they must be brought in from the main settlements or towns and assured of employment for the season. Conditions of this kind at times not only necessitate the retention of some inferior labor and otherwise complicate matters, but during periods of low water supply or other conditions which may cause restricted operation or a temporary closing down, this labor must be paid and boarded to hold it until conditions improve. This has often resulted disastrously to the operator and at times to the labor as the dry weather period may be of extended length, or the season's clean-up may be insufficient to meet the expense. It is often customary to form a partnership of two to six to operate a mine. This creates personal interest, promotes efficiency, and permits operation with very limited funds, as profits or losses are then to be shared equally.

TRANSPORTATION:

Ocean, rail, and Yukon River transportation facilities have remained practically the same for the past seven

years and more and the freight tariffs show but few changes since reported in 1922. Ocean freight tariffs from Puget Sound points to Alaskan coast points; joint freight tariffs via these points and the Alaska Railroad to points along the railroad and on the Yukon River; and similar tariffs via Skagway, the White Pass Railroad, and the American Yukon Navigation Co. to points on the Upper Yukon River, are given in the following tables for 1929 on certain commodities. Due to the method of classification, exceptions, etc., more complete tables can not be given, but as given will be found useful for general purposes.

The ocean freight tariffs show very little change since 1922, the principal change being in the rates to St. Michael which were formerly considerably higher but which are now the same as for Nome. The rates to Upper Yukon River points show no change on the commodities listed. Rates via the Alaska Railroad show numerous changes, some reductions, some advances. The rates to Iditarod show some decided advances.

The Alaska Railroad continued its usual weekly river service from Nenana to Holy Cross during the season, one steamer continuing on down to Marshall every other week. A small boat carrying passengers and mail and a very limited amount of freight was operated between Holy Cross and

St. Michael by the Northern Commercial Co. Two different interests operated small steamers between Holy Cross and Iditarod, these steamers also making several special trips to St. Michael for freight routed that way because of the increase in rates to the Iditarod via the Alaska Railroad route.

The Alaska Road Commission did some excellent work on new road and trail construction. A number of projects completed some years ago however have received no further attention so are now in bad condition. Other road projects were completed to a certain point some years ago and there stopped, and while the remaining distance possesses a trail, a division in the method of transportation required, has not permitted a reduction in freight rates. This condition is in part explained by the large number of projects under way, the extensive system of roads and trails completed and requiring maintenance, especially the construction and maintenance of the principal highways, compared to the inadequate appropriations available for this purpose. In other cases, the trails or roads are now little used, the number of operations and population of these areas having greatly diminished. This, however, is a poor reason for permitting good trails and roads to become impassable, or for stopping the completion of a project, as the future of such areas is greatly dependent upon accessibility. One of the most

COMMODITY FREIGHT RATES TO ALASKA COAST PORTS - 1929.

| | SOUTHEASTERN & SOUTHWESTERN ALASKA. | | | | SEWARD PENINSULA. | |
|-------------------------------|-------------------------------------|--------------------|-------------------|-----------------------------|--|-------------------------|
| | Ketchikan | Wrangell Juneau | Haines Skagway | Coriova Valdez Seward | Nome St. Michael Bluff (ships-side) | Golovin (ships-side) |
| Seattle or Tacoma, Wash., to- | | | | | | |
| Miles from Seattle, approx. | 757 | 859-1033 | 1137-1153 | 1599-1856 | 2500-2620 | |

COMMODITY:

| | (a) | (a) | (a) |
|---|-------|-------|-------|
| Agricultural implements, etc.: | 6.00 | 6.00 | 6.50 |
| Coal, in sacks, per 2000 lbs.: | 4.00 | 4.50 | 5.00 |
| Freight N.O.S. ordinary, i.e., General Merchandise: | 7.50 | 8.50 | 13.00 |
| Flour, grain, feed, in sacks: | 7.50 | 8.50 | 12.00 |
| Hay & straw, in bales, 22 lbs. or more per cu. ft.: | 11.00 | 12.00 | 14.50 |
| High explosives, powder, etc.: | 14.00 | 14.00 | 21.50 |
| Lumber, common, not over 32 ft. long, per 1000 ft. B.M. ft.: | 7.00 | 8.00 | 15.00 |
| Mining machinery, no single piece over 4000 lbs. wt. (b) | 7.50 | 8.50 | 13.00 |
| Oils, explosive: 110 gal. drums at 24 cu. ft. | 7.50 | 7.50 | 12.50 |
| Oils, fuel, Kerosene, engine, etc.: | 7.50 | 7.50 | 12.50 |

RETURN FREIGHT - SOUTH BOUND

| | | | |
|---|-----------|------|------|
| Carriers, empty drums: | (2.50 | | 3.50 |
| 110 gal. drums at 24 cu.ft. | (2.50 | 3.25 | 3.50 |
| Ore & concentrates, value not exceeding \$60 per 2000 lbs. (c) | (7.50(d) | 4.00 | 7.50 |
| | (7.50(d) | 4.50 | 7.50 |

All rates are on commodities in dollars and cents, per ton of 2000 lbs., or 40 cu. ft. measurement as a ton, at ship's option, whichever brings the higher rate. Rates do not include charges for any wharfage, storage, transfer, handling, lighterage, or other terminal charges, or marine insurance. The average handling, loading and unloading, and wharfage charges for both ends are about \$3. to \$5. per ton.

- (a) Unloaded at ship's side, at anchorage. Lighterage from ship's side to shore \$8. to \$12. additional. Upper figure for carload lots, minimum 15 tons, lower figure for less than carload lots. Option of mixed carloads on commodities in similar class, except on coal and explosives. Ice-bound in winter, hence no winter service. Rates to York, Deering, Keewalik, etc., average \$3. to \$4. more on C. L. lots, \$2. to \$10. more on L. C. L. lots than those to Nome, etc.
- (b) Additional charge on graduated scale for heavy pieces weighing over 4000 lbs.
- (c) 25% additional for each 100% or fraction thereof of excess valuation.
- (d) On valuation not exceeding \$100 per ton of 2000 lbs.

JOINT FREIGHT TARIFFS 1929 VIA SKAGWAY & YUKON TERRITORY,
 BETWEEN SEATTLE, OR TACOMA, WASH., AND ALASKAN POINTS ON
 UPPER YUKON RIVER.

| | | EAGLE | CIRCLE | BEAVER | RAMPART |
|---|----------------|---------|---------|---------|---------|
| Distance from Seattle, approx. miles | | 1,776 | 1,951 | 2,124 | 2,299 |
| ARTICLE | CLASSIFICATION | RATE | | | |
| Coal, in sacks: | | | | | |
| Carload, min.Wt. 10 tons | Commodity | 51.00 | 56.00 | 59.00 | 60.00 |
| | (Class A | (68.00 | (68.00 | (68.00 | (68.00 |
| | (Class A | (74.00 | (74.00 | (74.00 | (74.00 |
| High explosives, caps, etc. | 1½ Class A | (138.00 | (138.00 | (138.00 | (138.00 |
| | (157.50 | (157.50 | (157.50 | (157.50 | (157.50 |
| Hay, compressed, 22 lbs. to cu. ft.: | | | | | |
| Carload, min.Wt. 7 tons | Commodity | 56.00 | 57.00 | 59.00 | 60.00 |
| Grain, feed: | | | | | |
| Carload, min.Wt. 10 tons | Commodity | 55.00 | 58.00 | 59.00 | 61.00 |
| | (Class A | (68.00 | (68.00 | (68.00 | (68.00 |
| Groceries: (a) | Class A | (74.00 | (74.00 | (74.00 | (74.00 |
| | (Class B | (80.00 | (80.00 | (80.00 | (80.00 |
| " | Class B | (90.00 | (90.00 | (90.00 | (90.00 |
| | (Class A | (68.00 | (68.00 | (68.00 | (68.00 |
| General Hardware: | Class A | (74.00 | (74.00 | (74.00 | (74.00 |
| Lumber, common, less 40 ft. long | Commodity | 70.00 | 70.00 | - | - |

JOINT FREIGHT TARIFFS VIA SEWARD AND ALASKA RAILROAD, 1929, BETWEEN PUGET SOUND AND ALASKA POINTS

| Alaska points | Anchorage | Talkeetna | Nenana | Fairbanks | Tanana | Holy Cross | Iditarod | Rampart | Circle | Eagle |
|---|-----------|-----------|--------|-----------|--------|------------|----------|---------|--------|--------|
| Approx. distance from Seattle-- | 1970 | 2083 | 2268 | 2325 | 2466 | 3009 | 3410 | 2541 | 2889 | 3064 |
| <u>Commodity</u> | | | | | | | | | | |
| High explosives, etc.: | | | | | | | | | | |
| C. L. min. wt. 10 tons..... | \$ 36.00 | 57.40 | 75.00 | 84.00 | 84.00 | --- | 129.00 | 106.60 | 136.60 | 148.60 |
| L. C. L. | 64.20 | 93.80 | 125.00 | 130.60 | 147.00 | --- | 198.00 | 158.60 | 188.60 | 200.60 |
| Groceries: | | | | | | | | | | |
| C. L. min. wt. 12 tons, 5th class..... | 27.00 | 34.20 | 41.00 | 41.00 | 46.00 | 46.00 | 85.00 | 59.00 | 74.00 | 80.00 |
| Grain, flour, etc., in sacks: | | | | | | | | | | |
| C. L. min. wt. 18 tons..... | 17.80 | 19.40 | 27.00 | 28.00 | 38.00 | 44.00 | 83.00 | 45.00 | 60.00 | 66.00 |
| Hay & straw, in bales: | | | | | | | | | | |
| C. L. min. wt. 12 tons..... | 19.20 | 21.80 | 26.00 | 26.80 | 37.00 | 43.00 | 82.00 | 44.00 | 59.00 | 65.00 |
| Lumber, common, soft: | | | | | | | | | | |
| C. L. min. wt. 20 tons..... | 14.80 | 17.40 | 21.00 | 21.60 | 32.00 | 38.00 | 77.00 | 39.00 | 54.00 | 60.00 |
| Mining machinery: | | | | | | | | | | |
| Any quantity, single pieces not over 4000 lbs. (a)..... | 20.00 | 22.00 | 28.00 | 30.00 | 39.00 | 45.00 | 84.00 | 46.00 | 61.00 | 67.00 |
| Oils, explosive, fuel, lubricating: | | | | | | | | | | |
| C. L. min. wt. 15 tons (b).... | 5.40 | 12.20 | 25.40 | 25.40 | 36.40 | 42.40 | 81.40 | --- | --- | --- |
| L. C. L. | 10.00 | 18.00 | 37.20 | 40.00 | 48.20 | 54.20 | 93.20 | --- | --- | --- |
| Return freight | | | | | | | | | | |
| C. L. min. wt. 10 tons..... | 7.90 | 9.00 | 13.75 | 15.00 | 23.75 | 23.75 | 38.75 | --- | --- | --- |
| C. L. min. wt. 20 tons..... | 6.30 | 7.20 | 10.50 | 12.00 | 20.50 | 20.50 | 35.50 | --- | --- | --- |
| L. C. L. | 9.45 | 10.80 | 16.50 | 18.00 | 26.50 | 26.50 | 41.50 | --- | --- | --- |
| Carriers, drums, barrels, etc.: | | | | | | | | | | |
| Empty & second hand (f) any quantity, one half 1st class. | 6.80 | 11.50 | 16.40 | 17.50 | --- | --- | --- | --- | --- | --- |

Note: All rates given above are in dollars and cents per ton of 2000 pounds, and unless otherwise noted are all commodity rates in carload lots (C. L.) straight or mixed or in less than carload lots (L. C. L.), minimum weights as given. Rates on Tanana, Yukon, Innoko and Iditarod Rivers in effect only during season of navigation until August 25 of each year. Wharfage, handling, etc., charges at Puget Sound ports, Seward, Nenana and points of destination are included in above rates.

(a) Additional charge for each heavy piece weighing over 4000 pounds.
 (b) No through rates. Rates from Seward only.
 (c) Special commodity rate from Seward on fuel oil not over 30° gravity in carload lots, min. wt. 20 tons.
 (d) Special commodity rate from Puget Sound ports to Iditarod only on fuel oil not over 27° gravity in carload lots, min. wt. 20 tons.
 (e) A charge of 25 per cent additional is made for each 100 per cent or fraction thereof of excess valuation.
 (f) No through rates. Rates to Seward only.

important road projects completed this year was the Steese Highway connecting Fairbanks and Circle by auto highway, a distance of 165 miles. It was opened through for public use this spring and besides being a very scenic highway and an important connection between these two places and enroute, it is and will be of great benefit to the mining operations, communities, and development along and adjacent to its route.

Much has recently been said and planned for the construction of an International Highway which by an estimated expenditure of \$7,000,000 would, by utilizing some of the already constructed roads in British Columbia, Yukon Territory and Alaska, and the construction of about 700 miles of new connecting road, provide an auto highway from Seattle, Washington, to Fairbanks, Alaska, a distance of about 2,000 miles. Arguments have and can be made for and against such a project, but it will apparently materialize for there is much to warrant it, not only for tourist travel and a highway available to the so-called International or Circum-Globe Air Route, but it will traverse a very extensive country both in Canada and Alaska, which it is claimed possesses great potential mineral and other wealth but most of which remains unknown or undeveloped because of inaccessibility. The cooperation of the United States, Canada and Alaska has been pledged, it now remains to bring about special government appropriation for this worthy project.

The Bureau of Public Roads continued its fine work in constructing and maintaining roads and trails in the forest reserves in Southeastern and Southwestern Alaska. Some of these roads directly benefit the mining operations in those areas. The road connecting Moose Pass Station on the Alaska Railroad with Sunrise and Hope, a distance of 45 miles, with an additional 12 miles beyond to the Hershey Quartz Mine on Palmer Creek is an excellent piece of work and would rank with the best of its kind anywhere.

The development of air transportation in Alaska has been very rapid and is one, if not the greatest, aid in the present and future development of the country. The first commercial airplane flights made in Alaska actually date back no farther than 1923, the writer making the longest trip up to that time in connection with mining with Noel Wein in 1924, flying from Fairbanks to Eagle, a distance of about 220 miles as flown in 3 hours and 20 minutes. One company, which at present has over ten planes in use, has a base at Anchorage, Fairbanks and Nome, and at a few minutes notice will start out for practically any place in Alaska. Localities which by other means of transportation could not be reached from these places in from 5 to 20 days and more are now reached by airplane in from 3/4 to 5 hours. Thus the airplane trip from Fairbanks to Nome is

now made in less than $4\frac{1}{2}$ hours, a trip requiring at the best by other means 12 to 16 days, and to Livengood in the Tolovana district in less than 40 minutes, which otherwise would require 4 to 5 days of hard hiking with a pack over a tough trail. The benefit to mining as well as other industries is readily recognized both in the great saving in time and the ability to land prospectors and others and their outfits in distant localities which could otherwise not be attempted because of the inaccessibility. Another company is operating planes from Seattle to Juneau and points enroute and the usefulness of these airplanes was well ~~illustrated~~ ^{demonstrated} during the rush from Juneau to the important lode discoveries in the Taku region this year. Other planes are also being used elsewhere in Alaska. Some of the mail is carried by plane and fresh provisions and even small mining machinery and parts have been so delivered to some of the isolated mining districts at a cost closely equalling the rates by the customary pack horse method. While several fatalities have resulted from accidents to independently operated planes in poor condition, the licensed organized airplane interests have not met with a fatal or serious accident during the many flights made. More than 60 airplane fields have been provided through the aid of the Territory of Alaska and the cooperation of the townspeople at the various localities.

The review of the placer mining operations and devel-

opments conducted in the various mining precincts follows. It has formerly been the custom to report them under a district name designed usually by some local feature, the boundaries of many of these districts being very indefinite. Complying with new regulations, a new division will be followed as closely as possible in this report whereby the division by mining precincts will be used, the boundaries of which are definitely established by law. To avoid possible confusion, the old district name will also be given if deemed necessary. There are a few instances where certain areas have and will continue to be reported under precincts to which they are most accessible, but which legally lie in a different precinct. It is hoped that for the benefit of the people in those areas this condition will be corrected by the Court.

REVIEW BY MINING PRECINCTS.

SOUTHEASTERN ALASKA

While the first reported discovery of placer gold in Alaska was made in 1850 in the Kenai River Basin in Southwestern Alaska and a little mining done there, it was not until 1880, when gold was discovered near Juneau, that commercial production really began. Subsequently placer mining was done at numerous localities in Southeastern Alaska, some being conducted on a large scale. Since the

passing of these operations years ago this section has not been an important producer of placer gold. This year, however, witnessed the resumption of placer mining in one of the well known localities , where after several years of extensive preparation, hydraulic mining on a major scale was again conducted on Porcupine Creek in the Skagway precinct. A little mining was done on Montana Creek and near Wyndham Bay in the Juneau precinct, and along the beaches at Lituya Bay, Yakataga Bay and Yakutat in the Sitka precinct, but these operations were conducted mainly by manual methods and on a very small scale.

JUNEAU PRECINCT.

Placer mining in this precinct was conducted mainly on Montana Creek lying 12 to 15 miles northerly from Juneau. The first placer mining on this creek dates back to 1882, two years after the discovery of gold on Gold Creek at Juneau. The sluicing at that time gave fair returns but as most of the ground was found to be low grade, it has lain idle for many years. New interest has recently been taken in this locality as colors of gold can be obtained by panning at many localities along this creek and McGinnis Creek. The recent work done so far has been mainly in prospecting, a small gold recovery being made thereby.

Harry Watson conducted the principal work at the junction of Montana and McGinnis Creeks where he used a small "Crescent" scraper, operated through sheaves by cable from a Fordson tractor, in mining several small cuts. The average depth of gravel here is 7 feet to the clay false bedrock mined to. The gravel mined is relatively small and loose although along the limits of this area and especially in the creek and flats below, numerous large boulders and considerable clay are in evidence. By shaft sinking and trenching an area about 600 feet wide and 2500 feet long has been more or less prospected which is reported to show gold values from 20 to 40 cents per cubic yard. About 3000 cubic yards have been mined by this method, the total gold recovered therefrom was \$900. But one man is employed and the operation is conducted mainly for prospecting the ground. It is stated that 175 cu. yards were handled by this out-fit during the best run of 9 hours. It is hoped to develop an area of sufficient size and gold content to justify the installation of a small flume dredge, but the occurrence of heavy boulders and a general change in the character of the ground beyond the area so far prospected may show it to be unfavorable for this.

Gus Bohm, and J.F. Ross, prospected and shoveled in a little ground a mile or so down the creek from Watson's, and Frank Vincinetti and three or four others did similar

prospecting farther up Montana Creek.

Placer mining in the Silver Bow Basin back of Juneau is a thing of the past, although some hydraulic stripping is being done there by the Alaska Juneau Co., a large low-grade gold lode operation. In the mining of large tonnages of ore, the ore body there is caved to the surface. As the ore outcrop is usually covered with considerable debris and other material which must be kept from mixing with the ore, this company is first stripping such areas by hydraulic methods. Several men are employed on this work, the water being obtained from an old high line ditch. Sluices are set in order to dump the material where desired. Some of these sluices are provided with riffles and as the material carries some gold, a small quantity is recovered.

SKAGWAY PRECINCT.

The principal gold placers in the Skagway mining precinct or Porcupine district are located on Porcupine Creek and its tributaries, McKinley and Cahoonⁿ Creeks, and on Glacier Creek. The placers on Nugget Creek were worked in a small way some years ago. Extensive prospecting by drilling was at one time done on the Klehini River flats near Porcupine Creek, and the Salmon River Valley and Bear Creek were also prospected by manual methods. This prospecting, however, failed to disclose workable deposits. The principal opera-

tions conducted during the early days were on Porcupine, McKinley, Cahoon and Glacier Creeks where the strong relief and large water supply of the region provided exceptional facilities for hydraulic mining. (1) Large water supplies under

(1) U.S. Geological Survey, Bull. 699, 1919, by Henry M. Eakin.

high pressures were developed by relatively short flumes or pipe lines. Much excellent timber is available. Both creek and bench or old channel deposits occur and while no unusual difficulties exist for mining the benches, the chief obstacles encountered in mining the creek gravels are their position in the narrow rock rimmed canyons, the large quantities of water carried by these streams and the presence of much heavy wash and large boulders. The conditions taxed the ingenuity of the operators, large by-pass flumes were constructed to carry the water past the areas to be mined, expensive heavy machinery for boulder disposal was required and, in general, the mining of these creek deposits was a difficult task. During a number of high water periods the by-pass flumes were carried out and the operations filled in and covered over with material ~~brought~~^{brought} down by the floods. Hydraulic elevators were used at some localities. Most of the placers capable of being profitably worked under the existing conditions were mined in the past although a considerable extent of the creek bed in the canyon below the junction of Porcupine and McKinley Creeks,

and some bench or old channel placer still remains. After many years of idleness the various holdings and outfits were acquired by one company and preparations to resume mining on Porcupine Creek were started in 1926. A small pit was worked in 1928, but actual operation did not begin until this season.

This area is reached via Haines, Alaska, a small settlement near the head of Lynn Canal. A good road from Haines follows along the eastern limit of the Chilkoot Inlet and River to the Klehini River, thence up this River to the crossing at the mouth of Porcupine Creek, a total distance of 36 miles. The Klehini River is a large turbulent muddy stream, quicksands are present and its crossing is a dangerous undertaking unless made in a native boat. The lives of fourteen men and many horses are reported to have so far been lost in making this crossing. A cableway has been stretched across the river about 10 miles downstream from this point by which a man can cross although a crossing at that point is of no help to the mining interests. A serious obstacle to the mining in this area is the crossing of this stream. Freight is brought by auto truck to this crossing at a cost of \$25 per ton from which place it must be taken across the river in small native boats or canoes, or when water conditions permit by pack horses. After crossing the river a road leads to the present operations about 3 miles up Porcupine Creek. All

freighting is done during the summer as sufficient ice does not usually form on the Klehini River during the winter to permit its crossing.

The Porcupine Gold Mines, acquired the extensive placer holdings of 72 claims on Porcupine Creek and its tributaries, McKinley and Cahoonⁿ Creeks, and beginning in 1926 several years were spent in rebuilding flumes for the water supply, constructing a by-pass flume for the diversion of the creek water and in much other preparatory work. Two camps are maintained, the lower or general camp being the site of a saw mill of 20,000 B.M. Ft. capacity, where all lumber required is sawed. The difference in elevation between the lower camp and the mine is about 700 feet, the distance about 2 miles. A high line flume 9000 feet long and 4 feet in width takes the water from McKinley Creek. This provides a 300 foot head in the creek workings on the Fenley Claim and about a 150 foot head at the bench on the Lewis Claim located on the right limit of Porcupine Creek, two claims upstream from the Fenley. To obtain this water supply it was necessary to carry the water across McKinley Creek. This was done by erecting an "A" type truss timber bridge across the rock canyon a short ways above its junction with Porcupine Creek. This bridge was constructed to support the flume of 2000 miners inches minimum carrying capacity, as well as being a viaduct capable of supporting

any traffic incident to the transportation of supplies, etc. The bridge span is 280 feet long, the bottom of the flume being 280 feet above the level of the creek flowing beneath it.

The hydraulic operations conducted in the creek and the conditions encountered are unique and of special interest for no other operation of its kind is now being carried on in Alaska. The creek deposit being mined lies at the bottom of a narrow rock walled canyon and ranges from 40 to 60 feet in width at the surface to 5 to 15 feet at bedrock. Its average depth is 15 to 20 feet. Bedrock is a slate with some hard dikes, the bedrock surface being irregular in contour with potholes and high points. The average creek gradient is said to be about 2 percent. The gravel is mainly of heavy wash about 30 percent being stated to be over 10 inches in size, a considerable number of boulders being between 24 to 30 inches in maximum dimension. The gold is distributed throughout the gravel but the main concentration is at and near bedrock. The gold is worn and flattened and coated with iron oxide, the largest pieces found range up to \$20 in value. Considerable iron pyrite and magnetite, and small amounts of wood tin and other minerals are present.

To divert the water from the creek bed and carry it past the ground to be mined, a by-pass flume 800 feet long, 20 feet wide and 4 feet deep was constructed along the right limit of the narrow canyon at the creek level. This flume was

successful in handling all of the water this season although its position was such that as mining advanced it overhung the working pit, not only making it a menace and difficult to support properly, but the entire width of the deposit could not be mined. It is planned to remedy this difficulty in the future by driving a tunnel for a by-pass where permissible, or blast back into the rock rim to improve its position.

A 30-inch diameter pipe line 1200 feet long delivers the water from the high line flume penstock to the "Y" from where an 18 inch line leads to the hydraulic elevator and a 14 inch line goes to the field giants. One 4½ inch and one 3 inch nozzle are used in the pit.

The gravels are piped down and along the pit to the head of a steel lined sluice about 100 feet long and 2 feet wide which carries the smaller sized material and the water to the elevator sump. The head of this sluice is equipped with a grizzly made of wood, steel shod, 6 feet wide, 6 inch spacing and set at an angle of about 45 degrees. Joined to and following this grizzly is a timber grid which covers this sluice its entire length. As the boulders and heavier material reach the head of this sluice, a 1/3 cu.yd. Sauerman "Crescent" scraper is drawn back and forth, scraping the material up and over the grizzly to the rock dump. The scraper is operated by a two drum hoist driven by a 30 H.P. motor. The

electric power is provided by a 50 K.V.A. generator driven by a 40 inch Pelton water wheel. One man operates the hoist and scraper, although several men must often be in the sump to aid in loading it. This scraper is not only too light and of wrong design but is otherwise not well adapted for this work. In being drawn up and over the grizzly, considerable of its load falls out, or a flat boulder may become caught in the grizzly stalling or upsetting the scraper and its load. The use of a stone boat properly rigged and operated suggests itself for boulder removal from the pit with a different means for screening out the oversize if this would then be necessary, although with the present set-up and operation the hydraulic elevator would have trouble handling any larger size material.

All material passing through the grizzly goes through the sluice to the elevator sump where a Hendy hydraulic elevator with a $5\frac{1}{2}$ inch nozzle and 14 inch throat lifts it 35 feet to the sluice boxes. These boxes are 4 feet wide, 150 feet in total length, set on a 12 inch grade and equipped with transverse rail riffles followed by block riffles. Two 8 inch water lifts are also provided in the elevator pit to handle the excess seepage water. About 50 percent of the material piped down passes through the grizzly and occasionally a long flat slabby rock may pass through, get to the elevator and choke it. It is stated that in 30 days of steady operation about 200 linear feet of the creek can be mined.

A short pit was mined in 1928, and this season a pit about 500 feet long was completed.

This company also completed preparations in opening up an old pit in the old channel deposit on the Lewis Claim along the right limit of Porcupine Creek. This deposit lies about 150 feet above the level of the creek and where opened up, it is about 60 feet in average depth, 80 feet wide at the surface, narrowing down within its slate walls to about 10 feet at the bottom. Hydraulic operation will start here next season.

The company employed 40 men this season, about half of them being at the mine camp. General labor is paid \$5 per day, plus board. Three 8-hour shifts are worked in the pit. Al Smith did a little sluicing on Marble Creek, a short lower tributary of Porcupine Creek.

COPPER RIVER REGION.

The Copper River Region embraces a large area and due to its accessibility, location, and drainage is broadly considered to include the following mining precincts: Kayak, Cordova, Valdez, McCarthy, Chitina, and White River. Placer mining activities are however restricted mainly to the McCarthy precinct which includes the Nizina district, the White River precinct which includes the Chisana or Shushana district, and the Chitina precinct which includes the Chisna, or Gulkana - Chistochina, Nabesna, Delta, Valdez Creek and

Nelchina placer districts. This precinct division, including as it does the Delta, Valdez Creek and Nelchina districts, which lie near to the northern, northwestern and southwestern borders, respectively, of the Chitina precinct, and are reached from other precincts from which they are best accessible, imposes considerable expense and difficulty in connection with legal matters concerning location, recording, etc. As these districts have always been formerly considered and reported as in other precincts or mining districts, the old division will therefore be followed in this report. The Delta district will therefore continue to be considered under the Tanana precinct in the Yukon basin; the Valdez Creek district as in the Talkeetna precinct, and the Nelchina district in the Knik precinct of the Cook Inlet-Susitna Region, of which these districts should rightfully be a part. According to the U.S. Geological Survey,⁽¹⁾ the Copper River Region, in

(1) Mineral Resources of Alaska, 1927, Bulletin 810-A

which that body includes the Nizina, Chistochina and Nelchina districts, made a total placer gold output valued at \$102,000 in 1926, and \$89,000 in 1927. All early indications tend to show that the output for 1929 from these districts was larger than in 1927.

McCARTHY PRECINCT.

NIZINA DISTRICT:

Three hydraulic operations employing 35 men were con-

ducted in the Nizina district during 1929, these being located on Dan and Chititu Creeks. Some drilling and other prospecting was also done on Lower Chititu Creek to determine its possibilities for dredging. A hydraulic plant is to be installed on Copper Creek and operated next season.

The Nickoli Mining Co., formerly the Dan Creek Hydraulic Mining Co., conducted hydraulic operations on an old gravel channel on the right limit benches of Dan Creek. This old channel deposit which lies well above the creek level has only recently been opened up and is said to range from 80 to 150 feet in depth, containing fairly heavy wash with considerable clay, many heavy copper nuggets and a very good gold content. A pit, approximately 200 by 200 feet in area and containing about 180,000 cu. yds. was mined this season, a crew of 12 men being employed. Eklund, Hall & Boyden also operated a hydraulic plant on Dan Creek, a short ways below the canyon on a lease from the Nickoli Mining Co. Only the three partners were engaged in this work and a very satisfactory season is reported. A hydraulic plant was at one time taken to Copper Creek, a tributary of Dan Creek, but as far as known was not operated, if so very little. O.A. Nelson of Chitina has acquired this plant and the Cayouette ground on this creek and was engaged in preparatory work incidental to starting hydraulic operation here next season. The Jno. E. Andrus hydraulic operation on Chititu Creek was

carried on with good results. But one of the two camps was however active this season with 20 to 22 men employed.

The novel and interesting hydraulic operations conducted on Dan and Chititu Creeks, where large supplies of water are available, all preparatory work and set up for the season's mining is done at one time whereby the sluice boxes are set below bedrock down the center of the entire pit to be mined that season, and the method of piping the gravels over the side of the boxes, etc., are fully described in U.S.B.M. Bulletin 259, p. 147-153. Tailings are stacked by giant but at the former Dan Creek operations practically all of the material was put through the boxes, the larger rocks, excepting the exceptionally large ones, being blasted and then put through. At Chititu Creek the boulders are stacked on cleaned bedrock in the pit by a simple efficient method which could be used to fine advantage at many operations elsewhere where conditions favor it. It utilizes a small steel stone boat with low sides operated by cable through sheaves and blocks from a steam donkey hoist set on skids. A relatively light gin pole 25 feet or less in length is erected in the pit on cleaned bedrock at the point it is desired to stack the rocks and guyed with light cables. To this is attached a sheave. The cable pulling the loaded stone boat to this point passes through this sheave which is further guided through blocks on the bank

or elsewhere. To the other end of the stone boat is attached the pull-back cable by which the empty stone boat is returned to the face. Thus there is a continuous cable arrangement, which is operated back and forth over the donkey hoist drum as the drum is operated forward or reverse, or by a two drum hoist, one forward, one reverse. The stone boat is delivered to the face from where boulders are being removed, while piping is underway on the opposite side of the boxes. It is loaded and then pulled to the gin pole, where as it is pulled closer to the sheave, the rocks roll off, after which the stone boat is returned to the face for another load. This system can be operated cheaply and quickly and the set-up for it can be quickly made.

CHITINA PRECINCT.

CHISTOCHINA DISTRICT:

The principal placer mining in this district is done on Slate Creek and the near vicinity, at the headwaters of the Chistochina River. Unfortunately, there is but little information available concerning the placer operations there. The Slate Creek Mining Co., formerly conducted large hydraulic operations on Slate Creek. This ground has for the past few years been hydraulicked by Arne Sundt with very satisfactory results. This season he had a crew

of 10 to 12 men engaged on this work. The Alaska Middlefork Mining Co., again had several men doing prospecting and assessment work on its property on the Middle Fork of the Chistochina River. It has been stated a party who was in the district this season is planning a mining operation on this property for next season. Geo. Todd and partner did some sluicing and prospecting on one of the tributaries of Slate Creek and are to install and hydraulic with a hose outfit next season.

WHITE RIVER PRECINCT.

CHISANA (SHUSHANA) DISTRICT:

According to the meager information available concerning the placer operations in the Chisana District, the number of operations and the gold output are gradually diminishing, but about 5 small operations using automatic dams and one hydraulic operation being reported active this season, a total of about 12 men being engaged. Johnson & James had a small crew mining with an automatic dam and a small hydraulic plant on Little Eldorado Creek and were the principal operation. Automatic dams are used for stripping and booming followed by shoveling-in by McGettigan & Green, and Miles Atkinson, on Bonanza Creek, Jno. Carroll and W.E. Kinney on Gold Run Creek. A Nelson mined a little on Bonanza Creek, and there were probably several other men mining in the district that were not reported.

Mining has been going on in the district since its discovery in 1913 and to date the total placer gold output has been about \$700,000. In 1927, the output is reported to have been \$15,000. Most of the placer ground on the creeks has been worked over several times, mainly by manual methods. The district is isolated and is generally reached from McCarthy, the end of the Copper River Northwestern Railroad, from where freighting into the district is done, by pack train during the summer over a 100 mile trail which crosses several dangerous streams and a number of glaciers, and by dog teams during the winter. Freighting costs are high and operation in the district is costly. A few years ago a new trail via Gulkana was opened which is much safer to travel as it avoids the glaciers. The placers are located at high altitudes above timber line, fuel and timber must be hauled a long ways, and the water supply is very small, being dependent mostly on melting snow and rain. Miners in the district contend a large area remains unprospected.

COOK INLET-SUSITNA REGION.

The Cook Inlet-Susitna Region is here designated as including the Kodiak, Iliamna, Seldovia, Kenai, Knik and Talkeetna mining precincts, although placer mining is now restricted mainly to the latter three. The principal placer mining of the Region is conducted in the Talkeetna pre-

cinct which includes the Yentna, or Cache Creek district, and other areas drained by the Susitna River, also in the Kenai Precinct which includes the Hope-Sunrise or Moose Pass district, and in the Knik precinct where placer mining is done mainly in the Girdwood area. By reason of location and accessibility, the Nelchina district is here included under the Knik precinct, and the Valdez Creek district under the Talkeetna precinct, although according to legal division both of these placer districts lie within the Chitina precinct in the Copper River Region.

The Cook Inlet-Susitna Region was at one time a region of much placer mining activity particularly those districts where the principal mining is still going on. Hydraulic operations, some of which were formerly conducted on a large scale produced a large portion of the Region's gold output. Dredges were formerly operated in the Kenai district, and later, a more modern dredge operation was conducted on Cache Creek in the Yentna district until 1927. There are numerous localities in the Region possessing physical conditions favorable for dredging although their economic possibilities must still be determined. Manual placer mining methods also yielded very satisfactory returns in the earlier days. While numerous possibilities still remain and there are still quite a number of profitable operations being conducted in the various districts the principal placer areas have

been extensively mined. The Region affords many features favorable for placer mining. Topographic and climatic conditions provide favorable water supplies, in many instances large supplies under high pressure. Ground conditions are decidedly different from those in the interior precincts, there being no permanently frozen or muck covered ground. The Climate is also more moderate as a rule particularly along the coast where a considerably longer mining season is available to some methods of placer mining.

KENAI PRECINCT.

HOPE-SUNRISE DISTRICT:

An exceptionally fine highway constructed by the Bureau of Public Roads from Mile 29, or Moose Pass Station on the Alaska Railroad, now makes the Hope-Sunrise district very accessible. The section between Hope and Sunrise was completed and opened to general traffic this spring. The distance from the railroad to Sunrise is 36 miles, and from Sunrise to Hope, $9\frac{1}{2}$ miles. This road also has been completed from Hope to the Hershey Quartz property at the head of Palmer Creek, a distance of 12 miles. The old road from East Fork to Lynx Creek, a distance of 8 miles has also been reopened and made passable for automobiles. This fine road system greatly benefits this area which was formerly most easily reached from Rainbow on the Alaska Railroad, crossing Turnagain Arm, to Hope by a gas boat operated at very irregular

periods. Trails then led from Hope to the various localities. The freight rates via auto truck from Moose Pass Station are now 1 cent per pound to Sunrise and Hope and $1\frac{1}{2}$ cents to Lynx Creek.

Eight placer operations with a maximum number of 21 men engaged were conducted in this district during 1929, Of these the principal production was made by 4 hydraulic operations with 16 men engaged. The placer gold output for the district this year probably did not exceed, but may have reached, \$10,000.

Chas. Harper conducted the only placer operation in the Hope area where he operated a hydraulic plant on the property of the St. Louis Mining and Trading Co. on Resurrection Creek. Until this year this property had not been operated for about 20 years. The creek deposit mined averages 7 to 9 feet in depth, portions of it being overgrown with timber and brush. The wash is heavy containing some boulders up to 4 feet in maximum dimension. Bedrock mined to is a brown clayey barren gravel, or conglomerate, which unconformably overlies the true slate bedrock in most of the lower 4 or 5 miles of this creek. This clayey gravel in the locality now being mined is about 5 feet thick and contains no gold. The contour of the slate bedrock is locally irregular and the creek gradient is low averaging about $2\frac{1}{2}$ per cent.

Water for the field giants is supplied by a 1400 foot

ditch from where it is carried to the Y by a 6000 foot pipe line, 30 to 24 inches in diameter. From the "Y" and in the pit 11 to 9 inch pipe is used. Two No. 2 giants with 4 inch nozzles are used in the field under a 135 foot pressure. A large supply of groundsluice water is available from the immediate creek. Tailings are stacked with a giant with $3\frac{1}{2}$ inch nozzle under a 200 foot head, water for this being supplied from another ditch formerly used by an operation further down the creek. The mining is at present being conducted just below a bend and in a narrow part of the creek bed. Small pits are therefore mined, usually 90 to 100 feet in size, as sufficient room must be given to divert the creek past the operations. Eight lengths of sluice boxes, 36 inch wide, are set on a 7 inch grade. The gravel is piped into the head of the boxes. Boulders are mostly removed from the pit, being loaded into a wire net handled by an overhead cableway operated by a small hoist driven by a Pelton water wheel. The water supply is ample for a steady supply to the two giants in the field and the one stacker giant although the field giants deliver more material than can be stacked with the available water for that purpose. Seven pits, or about 60,000 sq. ft. of area, 8 feet in average depth, were mined this season; a crew of seven men being employed when 2 shifts were worked, being reduced to 4 men and 1 shift later in the season. The hydraulic operation conducted for many years low-

er down on Ressurrection Creek by Matheson Bros. did not resume this year, as the ground would apparently not support profitable operation.

Jacobs & Amodt hydraulicked an old channel on the left limit bench of Lynx Creek on the Boulder Claim with very satisfactory results. These men discovered the pay on this bench in 1925 after several previous attempts by others had failed. The old channel has been dissected and cut up by Lynx^x Creek in eroding its deep valley. Its erosion and reconcentration in the creek bed down stream from the present workings no doubt account for most of the creek placer which was formerly mined there. No pay of consequence has been found above this point. This bench is located 50 feet above the creek level and while its extent has not been definitely determined the portion now being mined is apparently 150 to 200 feet in width and about 1000 feet in length, being cut off at each end, but other portions exist on the other limit of the creek. The depth of the deposit ranges from a foot or so at the outer rim to 25 feet at the present face and may be deeper farther in. The upper 3 to 5 feet show some sorting which occurs apparently along a more recent water course. This material is tight and cemented with clay. Otherwise the wash is heavy with large rocks and compact, containing much clayey material, and while the rocks are well rounded, the deposit shows no sorting. Bed-

rock is a slate with lenses of graywacke and stringers and blobs of quartz. The gold is coarse and mostly well worn although a little sharp gold, some with attached quartz, is also present. The average gold content of the deposit so far mined is about 55 cents per cubic yard. This deposit is indicative of the possibilities of many similar benches and old channels in this district and elsewhere.

About 4000 feet of the old Lynx Creek ditch is used to supply the water which is syphoned across Lynx Creek by 1000 feet of pipe, 17 to 10 inches in diameter, and delivered through 10 and 9 inch pipe to the one giant with a 4 inch nozzle at a head of 210 feet. This water supply permits steady operation with one giant. The ~~only~~ groundsluice or bank-head water is obtained from a ⁿ nearby draw and is generally too small in quantity to be of much use. The gravel face is piped down and into the head of the sluice boxes which are 4 boxes long, 26½ inches inside width, equipped with rail riffles and set on a 16 inch grade. Tailings dump into the creek below. Boulders are loaded into a net and disposed of by a short overhead cableway and a carrier operated by a small hoist driven by a Pelton water wheel. Mining on this bench began in 1926, all work being done by the two partners except occasionally when an additional man is employed. To date, an area averaging 60 feet in width and 325 feet in length has been mined, the average depth mined

being 18 feet. About 120 feet of this was mined this season. The cost of mining is about 35 cents per cubic yard.

Tolson & Co., 4 local miners, operated the hydraulic plant in the upper channel deposit on the left limit of Canyon Creek near Mile 28 on the road out of Moose Pass. This partnership operated the property for a while last year, this season continued until August. The gold recovery was small and the operation will not be undertaken again under present arrangements. This season mining was done mainly at the head of the big cut but bedrock could not be reached. A small area was then piped out at the head of this cut but well on the right limit which was found to be very low grade. The pay, if present, apparently lies deep on the left limit of this old channel. This property is owned by the Canyon Creek Development Co. of Philadelphia, who spent a large sum of money a few years ago in preparatory and development work on this property with plans for subsequent operation on a large scale. The plans were to first mine out this high channel, while a high dam was being constructed in the creek bed to raise and divert the creek through this channel. This would then permit the drained creek placer in the canyon below to be mined. This dam, constructed of timbers and filled with clayey wash hydraulicked from the benches above, was erected to a height of 60 feet when all plans were abandoned.

Being unattended, the two lower outlets of this dam collapsed and filled up, impounding the water, which on July 4, 1928 broke through taking with it some of the hydraulic filling. The timbers remain in place but the structure is now a menace to the bridge below the canyon. When completed this dam was to be 110 feet high or 90 feet to the spillways. Hydraulic mining was conducted for several seasons in this high gravel filled channel, when about half of its 1700 feet length was mined out with unsatisfactory results. This old channel deposit contains a stream sorted tightly packed heavy gravel, confined within its narrow and steep slate and graywacke rock walls. The gold content is small. The average width at the bottom is about 30 feet. This lower gravel is covered with a deep overburden of glacial material, a section 5 to 25 feet in thickness being a cemented blue clay and fine gravel. In places, the glacial material has been impressed deep into the underlying stream gravels. This cemented material on caving comes down in enormous blocks which the giants cannot break up. They, as well as this material, in the banks, therefore had to be blasted to bits before they could be disposed of. The cut was opened to a width of 150 to 200 feet at the surface. The total depth from surface to the bedrock floor ranges from 100 to 140 feet. A No. 7 giant with 6 inch nozzle under head ranging from 325 to 375 feet

was used in this pit.

Another old gravel channel exists further down stream on the same limit of this creek, being about 1 mile long, 50 to 70 feet wide at the bottom, about 150 feet wide at the top, and 90 feet in maximum depth. The bedrock floor at the lower end of this channel is but a few feet higher in elevation than the level of the present creek. The creek water diverted through the upper channel was to be flumed over to the head of the lower channel and used to groundsluice it down in preparation for its eventual mining. The present creek placers in the canyon below the dam are stated to range from 7 to 12 feet in depth and to contain high gold values. Years ago, however, much of this creek ground was mined by the early miners who constructed wing dams and worked the creek bed by shoveling into sluice boxes. The property possesses a large amount of hydraulic equipment, a fine saw mill, a good camp, etc., and a large water supply.

Oscar Dahl mined on his property, the former Wilson ground, on Canyon Creek, just below Mills and Fresno Creeks. Hydraulic mining this season was continued on the left limit bench of Canyon Creek although the larger part of this season was spent on a pit which was found to be off the pay. After Tolson & Co. finished their operation on Canyon Creek, they assisted Dahl and somewhat better results were obtained. The deposit here which is practically all a rounded well-wash-

ed gravel is 15 to 50 feet deep averaging about 20 feet. While slate and graywacke constitute most of the bedrock, certain local areas have this bedrock covered with up to 5 feet of white to yellow sticky clay. Chunks and wedges of this clay also occur irregularly placed through some of the gravel wash. The deposit is low grade and the gold occurrence is spotty, the main gold bearing wash being confined mainly to a certain irregularly occurring strata of mainly angular wash, ranging from 1 to 12 feet in thickness. No regular system of mining was followed this season although the gravel is piped down and driven into the boxes. One No. 4 giant with a 4 to 5 inch nozzle under a 300 foot head is used for piping. A natural tailing dump into the creek below is available. An average of 4 men were engaged. Prospecting on the other limit of the creek directly opposite the present workings is said to have uncovered some good ground in a bank of gravel about 35 feet high which is apparently Mills Creek wash. It is now planned to do next season's mining at this locality.

Others who mined placer in a small way in this district were M. Connolly on the left limit benches of Six Mile Creek; Tom Allison on the bars of Six Mile; and Bob Michaelson, and Fred Matz, on Mills Creek.

KNIK PRECINCT.

GIRDWOOD DISTRICT:

One hydraulic operation with 3 to 5 men engaged constituted the placer mining done in this district this season. This operation was conducted by Holmgren & Erickson on the benches of Crow Creek, a tributary of Glacier Creek. Hydraulic operations here were formerly conducted in the Creek bed and on a larger scale than at present. Of special interest at that time was the method of handling the boulders, which were drilled with light machine drills of the "Jack hammer" type, blasted, and piped into the head of the boxes, tailings being stacked with a giant. This hydraulic operation is described in U.S.B.M. Bulletin No. 259, p. 145-146.

Joshua Dawson had a small crew at work on California Creek, a lower tributary of Glacier Creek installing and operating a water wheel driven saw mill and doing other preparatory work for the installation and operation of a hydraulic plant there next season.

A good automobile road has been completed by the Bureau of Public Roads which starts at Girdwood, follows up the right limit of Glacier, and up Crow Creek to its head where the Girdwood placer property and several quartz properties are located. The Girdwood property has long been inactive but when court orders are cancelled which prohibited operation because of former possibilities of dumping some tailings on creek ground below, some plans

for its future operation will no doubt materialize.

NELCHINA DISTRICT:

The Nelchina district which legally lies in the Chitina precinct has been the scene of very little placer mining in recent years, although some of the early miners have stayed with it and do a little mining each season. The district has the reputation of having a spotty gold distribution, probably because of the deep and extensive glacial gravels there, which while containing minute quantities of gold have been eroded at places and reconcentrated by the creek helping to form small local areas of pay. Albert and Alfred Creeks are the principal ones mined on. The district is reached by trail from Chickaloon on the Matanuska branch of the Alaska Railroad. John Gallivan, Jack Cameron, and A. Christopherson mined on Albert Creek. Gust Nordgren, and Al Drees, mined on Alfred Creek. E. Wenkle was on Slate Creek. J. Schneller, and Oscar Vogel were prospecting.

TALKEETNA PRECINCT.

The Talkeetna precinct generally known as the Susitna Region, includes the areas drained by the Susitna River and its tributaries of which the Yentna, Chulitna and the Talkeetna Rivers are the largest. It, however, legally excludes the upper reaches of the Susitna River which lie within the Chitina precinct, but which for reasons of location and accessibility will herein be considered as a part of the Talk-

entna precinct. This precinct as herein considered therefore includes the Yentna district, and several small detached areas lying a short distance north of Cook Inlet, and the Valdez Creek district which legally lies in the Chitina precinct. The Yentna district more often referred to as the Cache Creek district also includes the Fairview area in the Kahiltna River Basin and the Rainy Pass area at the headwaters of the Swentna River. It also includes the drainage basins of the Chulitna, Talkeetna and other tributaries of the Susitna River where placer gold, and at times a little platinum is found at numerous localities but which has not been mined except occasionally in a very small way. Practically the entire placer gold output of the Talkeetna precinct is now made by the Cache Creek district and which, including that from the Valdez Creek district, amounted to about \$75,000 in 1929.

YENTNA DISTRICT

CACHE CREEK AREA:

Twenty-one placer operations with 36 men engaged were conducted during 1929 in the Cache Creek area which includes Cache and Peter Creeks and their tributaries. Eight of these were hydraulic operations with 20 men engaged, the other miners being engaged in groundsluicing and shoveling-in, prospecting, preparatory work or in doing as-

assessment. But two of the operations engaged more than 5 men. This area made a very creditable production in the earlier days and continued to do so as long as the dredge operated on Cache Creek. This dredge however dug the last of its ground in 1927 and has since lain idle. In the meantime placer mining in this area has declined, probably reaching the lowest stage in its history this year when the gold production dropped to about \$45,000. An improvement is however looked for in the near future as several of the operations were engaged in preparatory work subsequent to hydraulicking next season, and the principal operation is to be conducted on a larger scale.

The Cache Creek area is reached via Talkeetna on the Alaska Railroad. All supplies for the mining camps must be taken across the Susitna River at this point by poling boat. This river is a large turbulent glacier fed stream with many branches spreading out over its wide bed. In a straight line, it is about one mile from Talkeetna to the freighter's camp on the opposite or west bank of this river but it is 3 or more miles as travelled by river and land. Numerous difficulties and delays attend this crossing especially this season when they were increased by being dependent upon the whims and independence of the only parties now providing the means. The necessity of crossing this river is and always has been a heavy handicap to the district. A wagon road has been com-

pleted to Peters Creek or Mile $23\frac{1}{2}$. During the summer, the freight is here transferred to pack horses. A trail continues from here over the mountain and into Cache Creek. Another trail from here goes to upper Peters Creek. From just below the upper Canyon on Peters Creek, a pack trail crosses over the divide into the head of Cache Creek and completes the circuit. The distance from Talkeetna to upper Cache Creek by either route is about 45 miles. From Talkeetna to Yentna P.O. on Cache Creek the distance is 40 miles, to the upper canyon on Peters Creek, 40 miles. The freight rate to all camps is 20 cents per pound during the summer, and during the winter \$85. per ton.

The principal placer operation and producer of the major portion of the district's placer gold this year, was that of James Murray, who with a crew of 8 men hydraulicked on a right limit bench of Cache Creek just below the former dredge camp. Mr. Murray owns all the ground formerly owned by the Cache Creek Co. which includes 12 miles of this creek with its benches. Four or more tiers of benches occur along the right limit of this creek which although dissected by stream erosion are very extensive. While the creek bed has been dredged, considerable marginal ground was left as being better adapted to hydraulicking. The bench now being mined lies 20 feet

above the creek level, the other tiers lying above it. The results from this season's mining on this bench indicate a long successful life for this operation, although the gold tenor and possibilities of these benches beyond the immediate vicinity of the present workings must still be determined. In the present workings, the deposit ranges 5 to 8 feet in depth, consisting of average sized stream wash, however, containing a few large granite boulders, some streaks and wedges of clay and other material which apparently is resorted glacial wash. The gravels are covered with a little soil, brush and cottonwood timber. The bedrock is a soft coal formation composed of sandstone, shale, conglomerate, clay and lignite. An average of about 2 feet of this bedrock is taken up in mining so the average total depth mined is about 6 feet. The gold is coarse and well worn. The gold content varies but this season averaged better than 25 cents to the square foot.

Water for hydraulicking is obtained from Nugget Creek, a ditch 6 miles long, delivering it to a large reservoir on top of a high bench from which it is fed to another reservoir located 80 feet lower in elevation. From this lower reservoir it is carried by a 1 mile pipe line, 22 to 16 inches in diameter to the "Y" where 11 inch lines lead to the working pit. This supply affords about 600 miners inches at a maximum and permits practically steady operation for the two fields

giants using 3 inch nozzles. The balance of the pressure water is available for the groundsluice, although water for this purpose is often inadequate for efficient work. Six to 8 lengths of 28 inch width steel boxes lined inside with side boards are set at the outer rim of the bench. A heavy grid of old manganese steel dredge riffle sets is placed on bedrock ahead of the boxes to facilitate piping the material into the head of the boxes. It protects the bedrock ahead of the boxes thereby overcoming troubles otherwise often caused by the development of a sump or pot hole at the head of the boxes. The sluice boxes are equipped with rail riffle sets placed lengthwise.

The width of the bench, or an average of 150 feet is mined. The pit is continuous along the bench, a new set-up of the boxes being made whenever the distance from the head of the boxes becomes too great for efficient work by the giants. The elevation of the bench affords a natural dump for the tailings. Three eight hour shifts, 2 men to the shift, were worked from May 28th until September 9th, when because of the dark nights this was reduced to two 8-hour shifts, the season's operation closing on September 21st. This operation, while not a large one, is one of the most efficiently and systematically conducted hydraulic operations in Alaska. Mr. Murray keeps a close check on the amount of water used, the time the giants are in operation, etc., and

has kindly provided the following operating details. This season 100,000 sq.ft. of area, 8 feet in average depth, were mined at a cost of 10.1 cents per sq.ft. or 33.6 cents per cubic yard. The water was at work piping gravel, etc., for 908 hours; while the balance of the time was spent as follows: removing rocks from pit - 598 hours; cleaning up - 126 hours; setting up - 548 hours; moving giants - 246 hours; wing trouble - 23 hours; box trouble - 30 hours; pipe line 361 hours; ditch and reservoir - 80 hours; a total of 2920 hours. High water or flood conditions caused ditch and pipe trouble and overtime for setting up, etc., consuming 208 hours, and as this was exceptional difficulty the working hours would normally have been but 2712 hours, or but 33.5 per cent of the total time available was actually spent in piping. As Mr.Murray explains, this was unusually low as this season was the first one spent mining the bench ground and numerous things happened which will probably not occur again. His former mining in the creek showed that piping was actually underway for 60 percent of the available time, and he expects to realize at least 50 percent in the future on the benches. With this system he can keep a close check on the work and knows what gold recovery will be made for each hour the giants are at work. This season \$28.66 in gold was recovered for each hour of piping. All set-ups and other preparatory work for next season have been made so that

everything is in readiness to start piping next spring. Operation is to be conducted on a larger scale next season.

Leasing from James Murray, A.J. Taraski, working alone, hydraulicked on a low bench on the left limit of Cache Creek on the New York Group. Fred Dassell sluiced a little on the right limit, and Wm. Pineo sniped with a rocker in some of the old cuts. Halvor Erickson with one man hydraulicked shallow creek gravels on upper Cache Creek on the former O'Rork ground, using 2 to 3 inch nozzles with an intermittent supply of water.

Al Wolf working alone hydraulicked on the left limit of Thunder Creek in a clay cemented gravel bed which dips and conforms with the bedrock formation and which lies higher in the geological column than the Tertiary quartz bed formerly mined on the other limit of this creek and on Dollar Creek. It is also very different in character than this quartz placer being composed of very well worn rounded pebbles of quartz, quartzite and jasper more or less cemented by a siliceous clayey material. The pebbles are of various colors, white, yellow, red, purple, etc. The material carries some gold, both sharp and worn, but its distribution is very spotty and the deposit is very low grade. The tertiary "quartz" bed formerly mined here and on Dollar Creek is described by the writer in the 1925 Annual Report of the Mine Inspector for Alaska, p.33, and has been fully described by

S.F. Capps as "An early Tertiary Placer Deposit in the Yentna District" in U.S. Geological Survey Bulletin No. 773, 1925. Thunder Creek has been pretty well mined of its known placer and the old Thunder Creek Mining Co. interests are now being brought to a close. The Creek provides a small water supply which however must be impounded and used intermittently during most of the season.

No placer mining was done on Falls Creek, or on Short Creek. Trepte, Hamberg & Gliska after prospecting and discovering pay this season on Dollar Creek just below the canyon, took a lease on the property and were engaged in preparatory work for hydraulicking there next year. Joe Krumenaker moved his hydraulic plant from Windy Creek To Chechaca Gulch. Ole Dahl did a little sniping on Nugget Creek. Chris Hammer-smith conducted his usual seasonal sluicing of the old deep St. Louis bench on Bird Creek and Wm. McGetigan did some sluicing and prospecting on lower Bird Creek and in that vicinity on Peters Creek.

Nick Balabanoff with 3 others conducted hydraulic operations on the former Harper ground which lies just below the upper canyon on Peters Creek. This creek deposit ranges 7 to 10 feet in depth, averaging 8 feet. The gravel is of average size although containing some large boulders. Bedrock is a conglomerate, sandstone and slate formation. Creek gradient is 2 to $2\frac{1}{2}$ percent. The best water supply in the district is available here providing a steady supply under 170

to 180 foot heads, and a large quantity of groundsluice water is obtainable from the immediate creek. There is a $2\frac{1}{2}$ mile ditch which carries about 500 to 600 miners inches. Main pipe lines are of 16 and 13 inch diameters. The present operators are working pits 100 by 100 feet by piping into the head of a short string of boxes set on a 6 inch grade. Tailings are stacked with a giant with 3 to 4 inch nozzle. About 50,000 sq.ft. were mined this season, the operation being delayed by a flood which refilled one pit before it was completed.

Frank Jenkins did a little hydraulicking on his upper ground on Willow Creek, but having acquired the property below also, spent most of the season in preparing for more extensive hydraulic operation next season. Chris Hansen also did some sluicing and prospecting on this creek.

On Peters Creek, below the lower canyon, Elmer Carlson did a little sluicing and is planning to resume hydraulic operation there next season, and Weatherell and Andresen did assessment work on their claims. Above the canyon, Henry Rodgers and Henry Peters prospected and did a little sluicing.

Monroe Cast operated his hydraulic plant on Poorman Creek. Tom Weatherell prospected on Gold Creek, a small tributary of Cache Creek. Dick Francis sluiced on Long Creek.

FAIRVIEW AREA:

This area lies about 25 miles westerly from Cache

Creek, from where it can be reached by trail, but is best reached by small power boat, going from Anchorage to the Susitna River, thence up this river and the Yentna River to the mouth of Clearwater Creek, a distance of about 135 miles from Anchorage. A trail leads from here into Mills Creek, a distance of 16 miles. Placer mining has been conducted on a small scale in this area for many years, mainly on Mills and Twin Creeks and from its discovery in 1906 to date has produced around \$45,000 in placer gold. Gold has been found on many of the creeks and while many endeavors have been made in the past to operate the placers by methods other than manual these have not been successful. Conditions in general do not avail water supplies sufficient to support any but very small operation. Gold is found widely distributed but has been found in workable quantities only at a few localities. This is no doubt due to the extensive beds of glacial wash which cover much of the country. This glacial wash contains a little gold and where large quantities have been reconcentrated, workable placer ground has at times been produced. This feature and the fact that the creek gravels are not frozen but wet, has complicated prospecting. At some localities, however, the source of the gold has apparently been the local bedrock. General conditions not adverse for dredging exist on Mills Creek and its tributary, Twin Creek. Gold is present in encouraging

quantities although the commercial possibilities must still be determined.

While the district has at different times received considerable publicity there has been very little activity there in recent years. There has been a decided decline since the writer visited the area in 1925. During 1929, placer mining was reported to have been done by only two men at two localities. Pat Collins, who has long been groundsluicing and shoveling-in on Upper Twin Creek continued this work. Sam Wagner, who first discovered placer gold in this area, sluiced and prospected. Matt Hugar's property on Mills Creek was idle. Alex Liska and Axel Nelson are reported as having prospected in the area and several prospectors were around Lake Creek.

VALDEZ CREEK DISTRICT:

Gold was first discovered in the Valdez Creek district in 1903 and to date about \$525,000 has been recovered by the placer mines. The main portion of this production was made from lower Valdez Creek, the Tamany bench, and several of the tributaries of Valdez Creek. Denali, the settlement of the district, is located on Valdez Creek, about 2 miles up from its junction with the upper Susitna River, and about 60 miles by pack trail to the east of Cantwell, on the Alaska Railroad. The Susitna River crossing is a dangerous one during the summer when it cannot be forded but must be

crossed by row boat. Freight rates into the district are high, even in winter costs of \$150 to \$200 per ton have been reported. The placers are located mainly between elevations of 2800 to 4600 feet above sea level and consequently the placer mining season is comparatively short.

This district has experienced heavy and extensive glaciation causing the deep scouring of the stream beds, destroying such placer as may have existed in them and scattering it over a large area. With the retreat of the glaciers, a deep layer of glacial material was left behind through which the streams have cut new channels into the underlying bedrock. This glacial material contains some gold and small isolated spots may at times be found containing considerable gold, but rarely sufficient to support profitable mining. The resorting of such material by subsequent stream action whereby large quantities are reduced to a relatively small volume, may form workable placer. Some of the preglacial placers escaped glaciation and destruction, as is the case with an old channel found and mined on the right limit bench of lower Valdez Creek, the Tamany bench. Unless stream erosion has exposed such remaining sections of preglacial placers, they are very difficult to prospect for. Nevertheless there remain possibilities of finding further sections of such channels but probably none as important as the one mentioned. The deep covering of glacial material on most of the benches, the depth of the

creek gravels of Valdez Creek above the canyon and of its tributaries, the generally very heavy gravel with many large boulders, and the unfrozen wet condition of the ground has been a great handicap to prospecting and mining in the district. In some instances, however, as on Lucky Gulch, Timberline, Rusty and White Creeks, the gold at the upper reaches at least, has apparently been derived from the erosion of the local bed^{rock} and the gravels are not so deep, some of these localities being near the upper limits of the heavy glaciation.

In 1926, a small stampede was started into the district by some unfounded publicity over new discoveries of gold. This caused much new locating and some prospecting, which resulted in a little mining. Some new quartz veins were also located and some work was done on them on Timberline Creek. Tellurium minerals were reported at many localities in both placer and quartz. Investigation by the writer revealed a few pieces of hessite, silver telluride, as being found in the sluice box concentrates on White Creek. These concentrates also contained pieces of native bismuth and arsenic and some galena, along with magnetite, rutile, garnet, pyrites, native copper and chalcopyrite. No trace of tellurium was however detected in numerous samples of quartz or rock taken in the district and later analyzed by Paul Hopkins of the U.S. Bureau of Mines at

Fairbanks. The extensive glaciation probably carried some of these minerals into this area from long distances away and apparently only in small quantity as the concentrates from sluicing the present creek gravels contained only a little. The district may however contain its original source, if so it has not yet been found. This stampede and excitement brought no material results although a small quartz deposit recently discovered is reported to carry high values in free gold. The district, however, no doubt contains considerable unknown mineral possibility and there is at least one placer operation of importance and a number of small ones which are now handicapped by present transportation facilities. The people in this district ask for a road to be constructed from the railroad suggesting that such a road would be a link in the purposed International Highway project, affording the connection to McKinley Park.

The principal placer operation in the district is conducted on the Tamany bench, a section of an old channel, which lies on the right limit bench of Valdez Creek. As described under "Drift Mining", this deposit was first mined successfully, later equipped with a large hydraulic outfit with which it was unsuccessfully mined. The present operators, Jno. Carlson, W. Horning, Dan Oman & Tom Maher were among those to acquire this property from the McKinley Gold

Placers, Inc. about 1927. Since then they have mined in this channel by drifting and continued to do so this season with 3 men engaged. They also hydraulicked on a bench on the right limit of Discovery Claim on Valdez Creek. This bench lies 40 to 50 feet above the level of the creek and is reported to contain water-washed gravel covered by 15 feet or more of clay and soil. With a small giant and water supply and 4 men engaged at this hydraulicking, the greater portion of the entire gold output of this district for this season was taken out in about 90 days. The season's work was very satisfactory, and next season it is planned to enlarge the operations to about twice the present scale.

J.C. Duff groundsluiced a cut 250 to 300 feet long across what is considered to be an old channel on No. 3 above on Valdez Creek. Many fine colors of gold can be panned in this cut which will be completed next season as its merits can so far not be determined. Duff also opened up a little channel on the right limit of No. 4 just opposite the mouth of Timberline Creek, which showed some encouraging prospects.

J.M. Olson "Laughing Ole" completed his prospecting tunnel about 150 feet in length to intersect an old channel on the left limit of No. 5 above. Some nice washed gravel but no pay is reported to have been encountered. Several Indians shoveled-in on No. 1 below.

L.S. Wickersham and his brother sluiced on the right limit of White Creek about ~~40~~⁴⁵ miles up from its mouth. L. Campbell "boomed" out a large cut on the right limit of No. 23 above on Valdez Creek but no pay ground was developed.

Coffield, Olson & Duff located a new quartz discovery on the divide between Timberline and Valdez Creek. The vein is reported to be $2\frac{1}{2}$ feet wide, the best sample taken assaying \$90 in gold per ton. A number of different locations were also made in the district this summer on quartz, ~~which~~^{that} is stated to pan well, by L. Campbell, L. Coffield, L.S. Wickersham, Jno. Carlson and Wm. Baker.

KANTISHNA PRECINCT.

Fifteen operations with 16 men engaged were conducted in this precinct in the vicinity of the headwaters of Moose Creek and the Toklat River. All of these used automatic dams for "booming" off the overburden and top gravels, followed by shoveling the balance into the sluice boxes. This mining was done by the following: Peter Nelson, and Joe Dalton on Eureka Creek; Jno. Lee, Wm. Julian, Andrew Ness, and Chris Nelson, on Glacier Cree^k; Jno. Miller on Yellow Pup, a tributary; Alex Mitchel on Glen, Charles Griss and Jno. Standall, and Dan Budiveniss on the Right Fork of Glen Cree^k; Charles Trundy on Spruce; Lawrence Ferrais on Friday; Charles Christensen, Sam Federson, and James Burrows, on Little Moose

Creek. This area is difficult of access, taking 4 to 5 days via trail from the railroad. The highway through McKinley Park, when completed will directly benefit the mining in this part of the precinct.

YUKON BASIN

FORTY MILE PRECINCT

The Forty Mile mining precinct adjoins the Yukon Territory of Canada to the west, and its southeastern portion, the Walker Fork area is best reached during the summer via Dawson, Yukon Territory. A wagon road starting from the opposite side of the Yukon River from Dawson follows the high ridges and leads to Glacier and Miller Creeks in the 60 Mile district, the distance to Glacier Creek being 53 miles, to Miller Creek, 62 miles. A freighter with a 4 to 6 horse-team hauls supplies during the summer as far as Miller Creek for 7 cents per lb. Being a high ridge route making numerous passes around 3500 feet in elevation above sea level, it can be used for such freighting only during 3 to 4 months. It is, however, the main route into the 60 Mile district. It is of interest to note that nine small placer operations using hydraulic and drift methods are still being conducted in this district and this summer the old 3½ cu.ft. steam operated Risdon dredge, originally erected on Walker Fork in 1907 and operated there for several years, moved to Miller Creek in 1913 and after dredging that creek moved to the 60 Mile River between Miller

Creek and Big Gold Creek but never operated at this latter place, was leased by Fairbanks interests this year and operated by them mainly to prospect the ground. Summer freight into Walker Fork is picked up at Glacier Creek from where it is taken up and over the divide, the international boundary, by tractor or team, following a rough tractor trail to the operations of the Walker Fork Gold Corporation, a distance of about 10 miles.

About 150 tons of freight are hauled into the Forty Mile precinct during the winter, about half of this freight, much of it being horse feed, is hauled from the Canadian side from the town of Forty Mile located at the junction of the Yukon and Forty Mile Rivers. The route follows the Forty Mile River affording a water grade and good conditions for hauling over the ice to the various points enroute. Freight-ing from these points into some of the camps is however not so simple at times, for heavy grades must be made and in following or crossing some of the frozen streams which often break out, overflow and glacier badly, dangerous conditions are encountered. The other half of the winter freight is hauled in via Eagle, on the Alaskan side. The construction of a wagon road from Eagle into the Forty Mile precinct was begun in 1917. It encountered heavy grades and other difficult conditions and required much expensive rock work in going up American Creek and its tributary, Discovery Fork, and for

many years this road reached only to Gravel Gulch, 12 miles out of Eagle. After about 5 more years it was finally completed to about the 17 mile point, from which place, the high ridge pack trail continues on into the camps, while the winter road or trail swings to the right and continues on. The summer pack trail is in general in fine condition, but numerous long ascents and descents must be made. There are also many streams to be crossed which cannot be forded during periods of high water, although two of the main crossings are by ferry. The winter trail can be travelled during the summer with a tractor or team as far as Liberty but with much difficulty and even as far as Dome Creek. This was accomplished this summer. During the summer most of this winter trail is soft and boggy and in the winter several of the streams overflow badly, especially O'Brien Creek. To date, more than \$200,000 has been spent on this road and trail system. Freight rates have not benefitted thereby, for while summer freight is hauled by team or tractor to the end of the present road it must be reloaded and transported from that point on pack horses. Freight rates are therefore exceptionally high although the cause of this cannot be laid entirely to the road and trail conditions, but also ^{to} the small amount of freight now taken into the district. This road project was apparently poorly advised but as a large sum of money has been spent on it as far as it goes, and a reasonable summer route must be had, it

appears advisable to complete this road as far as Steel . Creek, on the Forty Mile River, making a connecting point for Eagle and Forty Mile River freighting and a base from where freighting by pack horse to the various camps could be carried on.

The Forty Mile River is a large swift stream with numerous rapids and some bad water and is therefore not suitable for freighting by water at a reasonable cost. During the winter however it is frozen over and then affords the best route for freighting into the district. The small amount of freight taken into this district excepting perishables, etc., could all be quickly hauled at a reasonable cost over this route under a cooperative arrangement whereby the two good tractors there now could each pull a heavily loaded gang of sleds over the ice on water grade to the main settlements or divergence points along the Forty Mile River. It is reported that winter freighting via the Forty Mile River and into Walker Fork using a caterpillar tractor and sleds is done by one company at a cost of \$15. to \$20. per ton.

About 5 tons of supplies, perishables, and mail are taken into the district during the summer by pack horses via Eagle, the high cost of which is shown in the following table compiled from data provided by J.B. Powers, the freighter. Airplanes from Fairbanks made a number of trips

into Chicken Creek this year with passengers, at the same time bringing along some perishables, some of which were never received there before, such as fresh eggs, fruits, melons, etc. A charge of 30 cents per pound was made for transporting these perishables which is indicative of future freighting into distant isolated areas.

FREIGHT RATES ON STAPLES INTO THE FORTY MILE PRECINCT.

| | Distance, Miles | | | Rate, Cents per Pound | | | |
|------------------|-----------------|-----------|----------------|-----------------------|-----------|-----------------------|-------------------|
| | Summer | | Winter | Summer | | Winter | |
| | Via Eagle | Via Eagle | Via Forty Mile | Via Eagle | Via Eagle | Via Forty Mile | Via Forty Mile |
| Gravel Gulch | 12 | 12 | - | 5 | 1½ | Perishables 1¢ higher | Same as via Eagle |
| Liberty | 27 | 27 | - | 9 | 3 | | |
| Dome Creek | 36 | - | 62 | 12 | 4 | | |
| Steel Creek P.O. | 48 | 32 | 40 | 15 | 4 | | |
| Jack Wade P.O. | 64 | 63 | 54 | 20 | 6 | | |
| Franklin P.O. | 76 | 85 | 80 | 22 | 7 | | |
| Chicken P.O. | 85 | 106 | 103 | 25 | 7 | | |
| Walker Fork | - | 93 | 60 | 20 | - | | |

The freight rates from Seattle, Washington, to Eagle or Forty Mile via Skagway, the White Pass Railroad and Upper Yukon River steamers are given in the general report under "Transportation" and show these rates on most commodities to be \$60 to \$90 per ton.

It can readily be seen that the Forty Mile Camps are isolated, difficult of access and under the existing conditions in those camps, the cost of transporting supplies is practically prohibitive to the consideration of new development or profitable operation in any but the higher grade gravels. The placers of the Forty Mile pre-

cinct were not of the bonanza variety and while they supported many profitable operations, they have not been as extensively mined as those in many of the more easily accessible areas. They have however yielded about \$7,000,000 in gold since the beginning of placer mining there in 1886. While the number of operations has diminished, there has again been a gradual increase in the gold output of the district during the past few years due mainly to improved methods. Investigations for dredging possibilities have also been underway for the past few seasons. All indications point to more active mining in the future although there can be no material change until accessibility and transportation facilities are improved.

In 1929, 38 placer operations were conducted with an average of 75 men engaged. In addition, there were about 13 men who usually do a little mining on a lone scale but who were not so engaged this season. As usual in all of the mining precincts there is some duplication as some of the miners will mine a little for themselves but work for others when there is opportunity. There were but 4 operations where 3 or more were engaged and one interest had from 5 to 10 men engaged prospecting and doing other non-operative work. Nine operations employed hydraulic methods with a total of 37 men. Mining by open cut, drift, and prospecting methods were conducted on the many creeks, this

work being usually done in each case by a lone miner. About 15 men have their ground along the Forty Mile River and around Steel Creek Post Office, ^{and} who usually do a little mining or "sniping" on their own. Based upon midseason conditions, the total gold output for the precinct this year will not exceed but may reach \$100,000. This estimate is however, only indicative and subject to later revision.

WALKER FORK:

The principal and largest operation conducted in the precinct was that of the Walker Fork Gold Corporation, which employs a dragline excavator in combination with hydraulic methods. This operation was started in 1927 but it was not until this year that systematic operation was reached. This season's mining was conducted on No. 17 claim on Walker Fork, 20 men were employed, and the most successful season realized. This company holds 14 miles of ground on Walker Fork from Poker Creek down. Portions of this creek deposit were formerly mined, mainly by a dredge operated from the present camp up to the mouth of Poker Creek and by another dredge operated for a short while about 8 miles below this Camp. Steam scrapers and cableway excavators were also operated in the immediate vicinity of the ~~present~~ ⁺ camp just prior to the present operation. While it may appear that this ground has been pretty well worked and cut up, the dredging done is reported to have been restricted to only

certain portions and to have not been very successful in its gold recovery due mainly to the lower stiff clayey gravel carrying much of the gold and which was very difficult to disintegrate and sluice. The creek bed varies from 150 to 500 feet in width. The ground and bedrock conditions vary.

In the locality now being mined the total average depth of ground is 8 to 12 feet. From 3 to 6 feet of muck and top barrne gravel is stripped off ahead by hydraulic methods, the frozen gravels then thawing sufficiently in time for mining. About 5 to 6 feet of gravel usually remain to be mined in addition to an average depth of 2 to 3 feet of bedrock. The lower 2 feet or so of gravel is impressed or squeezed into a tight stiff clay. It contains much of the gold and must therefore be thoroughly disintegrated before it goes into the sluice boxes. Because of this condition hydraulic methods are best adapted to the mining of this character of ground and as the water supply here is usually small, a dragline excavator is used to dig the top gravels within its reach and to later handle all material delivered to it by the field giants. The gravel is of average sized material with no large rocks of consequence. Bedrock is mainly of various schists, with occasional beds of hard quartzite, some quartz stringers and blobs, with some igneous intrusive rocks at places mainly as dikes. The con-

tour and condition of bedrock varies but is not adverse to the method employed. The bedrock gradient is very low. The gold is well worn and flattened, being mainly of the small pumpkin seed variety although pieces up to \$60 in value have been recovered. The gold content of the ground varies, at times being sufficient to be classed as high grade.

The water supply is obtained from Walker Fork, there being two ditch lines. The high line ditch is two miles long, picking up the water below Poker Creek and carrying it opposite the present workings where a 700 foot pipe line, 24 to 10 inches in diameter, delivers it to the field giants under a 160 foot head. The low line ditch is $3/4$ miles in length from which a 600 foot pipe line, 18 to 11 inches in diameter, delivers it from its open end to the sluice boxes under a 40 foot head. The maximum water supply ranges between 250 to 350 miners inches but the supply is usually less and must then be impounded and used intermittently. This season has, however, afforded an exceptionally good water supply. A very fluctuating but usually small supply of groundsluice water is also available from the immediate creek. Two giants with 3 to 4 inch nozzles, depending on the water supply, are used in the pit, one giant however being placed so as to be able to also stack tailing when required.

The sluice boxes are installed on the bank along one

side of the purposed pit, being placed on timber bents so as to be elevated sufficiently above the surface of the ground to provide the required grade and as much dump room as possible. The first 80 feet of boxes act as a dump box and are 3 feet wide inside and paved on the bottom and part way up the sides with old dredge screens and other plates. There is a short drop and a recess at the end of each plate along the bottom which serves as an additional place for the gold to lodge. A heavy timber hopper straddles across the top of this dump box and is so constructed and arranged that it can be drawn along and set at any position best reached by the excavator bucket. Fastened across the top of this hopper are heavy poles spaced about 8 inches apart which serve to keep the large rocks out of the sluice boxes. Following this dump box is a length of tapered box reducing the width of sluice from 3 to 2 feet, then follows 50 feet of sluice, 2 feet in width. These sluices are equipped with sets of angle iron transverse riffles and several sets of punched plate, the last box however being a sluice undercurrent of punched steel plate set 3 inches above the bottom of the box on a wood grid for catching nuggets. The dump box is set on a 10 inch grade, the lower boxes on $10\frac{1}{2}$ inch. To aid in the distribtuion of the tailing, sheet iron sluices follow the end box.

The dragline excavator is a 50 B type, Bucyrus make, with caterpillar tread, full turn table, a 50 foot boom and

a $1\frac{1}{2}$ cu.yd. Page bucket. It is steam operated, the steam being provided by a 35 H.P. vertical boiler which consumes about 5 cords of wood in two 10-hour shifts. This wood costs \$12. to \$15. per cord landed at the excavator. One operator and a fireman are employed on the excavator per shift. This excavator first digs as much gravel as it can reach from its set up working its side of the pit down almost to the clayey gravel and swinging and dumping each bucket load into the sluice hopper. The giants then drive their top gravel to a sump from where it is handled by the excavator. The giants then pipe and "boil" up the clayey gravel to thoroughly disintegrate it, and so deliver it to the excavator to handle. Bedrock is then piped up and cleaned and delivered in the same way.

The average pit mined is 180 feet ~~long~~^{wide} and 280 to 300 feet long, the creek deposit often being mined two pits wide. It is stated that with a good steady water supply and steady operation of 20 hours per day a pit 50,000 sq. ft. in area or containing about 15,000 cu.yds. can be mined by this method in 10 to 12 days. The excavator under normal operation: digs and delivers from 50 to 55 buckets per hour. Its speed is however retarded for with the present system the bucket must be dumped slowly and gradually otherwise the material either piles up on the hopper grizzly or is fed to the sluices so fast that they become

clogged. This arrangement can be considerably bettered. The sides of the present hopper slope to the center and feed the material straight down into the sluice where it lies until sufficient water accumulates behind to again start it in motion and carry it along. It then usually starts with a rush, "booming" down the sluice and often clogging again elsewhere as the velocity of the flow diminishes. A hopper designed to slope from the back so as to feed downstream is suggested. The material as then fed would be in motion in the proper direction as it hits the water thereby increasing the carrying capacity. Changes could also be beneficially made in the sluicing arrangement and the sluice set-up, but there are limitations in this which are imposed mainly by the available supply of water, the character of the material to be sluiced, the dumping height of the excavator, and other conditions. At present, both a hopper tender and a sluice tender are employed and tailing must be piped to some extent. Seven men are employed per shift.

The use of a dragline excavator in combination with hydraulic methods is well adapted to mining certain placer ground, especially under the conditions which exist at this operation, where an ample water supply is not available to permit efficient operation by the usual hydraulic methods alone. The hydraulic feature is particularly well adapted where such clayey gravel, difficult to disintegrate and wash,

occurs. This operation has been able to mine more than twice the amount of ground that could have been mined by straight hydraulic operation. This season, 3 pits had been mined by July 20, and 3 more were to be mined, after which the balance of the season was to be devoted to stripping ground ahead and to other preparatory work for the following season.

The only other placer mining done in this area was that conducted by James Campbell who drifts a little in the winter and takes out a small cut in the summer on Davis Creek, a tributary of Walker Fork. Ole Samuelson, at the mouth of Poker Creek did not mine this season. Frank Pratt prospected on lower Walker Fork.

JACK WADE CREEK:

The principal operation on Jack Wade Creek was that of Chas. Martin, who with 2 other men employed, hydraulicked on the property formerly mined by McCandless & Sykes up to 1924 with a Bagley scraper. Three to 4 feet of muck and top gravel are now stripped off ahead by giant leaving 8 to 9 feet of gravel, the lower 1 to 2 feet being tight and clayey, to be sluiced. The bedrock gradient is low so the method of piping over the side of the boxes is followed. The water supply is usually small and must be used intermittently. Tailings are stacked by giant. Water for the giants is supplied by a one mile ditch from which a 30 to

10 inch pipe line delivers it to the pit under a 100 foot head. The average pit mined is 100 feet long and 150 feet wide. The sluice boxes 11 in length, 30 inches wide, are set on an 8 inch grade down the center of the purposed pit, the upper end of this string of boxes being set 3 to 4 feet above bedrock. A wooden back stop is erected along one side of these boxes and the material on one side of the pit is then piped over the side. The other side of the pit is then handled similarly. The material remaining alongside and under the boxes after the rest of the pit has been cleaned up is finally piped onto the ground ahead to be handled in the next pit. Three of these pits were mined this season, one long shift being worked each day. The cost of conducting this operating, including all preparatory work, is about 50 cents per cubic yard.

Others mining on this creek were N.W. Patterson, James Morris, Walter Hunt, Tom Lynch, Wm. Kirkpatrick and Andrew Larsen, who usually worked alone, taking out small cuts during the summer while several of them did a little drifting during the winter. Chas. Johnson did some prospecting during the winter. Others owning ground on this creek but who did no mining this season, are C.E.M. Cole; Jno. E. Powers; Richard Mitchell; and Ed Eckstein.

Jack Wade Creek occupies a valley ranging to more than 500 feet in width. The gravels range from 3 to 20

feet in depth, averaging about 10 feet, and are covered with muck from a foot to 25 feet in depth. Some high rock reefs occur at places.

CANYON CREEK:

Geo. Sparks with one man took out a small cut during the summer and drifted during the winter on his property on upper Canyon Creek. Tom Phillips was engaged in prospecting and doing assessment work on the Gustaveson Group. James Meese was on Wood Creek, a tributary of Canyon, and Gus Swanson mined on Squaw Creek, another tributary, for a part of the season. Canyon Creek was not visited, but one of the miners from there contends that Canyon Creek possesses dredging possibilities.

NAPOLEON CREEK:

Jno. Ostergard operated his small hydraulic plant near the mouth of Napoleon Creek, and Geo. Lysell and Ed Eckstein prospected and did assessment work further up this creek. Ed Eckstein also did a little open cut mining on Butte Creek. J.M. Brooks prospected the high benches along the Forty Mile River near Napoleon Creek, and James Weeks mined on a bar of the Forty Mile River about $1\frac{1}{4}$ miles below the mouth of Napoleon.

FRANKLIN GULCH:

Geo. Mock, Tom Tomlinson, and Jno. Roberts, each conducted their small open cut mining operations on Franklin Gulch on which the first gold discovery in the district was

made. Only manual methods have been used in mining this Gulch, which yielded such good returns in the earlier days.

CHICKEN CREEK AREA:

Very little mining was done in the Chicken Creek area, especially on Chicken Creek which has been mostly acquired by the Lee Steele interests, now under the name of Frank Knowles, Trustee, and for several years prior to this known as the Alaska Consolidated Gold Corp'n. These interests have for several years been acquiring more property in the district with a view to future operation mainly by dredging. They now hold practically all of Chicken Creek, a great length of Masquito Fork which is a large tributary of the Forty Mile River, Ingle Bar at the mouth of Ingle Creek, some ground on Napoleon Creek, and many miles of the Forty Mile River, mainly above Steel Creek. The placers of Dome Creek are also included. In 1926, some drilling and other prospecting was done on Chicken Creek, Ingle Bar and elsewhere in that vicinity by these interests and some has been done since. This season these interests had from 5 to 10 men employed for a time on similar work on Chicken Creek.

The Forty Mile River was dredged some years ago by a 3½ cu.ft. steam driven Risdon dredge, formerly on Walker Fork, from about ½ mile above the mouth of Uhler Creek to a short ways above Franklin, a length of about 5 miles. This dredge was operated for four seasons and is reported to have

recovered about \$265,000 in gold during that period. The width of the principal gold distribution is reported to have been 85 to 115 feet, although the distribution was spotty. The depth of gravel dredged varied a great deal, from none up to a maximum of 9 feet. High rock reefs and many large rocks were present and as the river is a large swift one, flood conditions occurred at times. The river wash was loose and shifting, bedrock being hard and irregular due to repeated scourings. This dredge operation was not profitably conducted although this was probably not due entirely to the character of the ground alone. The distribution of gold along the Forty Mile River like along some other large streams is irregular and spotty. The source of much of this gold is no doubt the high bench and other deposits which occur at a number of localities along this river and its tributaries, and has been reconcentrated in the river bed below. These river gravels are shifted and reworked not only by the swift water but also by ice which, in most cases, forms to bedrock freezing the gravels. During the spring break-up these gravels are then lifted by the ice, rafted downstream and re-deposited elsewhere.

Chicken Creek is a small stream about three miles in length, Stonehouse Creek entering it near its head, and Myers Fork coming in on the right limit about half way down Chicken Creek. It occupies a valley but a few hundred feet wide in

its upper reaches, ^{but} ~~which~~ ^{is} wide to 1500 to 2000 feet and more on reaching the broad flat at its mouth at Mosquito Fork. Bench deposits occur mainly along its right limit. The high bench gravel channel which came down Myers Fork, apparently cut across and continued down Lost Chicken Creek. This high channel was cut out by the subsequent erosion by Chicken Creek and reconcentrated in its lower reaches. Chicken Creek has been mined at places on many of the claims, mostly by manual open cut methods and by drifting. The maximum depth of the creek placer is about 30 feet, the depth of gravel varying from 4 to 15 feet, the muck averaging between 5 to 8 feet, but varying from a few feet to a maximum of 15 feet. The gravel is small to medium in size. Bedrock is mainly a soft coal formation of clay, shale, sandstone, and lignite beds, but in the upper reaches is mainly a slate. Practically all of the ground is frozen. Drilling at the lower end of the creek is reported to have developed a maximum width of pay for dredging of about 1500 feet. A sufficient volume of pay gravel to support a profitable dredging operation is reported to have been developed. Geo. C. Traub was the only one mining on Chicken Creek this season. Working alone, he took out a small cut, and then turned his holdings to the company.

Frank Purdy conducted a small hydraulic operation

on Myers Fork, where on the left limit bench, he has for some years been successfully mining a deposit composed of 2 to 8 feet of gravel covered by muck up to 20 feet thick. The ground is solidly frozen. Small narrow cuts are mined by piping the gravel into the head of the small sluice boxes with a small nozzle under low head. The ground carries from 40 cents to \$1 in gold per sq.ft. A cut just completed which was 12 to 15 feet wide and about 75 feet long, yielded \$600 in gold. Ole Tweedin, working alone, operated a small hydraulic plant on the right limit benches of Myers Fork.

Joe Brost took out a small open cut on Stonehouse Creek, an upper tributary of Chicken Creek, and also mined on some of the Forty Mile River bars. Gene Starbird who generally has mined on Stonehouse Creek using an automatic dam is reported not to have mined this season.

Fred Whitehead and Harvey Van Hook installed a small hydraulic plant on the Carrie bench on a right limit pup of Lost Chicken Creek. This bench deposit, apparently a portion of the high channel which came down Myers Fork, here lies about 300 feet above Chicken Creek on its left limit and continues on through into Lost Chicken Creek. It is claimed the pay on this bench is 800 to 1000 feet wide, from a foot or so to 25 feet in average depth but a maximum depth of 45 feet, with but a foot or two of muck overbur-

den. A very large yardage considered to contain more than 50 cents in gold per cubic yard is claimed. A small cut was taken out this season, yielding 60 cents in gold per cubic yard. This operation must now obtain water ~~by~~^{for} hydraulicking from a small gulch and was therefore handicapped. These operators contend their ground will justify pumping water from the Forty Mile River by hydroelectric power which can be developed there. This would however be quite an undertaking but cannot be seriously considered until this ground has been thoroughly prospected and its possibilities definitely determined.

INGLE CREEK:

Antone Johansen, and Geo. St. Marino, each conducted small operations on Ingle Creek, working alone in open cutting and drifting. Ingle Creek itself is a small stream in a narrow steep valley ~~but~~^{which} widens into a small flat at its mouth. This flat has been prospected for dredging along with Ingle Bar, which lies on the opposite bank of the Forty Mile River. Ingle Bar is about 50 to 60 acres in area and from 12 to 16 feet in depth. An open cut operation using a scraper was conducted on it some years ago, ~~which~~^{and} is reported to have mined some good ground. The wash is quite heavy and while boulders are probably present no large ones in quantity were in evidence on this bar. The ground is not frozen. Bedrock is a slate, stated to be

very hard and firm.

FORTY MILE RIVER:

Quite a number of lone miners spend at least part of the season working along the bars and low benches along the Forty Mile River, up and down stream from Steel Creek P.O. Rockers, groundsluting and shovel-in methods and in a few instances small hydraulic outfits are used. Beginning 6 miles above Steel, and going down River were Frank Watson, then Emil Kruger on 5 mile Island, Jno. Bourk at Flat Creek with a hose outfit, Gus Swanson on Maiden Bar, Nick Schneider at Steel, Fred Berry with a rocker $\frac{1}{2}$ miles below Steel, then Fritz Hostettler on Bonanza Bar and Chas. Thorsell with a hydraulic plant on Discovery Bar. E.B. Ewing, Henry Seymour, Joe Ghigge, Pete Jorgenson, Justice Elden and J.A. Kemp who usually mine a little along this river were otherwise engaged this season as were J. Madigan and Ole Berg of Nugget Creek.

DOME CREEK:

Hydraulic operations were conducted on Dome Creek this season although on a reduced scale. These operations were conducted by Lee Steele, under the name of Frank Knowles, Trustee. For the past few seasons the operations here were carried on under the name of the Alaska Consolidated Gold Corp'n., and prior to that as the Dome Gold Corp'n.

Very extensive bench deposits follow down the right

limit of Dome Creek. The continuity of these benches is broken only where the tributaries have eroded them. No mining has been done in the creek bed but hydraulic operations have been conducted ^{on these benches.} for some years, mainly in the vicinity of Miller and Georgia Gulches. There are apparently three tiers of benches, the principal one being the ^{upper bench.} The maximum total width of these benches is 1500 feet and more, the better pay being confined to a particular section possibly 250 feet or so in width. This main bench deposit lies about 100 feet above the level of the creek. It varies in depth, from a few feet at the outer rim to about 70 feet in greatest depth. The deposit is frozen. There is no muck covering although a foot or two of moss and soil overlies the gravel. The gravel is fairly small and much of it is flat. A large amount of sand is present. Bedrock is a soft schist with interbedded quartzite. The main gold content is distributed in the lower gravels so that the depth of gravel which can be profitably mined is usually limited by the small available water supply and other conditions.

An 8-mile ditch brings the water from upper Dome Creek, a 24 to 18 inch pipe line carrying it to the "Y" from where 12 and 10 inch lines lead to the giants. Length of pipe line and the head varies with the locality. At the lower end of the ditch the available head is about 150 feet. Dome creek drains an unusually dry area, the water supply is therefore very erratic, being dependent mainly upon the

melting snow and rainfall. During a large portion of the average season, therefore, the water must be impounded and used in splashes. Usually two giants with 3 inch nozzles are used at a time in the pit, three giants with 4 inch nozzles when water supply permits. The material is broken down with the giants and piped into the head of the boxes. Usually from 18 to 20 lengths of boxes, 36 inches in width, are set on a 10 inch grade. The large quantity of sand and a limited water supply often causes the sand to accumulate or overload the boxes. There is a natural dump room below the bench for the tailings from where an occasional heavy freshet carries them down the creek. In a good average season about 100,000 cu.yds. have generally been mined although the usual scale of operation was not conducted this year. From 15 to 20 men were formerly engaged, this season there were an average of about seven.

This season mining was conducted at Georgia Gulch where from May 10 to July 10 between 20,000 to 25,000 sq. ft. of ground, 35 feet in average depth was mined. Operations were then moved to the vicinity of Miller Gulch where at the time of my visit a new pit was just being opened up. A width of about 250 feet considered to be the main pay area of this bench is to be mined. The ground here ranges from 40 to 50 feet in depth. Its location will only permit about a 50 foot head on the giants on bearrock,

this point being about 5½ miles from the ditch intake. It is planned to continue this ditch on to Johnie Gulch in the near future and start mining there.

EAGLE PRECINCT.

During 1929, 13 placer operations with 26 men engaged were conducted in Eagle mining precinct which includes the Eagle, Seventy Mile, Charley River and Fourth of July Creek areas. The total placer gold output for the precinct this year based upon early indications was probably around \$25,000.

EAGLE AREA:

But two operations, using automatic dams for "booming" off the upper gravels followed by the shoveling in of the remaining gravels and the bedrock, were conducted in this area. This method was used by Ed Olson in mining out a small cut on No. 4 A claim on Discovery Fork, and by Wm. Fritch and his son, at the mouth of Discovery Fork on American Creek. Jess Samis "sniped" on American Creek on No. 10 claim, and Frank Sandberg "sniped" on No. 6 Discovery Fork. H. Ross, and F.E. Orno did not mine their ground this year.

SEVENTY MILE AREA:

While 8 operations with 21 men were conducted in this area this season and the season was an exceptionally good one for water, the main operations were not conducted on the

usual scale.

Froelich, Kummer & Ott carried on with their hydraulic operation on Crooked Creek, three men constituting the crew. Mining did not resume until late in the spring being delayed by the deep snow remaining late and the exceptionally heavy "glacier" ice which formed over the creek bed to a depth of 15 feet and required 37 days to remove sufficiently to permit mining. After a poor season last year, when mining was done in low grade ground just below a high rock reef, this has now been passed and the prospects ahead showed coarser gold and better ground. This ground ranges from 12 to 20 feet in depth, there being a maximum of 15 to 14 feet of muck over an average depth of 6 feet of gravel. The average gold content is 10 to 15 cents per sq.ft. The muck is removed a season ahead by stripping with giants and by ground-sluicing. The gravel and bedrock is piped over the side of the boxes, similar to the Eagle system. Ten to 14 boxes are set in a trench previously piped down the center of the proposed pit, on a grade of 8 inches, the head of the boxes being set 1 to 3 feet above bedrock, the lower end of the boxes usually being just below bedrock surface. Specially equipped boxes 30 inches wide are used and board aprons to pipe against are hung centrally along these boxes from metal standards. Full details of this operation are given in U.S. S.M. Bulletin No. 259, pages 150-152. This season but about

30,000 sq.ft. were expected to be mined. A new ditch $2\frac{1}{2}$ miles long was to be completed by this fall which will take the water from Eldorado Creek and deliver it 90 feet higher than the old ditch level which now only provides an 80 foot head. The new ditch will give a 160 to 170 foot head in the pit, greatly improving operation.

Moss & Parson conducted hydraulic operations this year with a crew of 4 men on the former Bryant ground on Alder Creek. Several small cuts were mined but the operation was shut down on July 16 due to a reported disagreement among the operators.

C.F. Yost working alone operated his small hydraulic plant on Nugget Creek. E.A. "Nimrod" Robertson on Flume Creek did not mine. Axel Johnson took out a small cut on Great Bear Bar on the Seventy Mile River. Gus Nelson and Andrew Carlson did some open cut mining on Broken Neck Creek, but were engaged mainly in installing a small hydraulic plant. Max Druse with one man operated ^{the hydraulic plant on R.E. Steele's property} the Curtis Bar. E.M. Webster did not mine this year on Lucky Gulch, a tributary of Fox Creek.

Bob Cameron and Paul Whitehead rehabilitated a mile of old ditch on Barney Creek and installed a small hydraulic plant and saw mill. They were also to take out a small cut with a hose outfit on the right limit bench which lies about 40 feet above the level of this creek. It is purposed to

on Fox Creek. Wm. Russell Mitchell copy

mine this bench with the new plant. It is stated that the full water supply available is sufficient to operate two $2\frac{1}{2}$ inch nozzles under about a 100 foot head.

FOURTH OF JULY CREEK:

Dick Bauer operated the hydraulic plant of the July Creek Placer Co. on Fourth of July Creek this season under a lease arrangement. A crew of 5 men was employed and a successful season is reported. This plant was operated for several seasons prior to this by Ellingen & Delezene under a similar arrangement. Considerable trouble was formerly had with the $10\frac{3}{4}$ mile ditch system by permitting the water from the $8\frac{1}{4}$ mile upper ditch, bringing the water across the divide from Washington Creek, ~~and allowing it~~ to run wild into the Ruby Creek ditch thereby carrying much sand into the lower ditch. It is reported that the present operator has abandoned the upper ditch and is now using only the lower one $2\frac{1}{2}$ miles in length. In either case, the supply must be impounded in a reservoir and used intermittently during most of the average season. An average of 2 to 4 feet of muck and moss and 2 to 3 feet of barren top gravel is first stripped off leaving an average of about 10 feet of pay gravel which is piped over the sides of the boxes similar to the procedure on Crooked Creek. Bedrock is mainly a softened conglomerate with some sandstone and shale at some localities. The gravel is rounded and of average size. The average grade of

the creek is about 100 feet to the mile.

CHARLEY RIVER:

The Charley River area was formerly reported under the Circle district but according to the mining precinct division lies within the Eagle precinct. No mining is reported to have been done in this area although Al Brown & Martin are reported to have done some prospecting on Charley River.

CIRCLE PRECINCT.

The Circle mining precinct embraces four placer mining areas, viz., Woodchopper, Deadwood, Miller House and Birch Creek. While a considerable number of small operations are conducted in each area, the principal ones are the hydraulic operations in the Miller House area and the C.J. Berry hydraulic mine on Eagle Creek in the Birch Creek area. The dredge formerly operated at Mammoth and Mastodon Creeks was for many years the principal gold producer of the precinct, but as this dredge ceased operation after the close of the 1926 season the annual gold production of the precinct has since been considerably less. Based upon early indications it is estimated the precinct will produce around \$100,000 in gold this year, an increase over last year, and the largest since 1926. This is attributed to the exceptionally favorable season for water. The Circle precinct is one of the earliest of the interior placer gold producing sections and during the

period 1894 to 1927 inclusive, produced \$7,500,000 in gold from its placers. The accessibility of the precinct which was formerly via the Yukon River and Circle, has been greatly improved by the completion this year of the Steese Highway which connects Fairbanks and Circle, a distance of 165 miles. This road now permits travel and the bringing in of supplies throughout the year via Fairbanks and passing through the principal mining areas is not only of direct benefit to present operations but has opened up this part of Alaska so that new mine development can be undertaken. One company now operates its own truck obtaining all of its supplies via Fairbanks while others are served by regular truck and automobile service carried on between Fairbanks and Circle at rates in small lots averaging 3 to 4 cents per pound to Miller House, and $3\frac{1}{2}$ to $4\frac{1}{2}$ cents to Circle. As the condition of this road improves, these rates will become especially the rates on larger quantities.

During 1929, 41 placer operations with 79 men engaged were conducted in the precinct. Of these, 10 were hydraulic operations with 39 men, 17 small open cut or drift operations with 19 men, and 14 prospecting with 21 men. Coal Creek and Deadwood Creek were prospected further by shaft sinking, combined with drilling at the latter creek, and the results are reported as being favorable for dredging.

WOODCHOPPER AREA:

Six small groundsluicing and shovel-in operations engaging 7 men, several of these men also being engaged in drifting during the winter, 1 hydraulic operation with 1 to 2 men, and 7 prospecting operations with 8 men, were conducted in this area. Peter Fish and Frank Slavin were on Coal Creek, George Davis on Colorado, a tributary, Martin Adamik with a small hydraulic plant on Boulder, another tributary, and Robt. Carey prospected on one of the other tributaries.

The Treadgold interests of Dawson, Yukon Territory, continue with their option on Coal Creek which embraces the Beaton ground or lower 4 miles of this creek and the 3 miles above this owned by Slavin, Malstrom and Devers. This creek was prospected some years ago for dredging by a former large dredging interest with reported satisfactory results. It was optioned and again prospected by others a few years ago and later optioned to the present interests. A considerable payment has been made on this option and these interests had several men on the creek again this spring prospecting and doing assessment work. According to reports recently received the valley averages about $\frac{1}{2}$ mile in width, the ground being partly frozen but to a large extent thawed and ranging from 7 to 20 feet in total depth. The gravels are overlain by some muck, which is however in small minority, and no large boulders or clay of any consequence are present.

The water supply from Coal Creek is considered to be sufficient for stripping and thawing purposes. Drilling done a few years ago is stated to have closely checked that done some years before and prospecting has shown that the ground and other conditions are favorable and has developed a sufficient volume of good pay gravel to support profitable dredge operation. No plans for future development have as yet been definitely reported.

Groundsluicing and shovel-in mining was done by Sandy Johnson on Ben Creek, by Arthur Reynolds on Sam and also on Woodchopper Creek, by O.S. Lee with one man on Dome Creek, a tributary of Woodchopper Creek, and Geo. McGregor and Gus Abramson on Woodchopper Creek. Gus Abramson, Frank Bennett and Jno. Cornell did a little drifting and prospecting during the winter on Woodchopper Creek, Ned Greenough doing assessment work for Chas. Boyle.

DEADWOOD AREA:

Eight operations with 15 men engaged were active during the season, there being 2 hydraulic operations with 5 men, 5 open cut operations with 5 men, and one prospecting operation with 5 men.

Knudsen & Larsen resumed hydraulic operations on No. 4 above Discovery on Deadwood Creek this season, this property having been idle for several years. The Circle system of piping a portion of the pit over the side of the boxes

and piping the upper portion into the head of the boxes is usually followed in mining this ground but this season was spent mainly in preparatory work and in taking out several small cuts incidental to preparing for next season's operation. The gravels after being stripped average about 7 feet in depth.

Sam Rockness, Louis Lovik, M. Peters, Andrew Clatworthy and Wm. Woodman each did a little open cut, or winter drift mining, on Deadwood Creek, and James Stewart mined at the mouth of Switch Creek. Peter Bloom, Gus Chisholm and Henry Reupke did not mine, having optioned their properties.

Langlow & Larsen continued with their usual hydraulic operation on Switch Creek where two pits, each averaging about 50 feet wide and 175 feet long were mined in the narrow rock rimmed creek bed. The deposit is 8 to 10 feet in depth and consists largely of angular material. It yields 25 to 50 cents in gold per sq.ft. Bedrock, especially in the present pits, is very rough, blocky and deeply creviced, requiring much work by hand to clean it. While the upper 4 feet or so of the deposit is first removed by stripping with a giant all of the material is piped into the head of the boxes. But 3 to 5 lengths of boxes 24 inches wide are used being set at 10 to 11 inch grade. Tailings are stacked with a giant. The water supply is small and must be

used intermittently during most of the season. Two giants with 2½ to 3 inch nozzles are used under 110 to 120 foot head. The two partners do all the mining.

Deadwood Creek has long been considered for dredging and several years ago Chas. Guis began prospecting it for this purpose. Ellingen & Delzene continued with this work this spring by putting down additional crosscuts by shaft sinking and drilling. These parties now report 3 miles of the Creek to have been prospected which they estimate contains about 2,000,000 cu.yds. of gravel averaging 50 cents or better in gold per cubic yard, about half of this yardage being thawed ground, a large portion lying in the Upper Basin. The greatest depth to bedrock was encountered on Claim No. 44 below where one hole was put down 19 ft. to bedrock and continued 4 ft. further into a clay which comes in at this locality and constitutes the bedrock. This clay is not found in any of the holes farther up the creek. The main and central portion of the area ranges from 11 to 19 ft. to bedrock averaging about 12 ft. with about 4 to 6 feet of muck and soil overlying the gravel there. At the upper end of the area, in what is known as the "Upper Basin" and which is about ¾ miles long and 700 to 800 feet in maximum width, there is practically no muck overburden, the gravels being from 6 to 10 feet deep. Excepting false clay bedrock coming in at the lower end, bedrock is mainly a schist and a gran-

ite. The gravel is of medium size and all ground conditions are considered favorable for dredging. It is contended considerable more yardage can be developed in the flats below the present prospected area as others have in the past put down shafts in which some good values were reported as found as far downstream as claim No. 60 below. The completion of the Steese Highway now makes this area very accessible from Fairbanks and is a big factor in its consideration for future development and operation.

MILLER HOUSE AREA:

Ten operations with 25 men were conducted in this area, there being 5 hydraulic operations with 20 men, 4 open cut operations with 4 men, and 1 man on prospecting work.

The principal operation was that conducted by the C.J. Berry Dredging Co. on No. 2 below Discovery on Mastodon Creek where from 7 to 9 men were employed at hydraulicking the low bench. This bench lies on the left limit of the creek but a few feet above the creek level. The gravel which is of average size but containing some boulders is 6 to 10 feet in depth and is covered by muck ranging from a few feet in depth to a maximum of 20 feet along the hillside. This muck is stripped a season ahead of mining. Formerly the "Eagle" system of piping over the side of the boxes was followed but as a better grade is available at the present locality, the "Circle" or combination system is now used. Water for the

giants is taken from Mastodon and brought to the operation through a $3/4$ mile pipe line, 36 to 18 inches in diameter to the "Y". Eleven inch pipe is used in the pit where 3 to 4 giants using 3 to $3\frac{1}{2}$ inch nozzles are set up and operate under a 150 to 160 foot head. Tailings are stacked with a $3\frac{1}{2}$ inch nozzle. Groundsluice water is provided by a $3/4$ mile ~~in~~ ditch taking the water from the creek below the intake of the pipe line. The water supply this year was quite steady but as usual some intermittent use was necessary.

The size of the pits mined varies with conditions, the maximum size being 400 feet long and 160 feet wide. During a good season two pits are mined and three were planned for this year. Usually 15 to 16 lengths of boxes are set up in a trench piped down the center of the lower half, or so, of the purposed pit. The head of this string of boxes is usually set about level with the bedrock surface, the discharge end being below bedrock. These boxes are set on an 8 inch grade, are 30 inches wide in the clear, equipped with side protection boards, and metal back stops hung down the center from metal supports similar to those used on Eagle Creek. The ground at the lower part of the pit is piped over the side of the boxes, while that ahead of the boxes is piped into the head. The ground lying opposite, or near, the head of the boxes is piped upstream ahead of the boxes ~~and~~

and finally piped into the head. The extent of ground piped by either method is governed by conditions for in a pit just being completed at the time of my visit, about 125 feet of the lower end of the pit was piped over the side, while the rest of the pit or that portion ahead of the boxes had been extended about 300 feet upstream from the head of the boxes. Another bench lies 20 feet above the creek level and plans were made to also take out a pit there before the close of the season.

Jno. Anderson engaged from 3 to 5 men this season in conducting his hydraulic operations on No. 24 above on Mastodon Creek. This operation has for the past few years been carried on at a reduced scale and this season closed down earlier than usual due to labor conditions. The V shaped valley of the creek in this vicinity ranges from 150 to 250 feet in width at creek level and the deposit has been pretty well cut up by former mining. Average gravel with an average number of boulders overlies a generally slabby schist bedrock to depths of 6 to 8 feet. This gravel is solidly frozen and covered with muck from 2 to 20 feet thick, which has its maximum thickness along the rim. This muck is stripped ^{with} giants a season ahead. The usual size of pit mined is 150 by 150 feet, two of these are now usually mined in a season. Three giants with 3 to 3½ inch nozzles working under a 150 foot head are set up in the pit, although only one is generally operated at a time as the water supply ^{usually} ~~generally~~ necessitates its in-

ternittent use. Tailings are stacked with a giant. Generally about 7 lengths of boxes are set, these being 30 inches wide and set on 8 and 7 inch grades. These are provided with wooden back stops for piping against. The set-up of the boxes is otherwise very similar to that at the Berry operation and the same system of piping the gravels is used, namely, the combination or Circle system. This operation is fully described in U.S.B.M. Bulletin 259, p. 159-161.

Gus Erickson also operated a small hydraulic plant on No. 36, above, on Upper Mastodon Creek, while Boyer Leine did his usual sluicing about 3/4 mile above the Berry operation. C.W. Wheeler, Geo. Woods, and Chas. Belenberg, each did their seasonal ground-sluicing and shoveling-in on Independence Creek. Adolph Urban prospected on Crooked Creek.

Walter Crossman with 2 men hydraulicked on No. 15, Miller Creek where 2 to 3 pits, each about 150 by 150 feet are generally mined in an average season. The creek deposit averages 8 to 10 feet in total depth and after being stripped of muck, the 6 to 8 feet of average sized gravel is mined, using the combination or Circle system. The water supply must be used intermittently during most of the average season. A small amount of tin, as cassiterite, is recovered although not in commercial quantities.

West⁶⁷~~60~~vik Brothers operated their hydraulic plant on Bonanza Creek, no additional help being employed.

BIRCH CREEK AREA:

The Birch Creek area is a large one although most of the placer mining is conducted on Eagle Creek and on the north Fork of Harrison Creek, both being tributaries of Birch Creek. During 1929, there were conducted in this area 2 hydraulic operations with 13 men, 2 open cut operations with 3 men, and 5 prospecting and assessment operations with 7 men.

The principal operation was that of C.J. Berry who employed 9 men at his hydraulic plant on No. 15 above, on Eagle Creek. This creek deposit had the main paystreak pretty thoroughly removed by former drift mining but still was sufficiently high grade to class this ground with the richest now being hydraulicked in Alaska. The paystreak was defined, there being no side pay. Peculiarly, the pay has never been found below the point where hydraulicking first started in 1908, on Claim No. 8, above. Mining has now reached the upper end of No. 15 above. These operations have always been handicapped because of low or erratic water supply necessitating intermittent use. The pressure head is now about 100 feet in the pit and ~~quickly~~ ^{rapidly} becoming less. Three or 4 more seasons will reach the junction of Mastodon Fork and Miller Fork when operations will no doubt be discontinued due to the water conditions. The ground in cross section from the surface down is as follows:- 5 to 8 feet of barren gravel, sand, etc., covered by several feet of muck at places, 8 to 10 feet of pay

gravel; 4 to 6 feet of this lower gravel being tight with clay. Considerable sand is also present. This lower gravel is difficult to disintegrate and must therefore be well "boiled up" before being put through the sluice boxes. Peculiarly this clayey gravel wedges out as it approaches the edge of the deposit. Bedrock is a schist with some quartzite beds and ranges from soft to slabby. The gold is mainly coarse. Creek gradient is now about 3 percent and the contour of bedrock is fairly regular.

From 5 to 6 feet of upper gravel and overburden is now removed a season ahead by stripping with giants although formerly when a higher pressure was available an 8 to 10 foot depth was so removed. The pits now mined are 150 feet long and 170 to 200 feet wide. Nine giants are usually set up in various parts of the field although only one field giant and the stacker giant with $3\frac{1}{2}$ inch nozzles can be operated at a time. Under present conditions a trench is first piped into bedrock at the head of a completed pit and into the bank ahead after which 5 to 4 boxes are set in it on a 9 inch grade, and light wings erected at their head, A head giant then pipes out a trench to grade down the center of the purposed pit connecting with these boxes. From 8 to 10 more boxes are then installed on an 8 inch grade. Depending on conditions, the lower end of this string of boxes may be resting on bedrock, or a foot or so below, while the head of the boxes may be 6 to 10 feet above bedrock. The small

wings are then moved and set up at the head of the boxes to guide the groundsluice water. These boxes are of special heavy construction, 36 inches wide, protected with side boards, and steel standards fastened to each side and meeting overhead support steel plates which serve as back stops or aprons to pipe against. Special riffles of steel plates, rail sets, etc. are installed in these boxes. By working from one side to the other, as boulders are being removed from one side while piping is done on the other side, the gravel is piped over the side of the boxes. After cleaning up, the boxes are removed and the material remaining alongside and under the boxes is piped ahead onto ground to be mined in the next pit.

During an average season's operation two pits are mined although this year three and probably a portion of another may be mined. Costs average from 35 to 40 cents per cu.yd. which includes depreciation amounting to 12 to 14 cents per cu.yd. The cost however varies greatly according to the season, for in 1922 a very good one, 49,860 cu. yds. were mined at a cost of 19.96 cents per cu.yd. This system of hydraulicking was developed at this operation and is therefore known as the "Eagle" system and is fully described in U.S.B.M. Bulletin 259, p. 153-156.

Jno. Joslyn prospected during the winter on lower Eagle Creek, apparently looking for a continuance of the Eagle Creek pay. H.H. Bartlett also prospected last winter on

Gold Dust and Butte Creeks. McDowell & McGowen prospected and about midseason were reported as having discovered pay on the North Fork of 12 Mile Creek, a tributary of Birch Creek. The extent of this discovery was still to be determined. Hamilton & Coughlin Bros. operated the hydraulic plant on the Bondeau property on the North Fork of Harrison Creek for a while on a lease arrangement and, as reported, later transferred their rights to Erickson who, while operating but a short time, is planning for a more extensive operation next season. Ed Bartlett took a lease on the Jno. Clayworth ground on the North Fork of Harrison Creek and had two men engaged there in prospecting the ground and doing a little mining. He will take a hydraulic plant into the property this winter to be installed and operated next season. C.L. Peters operated an automatic dam and shoveled-in on Bottom Dollar, a tributary of Harrison, Chas. McDonald prospected on Birch Creek near McLean Creek and also on Great Unknown Creek. Mrs. J.R. Parkin had 2 men prospecting and doing assessment work on her property on Birch Creek, several miles below 12 Mile.

TANANA PRECINCT.

Placer mining in the Tanana precinct is conducted mostly in the Richardson or Tenderfoot district and the Salchaket River area, these areas being drained by tributaries of the upper Tanana River. They are reached via the Richard-

son Highway which connects Fairbanks, Valdez and Chitina by road. The Salchaket, and also the Delta placer areas, lie distant from this road and while a number of men prospect there each season, there are only a few small groundsluicing and shovel-in operations being conducted and the gold output is very small. The Richardson or Tenderfoot district is crossed by this highway, crossing Banner Creek about 70 miles out of Fairbanks and later following down Tenderfoot Creek.

RICHARDSON DISTRICT:

Five operations with 9 men engaged constituted the entire placer mining activity in this district this year. The gold output was naturally very small. The district, since its discovery in 1905, has to date a production of about \$1,750,000 in placer gold to its credit, most of this being produced by drift mining on Tenderfoot and Banner Creeks. In recent years there has been very little placer mining done there, a little renewed interest being attracted to it last year when W. Puntilla found a small area of drifting pay on No. 17 below on Tenderfoot Creek and made a production reported as being very good when considered on the basis of other drift mining operations of the present time. He did not resume mining this season. Paul Solka & L. Johnson did a little drifting during this summer on No. 6 below on Tenderfoot Creek, and Melvin and Kievicz groundsluiced on the right limit

on No. 1 below Discovery. Melvin & Kievicz also used an automatic dam and shoveled-in on Democrat Creek, while just below them Tokla & Luoma conducted similar mining. I. Isaacson, who usually has done a little drifting on Banner Creek was reported as not having mined this year. The same holds true of Paul Paulson on No. 5 below on Banner Creek. Fred Campbell conducted his usual open cut mining on the divide between Banner and Tenderfoot Creeks.

FAIRBANKS PRECINCT.

Ten gold dredges were active in the Fairbanks precinct in 1929, five of these being operated by one company employing a maximum of 900 men this season in stripping, thawing, dredge operation, dredge construction and other allied work. The operation of the other five dredges engaged 117 men. There were also conducted 40 other placer operations with 120 men engaged, among which were 8 hydraulic mines with 25 men; 10 open cut mines with 15 men, operated mainly by groundsluicing and shovel-in methods; 14 drift mines with 62 men, worked either during the winter, summer or both; 8 prospecting operations with 18 men engaged in sinking shafts, drifting, and other means. There were also a number of unrecorded prospectors in the field. Considerable duplication is involved as the same miners may be engaged ~~at~~ more than one operation during the year, ~~and~~ the general labor ^{is} migratory. Drift and open cut operations

have decreased in number and size, the dredging interests having acquired most of the ground formerly mined by those methods, and have also given employment to many who formerly conducted their own operations. Now that the extensive program of construction and development which has been underway in the Fairbanks precinct for a number of years has been completed and has now reached full operation, many of the men employed on such work will again attempt mining on their own resources. There will no doubt be an increase in the near future in the number of placer mining operations conducted by methods other than dredging, although with the dredging of the principal placers underway it must be admitted that the best days for most of the other forms of placer mining have passed. If the experimental operation being conducted on Eldorado Creek, where the deep frozen gravels are being hydraulicked underground, proves successful, it will afford new possibilities for some of this placer which possesses unusual physical characteristics.

The Fairbanks precinct ranks first among the mining precincts of Alaska in total placer gold output, which from 1903 to 1927, inclusive, is valued at \$75,260,000. The U.S. Geological survey reports the 1927 output at \$350,000, the lowest in the placer mining history of this precinct. Since then the output has been greatly increased by the operation of new large dredges. The production this year has been the

the largest for many years, ^{amounting to about \$1,240,000 which includes} ~~although at this time the amount~~
^{dredge} ~~the output from Norm & Creek, legally lying within the Tolovana precinct~~
~~cannot be definitely stated.~~ Next year's production should
show a large increase over that of 1929. This improved con-
dition is attributed to the dredge development and operation
which would not have been possible but for improved accessi-
bility, mainly by the Alaska Railroad. This railroad has
made Fairbanks easily accessible and permits quick delivery
of supplies and equipment throughout the entire year at a
reasonable cost.

The outstanding placer development and operation is
that of the Fairbanks Exploration Co., a subsidiary of the
U.S. Smelting, Refining & Mining Co. It is the largest ever
conducted in Alaska. Beginning about 5 years ago extensive
placer holdings were acquired by this company on Goldstream,
Gilmore, Pedro, Cleary and other Creeks in that area. These
placers were carefully and systematically prospected, after
which a very extensive development and construction program
was begun. The principal features of this program were the
construction of the Davidson ditch system, a central power
plant, and five dredges, along with the preparation of the
ground ahead of dredging and much other allied work. Three
dredges started operations in 1928, two more were construct-
ed and placed in operation this fall. Everything is now in
shape for next season to begin a long life of full scale
operation. The company has kindly provided the following

interesting details.

The central power plant is located at Fairbanks where electric power is generated by steam at 4000 volts stepped up and transmitted to the various parts of the field at 33,000 volts where it is transformed to 2300 volts for use by the dredges and otherwise. Motors smaller than 40 H.P., however, use the current at 440 volts. The steam plant contains two Stirling boilers, each rated at 1001 B.H.P. at 280% ratio, the steam gauge pressure being 240 lbs. A Smoot control automatically governs the combustion and steam generation. The boilers are equipped with chain grates. The electric power is generated by two 3750 K.V.A. General Electric Co., alternating current, 3 phase, 60 cycle, generators direct connected to two G.E. Co. 15 stage turbines at 3600 R.P.M. A 645 K.V.A. generator direct connected to a 500 K.W. 6 stage turbine is available for auxiliary and winter use. The water supply for the boilers is obtained from three 15 inch driven wells, being pumped by a "Coniflo" pump from the wells into a Bethlehem evaporator which treats 3000 lbs. of water per hour. Water from the turbine condensers is reused but the evaporator makes up about 5 percent of the water used. These wells are 127, 360, and 157 feet in depth, deliver 2400, 2900, and 3300 gals. of water per minute, respectively, at temperatures of 34, 38 and 41 degrees, respectively. Healy River coal crushed to pass a 6 inch screen is delivered in

railroad cars alongside of the plant, elevated by bucket elevator to the top of the plant where it goes through a rotary coal crusher which delivers 60 percent under 1/4 mesh, and 40 percent under 1 inch but over 1/4 inch. This goes to a 250 ton steel bin located above the boilers from where it is weighed and distributed to smaller bins feeding to the chain grates. It is of interest to note that this coal, while similar to lignite in physical characteristics is, according to analysis, quite similar to sub-bituminous coal. As received it averages about 8300 B.T.U. It is giving excellent results. It also stores well as proven by a 1000 ton lot of lump size which was stored in one pile and covered with 200 tons of screenings. After a year's time, this coal was used and found to be in the same good condition and of the same quality as when received at this plant. Pipes were set in this pile and temperatures were taken from time to time showing the temperature during storage to have never exceeded 38 degrees.

The preliminary details of the Davidson ditch system were reported several times prior to its final construction. The original plans were somewhat changed. This system has now been completed and is in operation so that the final details of its construction can now be given.

The main intake is on the Chatanika River a short distance below the junction of Faith and McManus Creeks

where a low bedrocked dam ^{di}inverts the water into the ditch. The elevation at this intake is 1487.85 feet. The ditch system then follows down along the right limit slopes of the Chatanika River valley crossing numerous tributaries of which the principal ones are Sourdough, No Name, Cripple, U.S., Ptarmigan, Grouse, Moose, Long, Boston, McKay, Belle and Crooked Creeks. These are crossed with steel syphons. At a distance of 43 miles from its intake, it crosses the Chatanika River with its longest syphon. It then continues down the left limit to Cleary Creek, up the right limit of Cleary Creek and crossing towards its head by syphon, continues to and around the head of Little Eldorado and Dome Creeks to the head of Vault Creek where it enters a tunnel, a distance of 78.6 miles from the intake. This tunnel cuts through the divide into the head of Fox Creek from which point, 79.3 miles from the intake, elevation about 1137 feet, one branch continues up Goldstream Creek to its tributary, Gold Run Creek, a distance of 4 miles, while another branch continues down Goldstream Creek for a distance of 7 miles. The elevation of the ditch terminal at Gold Run Creek is 1117.47 feet and at the end of the south branch, 1110.44 feet. In addition to the main ditch there is a lateral ditch 0.5 mile long bringing in water from Sourdough Creek, and a lateral from Belle Creek, 5.5 miles in length. The total length of the system, including the laterals, is 96.3 miles.

The following table provides some of the pertinent details:

Davidson Ditch Data

| | <u>Length miles</u> | <u>Width of bottom feet</u> | <u>Capacity in M. I.</u> | <u>Grade in ft. per mile</u> |
|---|-------------------------|-------------------------------------|------------------------------|--------------------------------------|
| Sourdough lateral..... | 0.5 | 12 | 3000 | 2.64 |
| Belle lateral | 5.5 | 8 | 800 | 4.22 |
| (1) Main ditch-intake to tunnel..... | 72.4 | 12 | 5500 | 2.11 |
| Tunnel 7x7 ft..... | 0.7 | -- | -- | 12.41 |
| Syphons (14) 46" to 56" dia..... | 6.2 | -- | 6500 | -- |
| Lower Goldstream branch. | 7.0 | 10 | 3000 | 3.70 |
| Upper Goldstream branch. | 4.0 | 10 | 3000 | 5.28 |

(1) Exclusive of syphons.

All syphons are of "Lockbar" steel pipe, the longest one, crossing the Chatanika River, being 8019 feet in length. The maximum head on this syphon is 543 feet. It is constructed of 2747 feet of 52 inch diameter pipe 1/4 inch thick, and 5274 feet of 46 inch diameter pipe of various thicknesses ranging from 1/4 to 7/16 inch.

The water supplied by this ditch system is used principally for hydraulic stripping of the muck and other overburden on Cleary and Goldstream Creeks. In addition, the company has the 10 mile Kokomo ditch which takes the water from the Chatanika River above Kokomo Creek and delivers it at Cleary Creek under a low head, and numerous small ditches on Cleary, Goldstream, Pedro and Gilmore Creeks.

The Davidson ditch system is the longest water conduit

in the North, being longer than the 12 Mile ditch system in the Klondike, Yukon Territory, and ranks among the longest conduits in the world, delivering water for mining purposes. By way of comparison, some details of the 12 Mile ditch system in the Klondike follow: The total distance from its intake to Gold Hill on Bonanza Creek is 70.2 miles. The difference in elevation between these two points is 1128 feet. The effective head at Gold Hill on Bonanza Creek is 375 feet, although higher heads are available elsewhere along the ditch. There are a number of long syphons of woodstave and steel pipe. The longest syphon is across the Klondike River and is constructed of 2410 feet of woodstave pipe, 49 inches in diameter, and 13343 feet of steel pipe in 43 to 49 inch diameters. The thickness of the steel is 11/16 inches. Exclusive of the distributing lines, the ditch system includes 38 miles of ditch, 9 foot bottom, 3½ foot depth, grade 6 feet to the mile; 19.6 miles of flume, 6 feet wide, 4 feet deep, grade 14 feet to the mile; and 12.6 miles of pipe in diameters ranging from 38 to 49 inches. *Sixteen miles of additional ditch, with 20 foot bottom was completed and added to this ^(12 mile) system this year.*

The five gold dredges are of most modern design and very strongly built, having steel hulls and steel superstructures. They were designed by the company's engineers, built by the Bethlehem Steel Co. at San Francisco, and erected by the company. All are electrically operated. Dredges Nos. 5 and 6 are identical in details. The details are best given by table as follows:

DETAILS OF THE FAIRBANKS EXPLORATION CO. DREDGES

| | NO. 2 | NO. 3 | No. 8 | NOS. 5 & 6 |
|----------------------------------|----------------------------------|----------------------------------|----------------------------------|-------------------------------------|
| Location | Lower Goldstream Creek | Cleary Cr. at Chatanika | Gilmore Creek | Upper Cleary and Central Goldstream |
| Date first operated | June 30, 1928 | July 14, 1928 | Aug. 25, 1928 | Nov. 25, 1929 Oct. 23, 1929 |
| Size of buckets | 10 cu.ft. | 10 cu.ft. | 6 cu.ft. | 6 cu.ft. |
| No. of buckets | 92 | 105 | 70 | 78 |
| Max. digging depth below water | 48 | 60 | 28 | 36 |
| Size of hull | 60'x120'x12' | 60'x148'x12" | 50'x99'x10 $\frac{1}{2}$ ' | 60'x108'x9' |
| Draught of dredge | 8 ft. | 8 ft. | 7 ft. | 6 ft. |
| Total installed motor H.P. | 728 | 728 | 405 | 470 |
| Size of screen (overall) | 8' dia. by 44' 7 $\frac{1}{2}$ " | 8' dia. by 44' 7 $\frac{1}{2}$ " | 6' dia. by 36' 2 $\frac{1}{2}$ " | 6' dia. by 43' |
| Size of screen perforations | 1/2" dia. | 1/2" dia. | 1/2" dia. | 1/2" dia. |
| Motors & Size - H.P. | | | | |
| No. Exclusive of auxiliary | 9 | 9 | 8 | 8 |
| Bucket Line motor | 250 | 250 | 150 | 150 |
| Sideline winch motor | 40 | 40 | 25 | 25 |
| Screen Motor | 75 | 75 | 40 | 60 |
| Stacker Motor | 50 | 50 | 25 | 25 |
| Stacker Hoist Motor | - | - | - | 25 |
| High pressure pump motor | 150 | 150 | 75 | 100 |
| Low pressure pump motor | 75 | 75 | 40 | 60 |
| Hopper pump motor | 40 | 25 | 25 | 25 |
| Pumps - number | 4 | 4 | 3 | 3 |
| Sizes - G.P.M. | 1 at 500 | 1 at 500 | 1 at 500 | 1 at 500 |
| " " " | 1 at 1000 | 1 at 1000 | 2 at 3000 | 2 at 4000 |
| " " " | 2 at 5500 | 2 at 5500 | - | - |
| Total water pumped G.P.M. | 12,500 | 12,500 | 6,500 | 8,500 |
| Grade of tables | 1 5/8 : 12 | 1 5/8 : 12 | 1 5/8 : 12 | 1 5/8 : 12 |
| Kind of riffles | Hungarian | Hungarian | Hungarian | Hungarian |
| Stacker, length ϕ to ϕ | 120 ft. | 170 ft. | 95 ft. | 105 ft. |
| " , belt, width | 38" | 38" | 32" | 32" |

The Nos. 2 and 3 dredges started their 1929 dredging season on May 10 and 8, respectively, closing it on Nov. 11 and 20, respectively. The No. 8 dredge started its season on May 1 and closed it on Dec. 23, setting a new record for the length of dredging season for Alaskan dredges of 237 days. The Nos. 5 and 6 dredges completed this fall started their first digging on Nov. 25 and Oct. 23, respectively, closing down for the season Dec. 9 and Dec. 16.

The creek placers being dredged were formerly mined by drifting, and by open cut methods including steam scrapers, cableway excavators, etc. Heavy tailings overlies some of the ground. The depth of the gravels and the muck vary, the muck ranging from a few feet to 25 feet with up to 50 feet at times along the outer limits. This muck is stripped ahead by hydraulic methods to such depths and limits as may be practical. The tailing piles are piped over on stripped ground. All of the ground being frozen, the gravels and such muck as may remain are thawed with water at natural temperatures, all water for thawing being pumped. The general procedure has been described under "Thawing" in the general report. The ground after being prepared ahead for dredging ranges mainly from 30 to 40 feet on lower Goldstream Creek, 10 to 20 feet on Central Goldstream, 8 to 15 feet on upper Goldstream and Gilmore Creeks, 12 to

25 feet on upper Cleary, and 40 to 60 feet on Lower Cleary Creek. The No. 3 dredge dug some ground this season on lower Cleary Creek 85 feet deep.

GOLDSTREAM CREEK & TRIBUTARIES:

Besides the dredging, ~~on this creek~~, two men mined on Goldstream Creek, Sam Olson taking out a small open cut and doing a little drifting several claims below No. 21 below, and August Wendt, mined in a small open cut. A.P. Virden hydraulicked alone, and Ardino shoveled-in, on Fox Creek. Pete Hansen mined on First Chance Creek. No mining was reported as having been done on Engineer Creek, which was under consideration for dredging by English interests during the past few years. Steve Liedy mined by open cut, and by drifting in the winter, on upper Gilmore Creek.

A. Zimmerman & Co. conducted two operations, one on No. 1 above Discovery and one near the head of Twin Creek. A total crew of 9 men was engaged for both operations. The ground is first stripped ahead with giants, the gravels then being piped into the head of a short string of sluice boxes. The tailings go into a sump from where they are dug, elevated and stacked by a cableway excavator. A long heavy gin pole is erected and guyed in place at the point where the tailings are to be stacked. To this is attached one end of a 1 inch diameter trolley cable so arranged that it can be slacked or tightened by the steam hoist operated from a point on the

bank opposite and in line with the sump. A travelling carrier, similar to the Fairbanks carrier used at the drift mines, is operated along this trolley cable, being controlled by a 3/4 inch hoisting cable operated from one drum of the steam hoist through blocks. As the trolley cable is slacked, the excavator bucket is lowered from the carrier into the sump, then with the hoisting cable, the bucket is pulled forward and loaded, at the same time the trolley cable being gradually tightened. The bucket is hoisted to the carrier to which it locks, bucket and carrier then being pulled up and along the trolley cable to the release button where the bucket is automatically released and dumped. It then returns down the cableway by gravity for another load. At Pedro Creek, a 30 H.P. boiler provides the steam for the 8 1/4 by 10 double cylinder two drum hoist. One man fires this boiler and operates the hoist and excavator. An average of 1/2 cord of wood, costing \$8.00 per cord, is consumed in a 10 hour shift. The excavator bucket is 4 feet wide and about 1 cu.yd. in capacity. It is of the Hanot type with a full bottom and toothed, similar to those formerly used by the cableway excavator operations on Goldstream Creek. The bucket is controlled by chains and lead blocks. This equipment is made at Fairbanks where it sells for \$1228 complete with excavator bucket, carrier, double and triple blocks, etc. A longer bail on the bucket than as now provided is suggested,

so the bucket can swing freely when released.

The water supply at both operations is small and when tailings were formerly stacked by giant, the intermittent and alternate use of the water was necessary most of the time and operation was greatly handicapped. All of the available water can now be used in moving the gravel to the sluice boxes, a feature which has been dominant to profitable operation. The man formerly doing the tailing stacking with a giant now does all the work connected with the mechanical stacking. The bucket returning by gravity saves power. The cost of setting up the cable-way is nominal, a relatively large area being handled from the one set-up. The additional cost for equipment, set-up, fuel, etc. is more than repaid by the additional water made available for use in the pit. The tailings can also be more closely stacked, as the excavator stacks them readily to heights of 50 to 60 feet and more.

The two operations together mine 100,000 to 140,000 sq.ft. of bedrock per season under the present method. But about half as much could be mined by the former method when the tailings were stacked with a giant. The ground on Pedro Creek is up to 30 feet deep which after stripping usually leaves 12 to 15 feet to be put through the boxes. At Twin Creek, the total depth of ground is 12 to 15 feet, some of which is first stripped off. The ground is frozen, contains

heavy wash, bedrock is generally blocky and creviced and conditions for hydraulicking are in general not favorable. One 3 inch nozzle is all that can be used in the pit, the head at Pedro Creek being 140 feet, at Twin Creek it is less than 100 feet. The upper Twin Creek operation has now been practically completed, future operation being planned at the mouth of Twin Creek where it enters Pedro Creek.

FISH CREEK:

The Tanana Valley Gold Dredging Co., Ltd. operated its dredge, prepared ground ahead, etc. on No. 4 above on Fish Creek, employing 38 men. This company started dredging operations on the upper end of No. 1 below Discovery on July 24, 1926. The dredge was only operated that season for a short period being then hemmed in by frozen ground. By 1928, provisions had been made to prepare the ground ahead of dredging and since then the operation has been better conducted. The dredge started its 1929 season on July 12 and closed it on Oct. 21.

This creek placer ranges from 18 to 60 feet in depth, the deepest ground being lower down the creek. The gravels are of average size with but few large rocks, and are covered with moss and muck to varying depths. This area was formerly mined to some extent by drift and open cut methods. Most of the ground is frozen but there are some narrow channels and small patches that are thawed. The total depth of the

ground at the present dredge vicinity is 20 to 25 feet, the width of dredging pay is stated to range from 100 to 300 feet. The small and erratic water supply does not permit much stripping of overburden. An average depth of about 10 feet of muck exists at this locality excepting along the immediate creek bed where most of it has been carried away.

The ground is thawed mainly with water although a minimum amount is thawed by steam. A ditch about 2 miles long brings in a small supply of water from the creek above, the pressure at the crossheads on No. 4 claim above Discovery being 18 to 22 lbs. Supplementing this ditch supply, water is pumped to the thawing points and reused. Pumping is done with a 6 inch centrifugal, and a 6 inch three stage high pressure pump, both being electrically driven.

The water from the ditch or the pumps is delivered through the main pipe line from which a 6 inch lateral 150 feet long takes off every 31 feet. Every 14 feet along these laterals is a connection for the $1\frac{1}{2}$ inch header pipes. These headers have a connection every 5 feet where a $\frac{3}{4}$ inch nipple and a "T" are attached. These "T's" are bushed down for the $\frac{3}{8}$ inch nipple and water hose connection. Each pair of headers extends 13 feet right and 13 feet left from the lateral and feeds twelve thawing points. The thawing points are spaced at 7 foot centers, usually in square relation. They are made up in 8 and 16 foot lengths of $\frac{1}{2}$ inch diamet-

er ordinary gas pipe connected with standard fittings. The points have open ends and at the top are fitted with a 1/2 inch "T" turned on side, the upturned arm being fitted with a soft malleable iron plug for a drive head, the base of the "T" being bushed down for a 3/8 inch nipple for the hose connection. With water turned on, the point is jetted and worked down as far as possible and is then driven by a hammer weighing about 4 lbs., at the same time the point being twisted and turned with a wrench. One man works at a number of points and, according to those in charge, it requires from 30 to 50 hours to set a point to bedrock. The open end points are difficult to drive in most of this ground and unless a medium high water pressure is provided while driving, they often get plugged. Points called "muckers" are driven into the muck wherever its thawing lags behind that of the gravel. These are of 1/2 inch pipe in 8 foot lengths with open end and with the regulation top and hose connection. When water conditions permit and everything is going satisfactorily, 400 to 450 points are in operation. The ditch water temperature is stated to average about 48 degrees, 58 degrees being recorded during the warmest days. The time required to complete an average thaw ranges from 9 to 15 days. Twenty-eight men are employed on the thawing, working in two shifts of 10 hours each. About 4 men per shift are engaged in driving points.

The dredge is electrically operated and is a screen

stacker type built by the Yuba Mfg. Co. It draws 5 feet of water. The hull is of wood, 44' by 110" by 9"; anchorage is by two steel spuds. The bucket line is close connected containing 81 - 5 cu. ft. buckets operated at an average speed of 21 buckets per minute. The maximum digging depth below water is 30 feet; the ladder and bucket screen is 27 feet long and 6 feet in diameter, overall, the screening area being 19 feet long, the upper two plates having 5/16 inch holes, the next two 7/16 inch holes, and the lower plate 1 inch holes. The screen is provided with a central pipe with high pressure nozzles, retar^ding rings and bars. The gold tables and sluices are fitted with steel shod hungarian riffles, the total gold saving area is 915 sq.ft., plus the save-all of 45 sq.ft. An 8 inch pump provides the water for the screen and tables, another 8 inch pump supplies the sluices, a 4 inch pump supplies the save-all, etc. The total installed motor horsepower is 270, exclusive of the two small auxiliary motors. The main drive and ladder hoist motor is 100 H.P., swing winch motor 20 H.P., screen drive 25 H.P., Stacker drive 20 H.P., 8" pump at 65 ft. lift, 50 H.P., 8" pump at 45 ft. lift 40 H.P., 4" pump 15 H.P. The stacker is 100'6" from center to center, and has a 30 inch belt. The power plant was formerly on the dredge but this year was moved on shore. It consists of two 135 H.P. Seattle Boiler Works boilers at 150 lbs., a Moore 300 K.W. turbine direct connected to a 320 H.P. Moore-

Allis Chalmers alternating current generator at 480 volts, 3 phase, 60 cycle. Current is generated at 440 volts. Healy River coal is consumed in these boilers at the rate of 14 tons per day. This coal is hauled by contract with caterpillar tractors from the railroad cars at Gilmore to the power plant, a distance of 15 miles. The cost at the power plant is \$14.50 per ton. Plans are underway to enlarge this plant as the dredge is underpowered. In 1928, the best season prior to the present one, the dredge was operated 99½ days, 32 percent of this time being lost mainly in delays while ground was being thawed ahead. The dredge that year dug 103,215 cu.yds. of gravel and 37,685 cu. yds. of muck and overburden. The operation is now under capable management and this year experienced its best season. The rated daily capacity of the dredge is 3000 cu.yds. and it is hoped to prepare sufficient ground ahead of dredging so that not less than 200,000 cu.yds. can be dug during an average season.

Jackson & Wickander hydraulicked on Last Chance Creek with good success, James White shoveled-in on Pearl Creek, Jerry Burk, and James Kirk, each conducted their small open cut operations on Fish Creek.

FAIRBANKS CREEK:

The Fairbanks Gold Dredging Co. operated its two dredges on Fairbanks Creek, No. 1 dredge on No. 5 below claim, and No. 2 dredge on No. 7 below. Both dredges were

digging downstream. The season's dredging started in June and closed on Nov. 11. The company employed 55 men, 20 being engaged in thawing ground ahead of both dredges. The No. 1 dredge is a 4 cu.ft. screen stacker boat driven by a new 150 H.P. Werkspur diesel engine which recently replaced the two former 110 H.P. Scandia Pacific Semi-diesel engines. The new engine consumes 115 gals. of 24 gravity oil per day. This dredge is digging an average of 2500 cu.yds. per day. The average dredging season is about 140 days. The mechanical details of this dredge have been given in past reports. The thawing ahead of this dredge is done with ditch water under 15 to 20 lbs. pressure at the crossheads. Points are set at 6 foot centers but it is planned to increase this to 8 feet. The ground now being thawed and dredged averages about 25 feet in depth. About 300 thawing points are the maximum number set here. From 14 to 16 days are required for the average thaw. Thawing equipment and procedure is otherwise similar to that used and followed ahead of the No. 2 dredge.

The No. 2 dredge after several reconstructions was again rebuilt and modernized in 1927. It was originally a Risdon dredge and brought to this creek along about 1908 from Yukon Territory. As recently rebuilt it is now a screen and conveyor dredge operated by two 75 H.P. Werkspur diesel engines which consume 100 gals. of 24 gravity oil per day. One engine oper-

ates the bucket line, the high pressure pump and the winches the other the low pressure pump, screen and conveyor. The bucket line is close connected and contains 81 - 4 cu.ft. buckets operated at a speed of 21 buckets per minute. The dredge is digging an average of 2200 cu.yds. per day and it is hoped to increase this to 2500 cu.yds. The maximum digging depth as designed is 28 feet below water but it has dug 31 feet. The new wooden hull is 40' by 90' by 6'. The draught of the dredge is 4 ft. in the bow and 5 ft. in the stern. The revolving screen is 24 feet long and 6 feet in diameter, overall, and is equipped with central pipe with high pressure nozzles, and retarding rings. The four upper plates have 1/2 inch perforations, the lower plate 1 inch. There is one steel spud which is offset with the conveyor. The conveyor is 85 feet long, center to center, and has a 30 inch belt. One 12 inch low pressure pump with a 6 inch booster pump provides the water for the screen nozzles, etc., and a 4 inch high pressure pump delivers the water to the hopper and the bucket ladder. Other details are very similar to those of the No.1 dredge. The ground now being dug by this dredge varies from 25 to 35 feet in depth.

. Most of dredgeable portion of this creek deposit has been dug from the upper end of the creek to the present location of the dredges. This deposit was formerly mined by open cut and drift methods. From 3 to 6 feet of muck prevails as a

rule where not eroded away. Tailing piles, old drift timbers, etc., are present. The deposit contains bands of clay and considerable sediment occurs with much of the gravel. This washes all right but slows down the digging speed and consequently lowers the dredge capacity. Thawed channels and patches are present and irregular thawing exists from the surface down. The balance of the ground, or about 50 percent, is frozen and is thawed with water. The total depth of ground ranges from 20 to 40 feet getting deeper down stream. The average width dredged ranges from 300 to 500 feet.

The thawing points used at this operation are made of 1/2 inch gas pipe. They are used with open end, the top being fitted with a standard "T" turned sideways, the upper arm being fitted with a soft steel plug for a drive head. Connection is made with a 1/2 inch nipple to the ribbed garden hose attached to the crosshead. It often happens that after a point has been driven a ways, to 20 feet or so, it strikes a boulder or cannot be put to bedrock. It may then be left to thaw as set, but as a rule, the present practice is to withdraw this point, insert a special driving point in the hole, and drive it to bedrock. This special point is made of 3/4 inch extra strong pipe to which is welded at the bottom a piece of drill steel drawn into a cross bit of 1 5/8 inch gauge and having two slotted or drilled holes of 1/4 to 3/8 inch width or diameter, one opposite the other and about 1 1/2

inches above the cutting edge. These holes are so placed that the water will jet downward and ahead of the bit. Both types of points are driven with an 8 lb. hammer, one man driving while another turns. The driving is hard and progress is slow as a rule. Water for thawing ahead of the No. 2 dredge is supplied by a 10 inch low pressure centrifugal pump and a 5 inch high pressure pump, belt driven by a 110 H.P. Scandia Pacific Semi-diesel engine, formerly on the No. 1 dredge. It is tried to keep the water pressure at the crossheads at around 30 lbs. but it often drops to 20 lbs. while driving. The ground at present being thawed averages 32 to 33 feet in depth, with some 40 feet deep. The points are set ~~here~~ at 10 foot centers and about 21 days are required to complete a thaw under average conditions. The greatest number of points set here is about 300.

Experiments have been made here, and also by other companies on Fish and Goldstream Creeks, at the suggestion and help of Irving Reed, whereby a small Jackhammer air drill was utilized in driving these 3/4 inch points at that time equipped with a chisel bit similar to those used by the Fairbanks Exploration Co. on Goldstream and Cleary Creeks. The speed of driving was considerably faster than by the usual method, although numerous difficulties were at first met. The experiments resulted in the adoption of the 3/4 inch point made of single extra heavy steel pipe cut into 5 foot lengths,

the ends being ground true and threaded with left hand threads, or, counterwise to the direction of the drill rotation, and so they would butt in the specially tapped and threaded sleeves. This overcame much of the breakage encountered with former points. The best bit was found to be the cross bit of 1 5/8 inch gauge bored with a center hole and four other 3/8 inch diameter holes centered around it, one placed between each angle of the bit. A special combined water head, swivel, and drive head for the attachment of the drill and delivery of the blow to the point was designed by Reed which permits quick shifting from one point to another.

This method has not been adopted for while it has much improved the speed of driving the points this is apparently not sufficient to repay the cost of equipment, air, and its delivery into the field, etc., in addition to the usual water thawing equipment which would still be necessary. At the operation on Fairbanks Creek this method is used at times to continue on with points that have been driven a considerable ways by the usual hand methods but have not been able to reach bedrock. It has been found that under such conditions the point can be driven to bedrock avoiding the abandonment of the partly set point, or otherwise trying to put down another point alongside by the usual driving methods. This appears to be the principal practical use and application of this method of driving thawing points with a machine drill, although further ex-

perimenting along this line is planned.

Lower Fairbanks Creek has during the past few years been investigated for dredging by several interests, although nothing definite has developed therefrom. M. Stepovich, who has drift mined in that locality in the past, was not engaged in such mining this year but is reported to be grouping claims apparently with plans for subsequent development. Fourth of July Hill, lying just east of Fairbanks Creek and opposite the mouth of Fish Creek, contains a high gravel bench deposit which has been considered at different times as affording extensive hydraulicking possibilities. M. Eagan & Co., the owners of a large area of this ground, conducted their seasonal prospecting and assessment work there.

CLEARY CREEK AND TRIBUTARIES:

In addition to the dredging and ground preparation operations of the Fairbanks Exploration Co. on this creek, R. Cunningham conducted a small hydraulic operation on No. 10 above, and Chas. Carlson on No. 9 above took out a small winter dump and during the summer did a little open cut mining.

The Chatham Gold Dredging Co. operated its 1 1/2 cu. ft. steam driven flume dredge on Chatham Creek. This dredge in digging up Chatham Creek encountered poor spotty pay and much frozen ground this spring, reaching the upper limits of the dredging pay ground. Operation here was therefore stopped late in July. The dredge, without dismantling, was then

moved back down to the mouth of the creek and within about a month's time had again resumed operation. The moving was done by placing the dredge on skids and large pipe rollers and pulling it along over the levelled tailings with block and tackle operated by caterpillar tractor. It was moved a distance of about a mile in less than two weeks. The dredge is to dig up the creek along the right limit which when first dredged was found to be frozen and was therefore left behind. The operators state this ground is now dredgeable, having naturally thawed because of drainage developed by former dredging. This little dredge has in the past dug about 1000 cu.yds. per day. Nine men are employed, seven being engaged on the dredge. An 80 H.P. boiler provides the steam. Matanuska coal is now used at the rate of 3 1/2 tons per day whereas 5 to 5 1/2 tons of Healy River coal were formerly consumed.

Nels Giske continued his prospecting by sinking shafts on the right limit benches of Chatham Creek and is reported to have struck the pay in the shaft completed this summer.

NOME CREEK:

While Nome Creek legally lies within the Tolovana mining precinct it should rightfully be in the Fairbanks precinct for reasons of its location and accessibility, and is therefore reported here.

The Nome Creek Dredging Co. operated its dredge on upper Nome Creek employing 15 men. The completion of a road from U.S.

Creek on the Steese Highway to Nome Creek this fall has been of great benefit. This Company hauled in and erected its dredge and power plant in 1926, starting dredge operation that year on Sept. 2. The dredge has a close connected bucket line containing 50 - 5 cu.ft. buckets operated at a speed of 24 buckets per minute. The wooden hull is 38' by 80' by 6' in size. The dredge draught is 4 feet. The maximum digging depth below water level is 15 feet. Anchorage is by head and stern lines. The revolving screen is 28 feet long, overall, and $4\frac{1}{2}$ feet in diameter, and is equipped with a central pipe with nozzles. The perforations are $\frac{3}{8}$ ", $\frac{5}{8}$ ", and $\frac{7}{8}$ " by $1\frac{1}{4}$ inch. The total gold saving area, exclusive of the save-all, is 890 sq.ft., the save-all area is 36 feet. Hungarian riffles are provided. An undercurrent of cocoa matting covered with expanded metal is also provided for catching fine gold which escapes amalgamation and recovery on the tables and sluices. The stacker is 60 feet long from center to center, and has a 30 inch belt. One 10 inch pump at 60 lbs. delivers the water to the sluices and screen nozzles and there is a 4 inch pump for the save-all, ladder, clean-up, etc. The dredge is electrically operated, power being generated by steam on shore. The electric motors on the dredge include a 75 H.P. induction motor for the bucket line or main drive; 30 H.P. for the winches; 15 H.P. for the stacker; 25 H.P. for the screen; 50 H.P. for the pumps; a total of 195 H.P.

The shoreplant has a 360 H.P. Wolf Locomobile steam plant, 225 lbs. pressure, direct connected to a G.E. Co. 480 volt alternating current, 275 H.P. at 225 R.P.M., generator. This current is transmitted to the dredge where it is transformed and used at 440 volts. The average power consumption is reported to be about 100 K.W. Wood is the fuel, the consumption of which was about $5\frac{1}{2}$ to 6 cords per day but which is reported to have been recently reduced by obtaining better wood. A few changes have been made on the dredge since first erected and plans are under consideration for a change in the power plant, either oil as fuel, or a diesel plant. The management reports the daily digging capacity of the dredge to now be 3000 cu. yds. The deposit being dredged is mainly of medium sized gravel with some boulders up to about 2 feet in maximum dimension. There is a little sediment but the material washes well. The deposit is free of permanent frost. There is no muck but some of the gravel is covered with a little soil and moss. The bedrock is Birch Creek schist. The gold is fine but shotty, with some coarse pieces, it is bright and uncoated. Very little black sand is present. The dredging pay varies from 250 to 450 feet in width. The depth of the deposit is 7 to 10 feet averaging about 8 feet, or including the bedrock dug the average dredging depth is about 11 feet. The ground is low grade.

Bostrom & Co., who are also interested in the Nome Creek Dredging Co., drilled and prospected on lower Nome Creek and at

midseason reported having proven up about a mile of ground and that they expected to prove up a large area containing better values than that now being dredged, and which would justify the installation of another dredge on that creek.

ELDORADO CREEK:

The Eldorado Mining Co., Sylvester Howell, is conducting experimental operations by hydraulicking underground on the Idaho Ass'n. on lower Eldorado Creek. A crew of 12 to 15 men is employed. This ground was mined several years ago by several other interests who drilled and blasted down the frozen gravels, hoisted them to the surface and sluiced them without the customary thawing. This was successful as far as the method was concerned but financially it was a failure.

This placer is an ancient creek deposit averaging at this locality about 180 feet in depth. Moss and peat to a depth of about 8 feet overlie 7 to 8 feet of muck, the balance of the deposit to bedrock being of average sized gravel with some beds and streaks of sand. Bedrock is mainly a mica schist, mostly soft, but having some slabby and harder strata. The bedrock surface is irregular with some high reefs and pot holes. The main gold distribution is mainly in the vicinity of bedrock. The ground is solidly frozen but unlike most deep frozen placers the gravels contain a "dry" crystalline frost, the total ice content of the gravels being exceptionally small and probably not exceeding 5 percent by volume. This peculiar-

ity makes this deposit as ideal as could be obtained for the method formerly used and the one now being followed.

The operation at present underway is being conducted in a block of ground opened up and mined by former operations. The old shaft has been deepened to permit the required grade from the working face to the shaft. The shaft is 180 feet deep to bedrock the former crib timbering to this point and the heavy square set at the bottom remaining. This part of the shaft is 7 by 7 feet inside the timbers. It has been sunk 26 feet deeper into bedrock, the lower 6 feet being the sump or tailing pit. A water storage sump of 2000 cu. ft. capacity and a 10 by 30 foot pump station has been cut out in the rock to one side of this shaft at the level of the top of the tailing sump. The main drifts from the bottom of the shaft are driven on an upgrade of 8 percent and the sluice boxes are installed therein. Further details of this development are not essential as the plans for future development will later be stated.

Present operation is conducted by pumping water from the storage sump with a high pressure 10 inch pump rated to deliver 2500 gals. per minute under 100 foot head at a speed of 1750 R.P.M., and driven by a direct connected 100 H.P., G.E. Co. motor. The pressure of the water as used by the giant has not been determined although Mr. Howell states ~~that~~ the maximum head required would not exceed 75 feet. The steam exhaust from the hoist on the surface, and the cooling water

after leaving the surface diesel plant, empties into the underground water storage sump. While no temperature, water, or other accurate measurements have been taken, the temperature of this water on being pumped from the sump is stated to be about 60 to 65 degrees Fahr. This water is pumped through the main pipe line and laterals to the working faces where it is used by the giants with 3 and 4 inch nozzles for hydraulicking down the gravels and bedrock. The retreating method is followed, working from the inner faces, out to the main drifts, etc. A face 5 to 6 feet high about half being in gravel and half in bedrock is mined, the material being piped ahead to the sluice boxes set in the main drifts. The gold is recovered in these sluice boxes, while the water and tailings are carried on by them and emptied into the common tailing sump at the bottom of the shaft. The water runs off by gravity returning to the storage sump for reuse, the tailings being dug, hoisted to the surface and dumped to waste. The tailings are dug by a 3/4 cu.yd. clam shell bucket, operated by cable from the surface hoisting plant, hoisted to the surface where it engages and locks to a heavy double cableway and carrier, and is then pulled up the cableway to the tailing pile and dumped, then returning by gravity to the bottom of the shaft for another load. At present this trip from the bottom of the shaft to the dump and back requires about 2½ minutes as the size and arrangement of the shaft and ^{the} hoisting equipment

do not permit faster operation. The ice in the gravel is melted during the hydraulicking and sluicing although the water so accumulated just about compensates for the amount hoisted out with the tailings, in fact, a little water may have to be supplied from the surface from time to time. The back of the workings are easily supported with timber crib bulkheads or by leaving small pillars, spaced at 25 foot centers. There are about 60,000 sq.ft. remaining to be mined from these workings, stated to contain 80 to 90 cents in gold per sq.ft., although the block is so cut up and present arrangements are such that no systematic plan of mining or operation can be followed. Mr. Howell states that with a 4 inch nozzle, an area 20 by 20 feet was mined in 8 hours, also that a $4\frac{1}{2}$ by $4\frac{1}{2}$ foot drift was hydraulicked in the gravel along the top of bedrock at the rate of 16 feet in one hour and with the water about 5 degrees colder or about 60 degrees, the advance was 14 feet per hour. These drifts later sloughed some so were a foot or so larger in size when completed.

Most of the equipment used, excepting the new diesel electric plant erected this summer, is that used on this property by former operations. Four 50 H.P. boilers equipped with snaking grates are available for steam purposes, although only two of these boilers are now used. A 7 by 10 double cylinder ~~drum~~ hoist is used to operate a Fairbanks type

cableway carrier and bucket for lowering men, timber and supplies. A 9 by 10 double cylinder, 3 drum hoist, operates the clam shell bucket and carrier. These two boilers consume 6 tons of Healy River nut coal in 8 hours, this coal costing \$8. per ton delivered at Eldorado Creek. While an old type 650 cu.ft. Leyner two stage air compressor is available it has not been used for this development, a small locomotive type duplex compressor delivering about 65 to 70 cu.ft. of air per minute having been used for the rock drilling. Three B.C.R.W. 430 Jackhammers using hollow hexagon steel are included in the outfit.

The high cost of steam power induced the company to install a diesel electric plant this summer. This plant consists of a 165 H.P. Washington Estep diesel engine direct connected to a 100 K.W., G.E. Co., 3 phase, 60 cycle, 440 volt, alternating current generator. Diesel oil of 27 gravity is used, the maximum consumption of this oil at full load according to the manufacturers claims is 15 gals. per hour ~~or~~ an estimated power cost at this plant of 3.7 cents per K.W.H. This oil costs about 19 cents per gal. at the power plant. The plant is to provide the electric power for operating the underground pump which supplies the water for hydraulicking and sluicing. It is planned to later electrify the entire operation.

The company plans to open up a new block of ground

on the Oregon Claim just to the north and adjoining the block at present being mined. These plans are as follows. A 9 by 9 foot or larger shaft will be sunk and timbered so as to improve hoisting conditions and permit the use of a larger clam shell bucket. This shaft will be about 180 feet to bedrock, then sunk 40 feet into bedrock so as to provide the 8 percent grade deemed necessary for drainage and sluice box grade. Below this will be a sump or tailing pocket 6 feet deep. Starting from the level of the top of this pocket, drifts will be driven 400 feet upstream and 400 feet downstream from the bottom of the shaft to which point all openings will drain. These drifts will be in rock. At the furthest end of these drifts, cross-cuts will be driven 250 feet to the right and 250 feet to the left on a suitable grade sloping to the drifts. These cross-cuts will be driven mainly by hydraulicking, being partly in the upper soft bedrock and partly in the gravel. Thus a block of ground containing 400,000 sq.ft. of bedrock and claimed to average about 90 cents to \$1.00 in gold per sq.ft. will be developed at a total estimated cost of about \$25,000 or $6\frac{3}{4}$ cents per sq.ft. Some parts of the drift may be in soft bedrock or partly in gravel and could then be cheaply driven mainly by hydraulicking but would then require timbering. The system of mining will be to work from both ends of the drifts at a time, hydraulicking in one cross-cut while the rocks are be-

ing thrown back, bedrock is being cleaned or picked up, etc., in the one opposite. The scale of operation will, however, be governed much by the speed the tailings can be handled and disposed of. The main pipe line would be laid along the drifts with connections and valves at suitable intervals for conducting the water to the working faces. The sluice boxes would be set the full length of the drifts and so the tops would be below the level of hydraulicking. A retreating system of mining would then start. Beginning at the extreme end of the developed ground, in the cross-cuts, with three giants with $2\frac{1}{2}$ to $3\frac{1}{2}$ inch nozzles set up about equal distances apart, the innermost giant would start at ~~working~~ piping down the face and driving the material on to the next giant which pipes down the face within its area and pipes it ahead, etc., the material finally reaching the sluice boxes. The giants and connections are advanced as the face advances toward the shaft. While the backs will hydraulick down quite smoothly and hold up well for considerable distances, support must be provided. For this it is purposed to put in crib bulkheads, 5 feet square, made of half round timber set three timbers wide then three over these crosswise, etc. The cribs will be placed 25 feet from center to center in rows, with a row every 25 feet but offset so that all of the bulkheads will be in equilateral triangular relation. It is hoped to mine not less than

1000 sq.ft. of bedrock in 8 hours with this plan, requiring a crew of about 24 men. Three 8 hour shifts are to be worked whereby mining would be conducted during two shifts, each of which would include 3 nozzle men, 2 rock men, 1 sluice man, and 1 man at the bottom of the shaft, while during the night shift 4 men would be engaged in timbering. Mr. Howell claims that under such conditions the operating cost, including development, would be about 35 cents per sq.ft.

Many problems will be encountered in successfully working out this system of mining and a relative large investment in new equipment will have to be made. While hydraulicking underground has been tried at numerous localities in the past and the present plan does not afford anything really basically new, the experiment is being made in ground, the character of which is no doubt as ideal as could be provided for the application of such a method excepting that all tailings must be hoisted and bedrock conditions may at times require considerable hand work in picking it up and cleaning it. Modern machinery and equipment will also play its part. Outside interests are also allied in the present undertaking and the development therefrom will be awaited with great interest. The method has much merit but whether it will prove to become a financial success is still to be determined. Since the above was written, it is reported this operation was shut down in November and prospecting by drill-

ing was begun as the gold recovery from the ground mined was considerable less than expected. Difficulty was also encountered in operating the clam shell bucket in this shaft so it was replaced for the time by a 1. cu. yd. self dumping Fairbanks bucket.

A. Andresen & Co. had a crew of 4 to 5 men drifting by the customary methods during both summer and winter on Eldorado Creek, and Joe Ragner was prospecting for drifting ground.

ESTER CREEK:

The largest operation conducted on Ester Creek was the winter drifting done by the Ester Mining Co. last winter on the Lee Jessen property, No. 3 below, on the right limit. This ground is about 100 feet deep to bedrock. Twelve men were engaged and about 12,000 sq.ft. of bedrock was mined although not profitably. Hammer & Christensen drifted on No. 2 below last winter and up to about midsummer. Sieberg & Olson drifted during last winter on No. 1 below, and this summer drifted on Eva Creek. Arndt, Stegert & Wheeler did some winter drifting on Eva Creek. Frank Hammer after completing drifting operations used a steam operated scraper in reworking and sluicing some old tailings on No. 2 below.

OTHER CREEKS:

Sproni & Frasco drifted during the winter on Vault Creek. Jno. Durand drifted on Dome Creek. Erceg & Colbert put down a 200 foot prospect hole on Our Creek. On Kokomo Creek, Victor Graham, Hector Beaton and Eagan Bros. & Griffith prospected on their ground by sinking shafts, the latter also doing some drilling on Jack Creek, a tributary. It was reported that a shaft was sunk on Kokomo Creek this summer under arrangements with Fairbanks dredging interests as a check on past prospecting and in substantiation of the dredging possibilities advanced for this creek.

On Sourdough Creek, Ben Weber did some open cut mining and Hilty Bros. were reported as preparing to start open cut operations. Frank Miller & A. Nichols did prospecting and assessment work on Homestake Creek and had under consideration the possible resumption of hydraulic mining there next season.

CHENA RIVER AREA:

Joe Chesna hydraulicked on Shamrock Creek with a crew of 5 to 6 men. The Palmer Mining Co. hydraulicked on Palmer Creek, this property being now owned and operated for Waechter Bros. of Fairbanks by A. McIntosh. T. Hamilton completed the 3 mile ditch and hydraulicked on the Van Curler property at Bedrock Bar on the Chena River. Cruzner & Lenherst drifted on Hell-for-Sure Creek. Two men drift-

ed on the Chas. Fowler property on tributaries of the South Fork of the Chena River.

TOLOVANA PRECINCT.

Thirteen placer operations with 52 men engaged were conducted in the Tolovana precinct, exclusive of the Nome Creek area, in 1929. Of these 8 were hydraulic operations with 24 men, 2 summer drift operations with 14 men, and 3 winter mines with 14 men. The water supply during this season was somewhat better than the average, but placer mining in the district has reached a very low stage. Drift mining formerly extensively conducted on the Livengood bench has practically passed as the profitable drifting ground has been mined. The present mining by this method is conducted on a small scale being mainly the "sniping" of small pillars or small irregular areas left by former operations. Hydraulic mining however continued pretty much as usual although the total gold output by the hydraulic mines was probably not as large as formerly made by these same operations. The total placer gold output of the precinct this year was probably not over \$65,000, a large reduction from that a few years back, the output in 1927 being \$151,000, although this included the dredge and other operations conducted in the Nome Creek area, and which by reason of its location and accessibility is not considered in this report as in the Tolovana precinct but as being in the Fairbanks precinct.

The Tolovana-Livengood area was discovered in 1915 being the last placer mining area of importance to be found in Alaska. From 1915 to 1927, inclusive, the Tolovana precinct has produced \$4,900,000 in placer gold. Drift mining was the principal method followed and a large number of these operations were conducted on the Livengood bench which lies along the right limit of Livengood Creek. The principal pay area of this bench varied in width and physical characteristics, but a defined main pay streak was mined over a distance of $4\frac{1}{2}$ miles mainly from the Jewel Claim at Wonder Gulch to the Ready Bullion Ass'n. Claim bordering Myrtle Creek on the East. This portion of the main pay streak ranged from 80 to 250 ft. in width, averaging about 150 ft. excepting opposite Amy, Gertrude and Ruth Creeks where there were some decided widenings. Thus at places on the Letrum Claim opposite Gertrude Creek some of the pay was 800 ft. wide, and on the Ready Bullion Ass'n. it was mined over 1000 ft. in width. The pay was not found in or below Myrtle Creek and no regular pay was found to continue to the east beyond Wonder Gulch. The depth of the ground varies from 25 ft. on the Jewel Claim to 130 ft. on the George Ass'n. The depth of gravel ranges from a few feet to 30 ft. and is overlain, sometimes by clean muck, while at most places the muck is usually mixed with much silt, clay, sand and rock fragments. The gold content of the gravel was not particular-

ly high grade, ranging from 50 cents to \$2.00 per sq.ft., averaging about \$1.00 per sq.ft., although there were some small areas which were richer. The ground is solidly frozen and conditions for drift mining were exceptionally favorable, the gravels permitting easy driving of the thawing points, and relatively quick thawing, easy picking and mining, very little timbering was required, and bedrock was usually not difficult to mine and clean up. As a result some of the lowest drift mining costs in Alaska were realized, one operation on the Marietta Claim, where a large block of small "chicken feed" gravel was mined and other ground conditions were very favorable, reporting a cost of 32 cents per sq.ft. The cost of drift mining in this district normally ranged from 45 to 75 cents per sq.ft.

Pay has not been found in the present bed of Livengood Creek and was not found on Livengood Bench according to reports until after a hundred or more prospect shafts had been put down. Lillian, Olive, Ruth, Amy, Gertrude and Wilbur Creeks have been mined mainly by open cut sluicing and hydraulic methods, the ground there being generally different in character than on Livengood bench. Most of these creeks have been pretty well mined of their profitable placer adaptable to these methods. The Livengood area lies within a peculiarly dry section of the country and also, due to topographic features, only small water supplies are avail-

able for mining. The available water limits the scale of operation as water must be impounded and used intermittently during most of the season by all of these operations, and often during prolonged droughts these operations have to close down. Livengood Bench and the lower end of Olive Creek have in the past been investigated for dredging possibilities but nothing developed therefrom.

Livengood, the post office and only town in the precinct, lies about 60 miles northwest by airline from Fairbanks. Airplane travel has made this point very accessible, the trip requiring 40 minutes on the average. The usual summer route is otherwise by launch from Nenana, down the Tanana River, then up the Tolovana River to the Trappers Cabin, a distance of 240 miles by water. From Trappers Cabin to Livengood is 12 miles via the wooden tracked tram which winds its way over the low marshy ground. Formerly another section of tram similar to this was available below the Log Jam but this is now out of commission. The gas boat service on the river includes three trips a month according to the mail contract, and corresponding operation of the tram. The tram is maintained and operated under arrangements made by the Alaska Road Commission. Freight rates from Nenana to Trappers Cabin are 5 cents per pound, and 1 cent per pound from Trappers Cabin to Livengood. Winter freighting is done via Dunbar on the Alaska Railroad, the distance

to Livengood being 65 miles. The winter rate on staples is 5 cents per pound, on perishables, 6 cents. About 100 tons of freight were brought into Livengood this year, about 75 tons going over the winter trail, the balance via water and tram. Summer travel via trail is most difficult and requires four hard days. The river and tram route never was practical and with the money that has been spent on it, a good ~~route~~^{road} into the area could have been built. It is obvious that the area is much handicapped by its isolation.

LILLIAN CREEK:

C.W. Hudson conducted the largest hydraulic operation in the precinct near the mouth of Lillian Creek on Discovery Claim. The two mile Samson ditch taking the water from Livengood Creek at No. 3 above claim provides the largest and best available supply in this area. Nevertheless this water can only be used intermittently during most of the season although for a short period this season a steady head of about 250 miners inches as a maximum was available. Under usual conditions from 4 to 10 splashes of 18 to 25 minutes duration can be made in 24 hours. At times this number is even less. A pipe line varying in length from 200 to 500 feet, 10 to 7 inches in diameter delivers the water to the pit under the present head of 50 feet. The average depth of the deposit varies up to 25 ft., of which muck containing many roots is first stripped off ahead leaving from 8 to 12 ft. of gravel to be

hydraulicked into the boxes. Bedrock varies a great deal in kind and character, being argillite, slate, graywacke, or serpentine, wherein are pot-holes and high reefs and knolls. One area mined had a blocky deeply creviced graywacke bedrock sticking up 6 to 8 feet higher than average bedrock level. This required much hand work to clean. The gravel is of average size with some heavy boulders. The gold is unusually fine, it being stated that 90 percent of it passes through a 100 mesh screen. Some cinnabar and considerable pyrite are recovered in the concentrates. The size of the pits mined vary with conditions, this season about 20,000 sq.ft. being mined. The gold content varies and in average is low grade. From 600 to 700 ft. of steel sluice boxes, 20 inches wide are used. The upper 400 feet are set on a $3\frac{1}{2}$ inch grade and the bottoms are equipped with punch plate laid over cocoa matting while the lower boxes are set on a 4 inch grade. The tailings are fanned over the creek bed by using sheet iron sluices or launders for this purpose. The gravel is piped into the head of the boxes by two giants using 3 to $3\frac{1}{2}$ nozzles. Six to 7 men were employed.

Mike Beegler hydraulicked as usual on the right limit on No. 1 above, on Lillian. Two to 3 men were engaged on the work, the gravels being piped into the head of a string of 15 steel sluice boxes, 17 inches wide, set on a grade of $12\frac{1}{2}$ inches. A small intermittent water supply obtained from this

short creek and the small draws is used usually in splashing with $2\frac{1}{2}$ to 3 inch nozzles under about a 150 foot head, there generally being 1 to 5 splashes per day of 7 to 8 minutes duration. The total depth of deposit varies from 25 to 40 feet, there being an average of about 6 feet of pay gravel, at places more, which is covered by slide material and 20 to 35 feet of muck and other overburden. The average depth put through the boxes is 6 to 8 feet. The deposit is irregular in character but contains the highest gold content of any hydraulicked in the area. The gradient is steep permitting a natural dump for the tailings. From 7,000 to 12,00 sq.ft. are mined in a season.

Wm. Barker working alone hydraulicked with a canvas hose outfit on No. 2 above Lillian where he has good ground 5 to 12 feet deep, and a steep gradient but a very small water supply, being well to the head of the creek.

OLIVE CREEK:

N.R. Hudson has mined on Olive Creek for a number of seasons but this year was engaged in piping out a long drain on the upper end of the Perfection Assn'. or No. 1 below claim in order that he will be able to hydraulic the upper end of this claim and Discovery Claim. A portion of this drain existed from former operation but when completed will be about 2,000 ft. long, reaching bedrock about 1500 ft. up from its lower end. Sluice boxes 24 inches wide are being in-

stalled on a 5 inch grade for the entire length of this drain up to where bedrock is reached. An intermittent supply of water is used through $2\frac{1}{2}$ to 5 inch nozzles. Heavy rocks are hoisted out of the cut by a net operated from an overhead cableway by a small steam hoist. The work was to be completed this season so that hydraulic mining can be resumed next spring. The depth of ground to be mined on Discovery is 24 to 25 ft., ~~depth~~ being mainly of angular wash. The gold is very fine. Some cinnabar is recovered.

RUTH CREEK:

Bentley Falls with two men employed hydraulicked on the right limit bench near the mouth of Ruth Creek. The deposit is mainly of angular material with not much sorting. The gold is rough and apparently comes mainly from the immediate bedrock. The small water supply permits only intermittent operation with 3 to 4 inch nozzles. Mining will probably be resumed further up the creek next season where it was formerly done.

GERTRUDE CREEK:

The Lucky Strike Mining Co., B. Douglas, engaged four men at the hydraulic operation conducted on the right limit of Glen Gulch, a tributary of Gertrude Creek. This hydraulic plant was installed in 1927. A $1\frac{1}{2}$ mile ditch, 1,500 ft. of pipe line, 16 to 6 inches in diameter, delivers the water to the giants with 2 to 3 inch nozzles under 65 to 75 foot

heads. Splashing must be done most of the season, a half hour run being available every $1\frac{1}{2}$ hours at the time of my visit but dropping to 10 or 12 splashes in 24 hours under average conditions. The deposit being mined is 20 to 35 ft. deep of which 20 ft. and more is muck but mostly ice. A sheet of practically clear ice, 10 to 15 ft. thick where exposed, conforms to the slope of ground which is here very perceptible. After stripping this ahead, from 6 to 8 ft. of gravel and bedrock is piped into the head of the boxes. Bedrock is a sandstone, shale, siliceous limestone, etc. usually soft or broken into small pieces and mixed with chalky clay material. The gold is mainly rough and little worn and mostly fine although some pieces from \$1 to \$10. are occasionally recovered. The gold distribution is spotty there seemingly being no defined run or channel and is therefore difficult to follow. There is a good bedrock grade so tailings can be fanned over the creek bed. This season it was expected to mine an area of about 25,000 sq. ft. The season's operation is limited by the area that can be stripped ahead.

LIVENGOOD BENCH:

As the McClelland hydraulic operation on a lower tier of Livengood Bench was abandoned several years ago, only a little drift mining was done here. It is rumored however that other parties are considering to mine by hydraulic

methods in this near vicinity. During this summer, Spall & Carroll employed a crew of 7 to 8 men in drifting on the Last Chance Claim. The ground here is 65 ft. deep but the pay is irregular. It was planned to mine an area of about 20,000 sq.ft. this season when possibilities for future operation will be considered. Silva & Escorde had 6 men drifting on the northeast corner of the Letrum Claim where they had put down a new shaft 100 feet to bedrock. The ground mined consisted of small pillars and edges of low grade gravel left by former operators. It has been found to be spotty and of very small extent so the operation after taking out about 6000 sq.ft. was to be terminated. Last winter Silva & Escorde drifted out about 4500 sq.ft. on the Eldorado, Henry Spall had 6 men drifting on the Gold Dollar, and Radek & Ban drifted on the Deep Channel with a crew of 5 men. None of these drift operations can be considered as having been successful. Further search for a place to drift on this bench is to be made. Fisko Bros. are to sink a shaft this winter and several others plan to do a little winter mining.

Jack Neilsen hydraulicked on Amy Creek. Healy, McGarvey & LeNont hydraulicked on Wilbur Creek and it is reported they are doing further work with a view to more extensive mining. While not confirmed, Browman & Olson were reported as having operated their hydraulic plant on Quail

Creek. Several prospectors were also reported as being on Hess and Beaver Creeks.

HOT SPRINGS PRECINCT.

Twenty-seven placer operations engaging 80 men were conducted in the Hot Springs precinct during 1929. Of these, one was a dredge operation with 24 men, 7 were hydraulicking with 20 men, 6 drift mined during the winter with 17 men, most of these continuing during the summer, 12 men working alone groundsluiced, shoveled-in, or sniped with a rocker, while the balance were engaged mainly in prospecting. There is considerable duplication in the men engaged as many worked at more than one operation. Placer mining in the Hot Springs precinct started in 1902 and up to and including 1927, \$6,560,000 in gold had been produced. A very creditable production of placer tin was also made as a by-product of some of the gold placer operations. The gold production this year cannot be closely estimated at the present time but was probably around \$100,000. Very little tin was recovered this season as but few operations were conducted in the tin bearing area. However, 3 or 4 tons, some being held over from last year, were shipped this season.

Placer mining is conducted in two areas which however are usually referred to as one, the Hot Springs district. The Eureka area, centering around the former settlement by that name, is reached from Hot Springs via wagon road, it

being 22 miles to Eureka. This road has been permitted to get in very bad condition although the area is equally as active, or more so, than it was three or more years ago. It is an area of summer mining, the main operations being conducted by hydraulicking or groundsluicing and shoveling-in, although all of these operations are small. The 16 operations active there engaged 29 men. The Tofty-Woodchopper area lies over the divide to the west of the Eureka area. It has in the past been an area mainly mined by drifting although at some localities open cut mining was done, and in 1927 a dredge operation was begun still farther west, on American Creek. This area is reached from near the mouth of Hot Springs Slough, 6 miles downstream from Hot Springs. A wagon road leads to Tofty, a distance of 12 miles, and from there on, 5 miles to Woodchopper. These roads are also in very bad condition being passable only with much difficulty. Freight rates from Hot Springs to Eureka are \$50. per ton, and \$60. per ton to camps in this area beyond Eureka, all hauling here being done during the summer. The summer rates to Tofty are $2\frac{1}{2}$ cents per pound, to Woodchopper 3 cents. Some winter freighting is $1/2$ cent less per pound. The freight to American Creek is handled by the dredging company being taken from Fish Creek Landing on The Tanana River by gas boat and small scow up Fish Creek and across Fish Lake from where it is hauled several miles over a road by truck to the camp.

While the Tofty-Woodchopper area has not been very active with mining during the past few years, a general improvement in placer mining in this area and also in the Eureka area is indicated for next year.

EUREKA AREA:

The principal operation conducted in this area was that of the J.H. Frank Co. on Doric Gulch and What Cheer Bar on Pioneer Creek. This hydraulic operation engaged 5 to 6 men not being conducted up to the usual scale this season due to the illness of J.H. Frank. A little hydraulicking was done on What Cheer Bar but Doric Gulch was the main objective. A creditable production was made. This property embraces all of lower Pioneer Creek, there being 52 claims. There are two ditch lines, the upper one of 4 miles, the lower one of 2 miles, which provided 50 to 80 foot heads on the benches or bars. The water supply must be used intermittently during much of the average season but is the best water supply available in this area. The hydraulic plant includes about 1000 lengths of pipe ranging from 22 to 7 inches in diameter, No. 1 giants, hose and nozzles, etc. There are also 3 boilers, 10, 12 & 30 H.P., a Bagley scraper, a donkey hoist, tractor, wagons, sleds, two good camps, etc., all of which are now for sale.

M.S. Gill hydraulicked on Last Bench on the right limit of Pioneer Creek; Jno. Malin sniped by rocking on Doric Gulch as did Chas. B. Allen on What Cheer Bar, and I.C. Givens on

Seattle Jr. Chas. Emmelung and partner prospected on and above Joe Bush Creek sinking a number of shafts.

On Eureka Creek, James Green did open-cut mining as did Ed Wurzbacker on the former claims of Bob Hight. Johnson & Hensley hydraulicked on Alice Bench with a crew of three, and Farmer & Jones hydraulicked on McCaskey Bar with a crew of 4 men during most of the season. On Rhode Island Creek, Frank Stevens hydraulicked, Tom Loveland groundsluiced and prospected, and during the winter Olson & Eavenson took out a small drift. Olson & Eavenson groundsluiced and shoveled-in on Omega Creek. V. Erickson did some hydraulicking on Chicago Gulch. J. W. Farrell mined by open cutting on Cooney Creek. Rider & Barker prospected on Kilarney, Gold Basin, and other creeks in that vicinity.

TOFTY-WOODCHOPPER AREA:

The Alaska Gold Dredging Co., Ltd., a British Company, entered the Hot Springs field last year to prospect and determine the dredging possibilities of the gold and tin bearing deposits on Sullivan Creek. All of the property holdings including the Tofty or Sullivan benches, Sullivan Creek as far as and including Miller Creek, 62 claims in all, were optioned, and later paid for in full. The company had 20 or more men engaged for the larger part of 1½ years on surveying, drilling, and other investigative work. About 200 drill holes were put down and while some of these holes struck good pay, others

were very low. This season the company had about 15 men engaged until July, when it was decided that the ground was not suitable for dredging and did not afford sufficient possibilities for its operation by any other method by a company. The average tenor of the ground was not only too low grade and the pay not continuous or sufficiently extensive to support company operation, but it was no doubt also determined by this company, as others have in the past, that it was impossible to increase the water supply, an important factor, as large quantities of water would be required to strip the 40 to 50 feet of muck overburden which overlies the 4 to 6 feet of gravel on the Sullivan benches, ahead of dredging or other surface mining. The company withdrew from the field disposing of its entire interests, including all claims, water rights, equipment, camps, etc., to Tillison & L'Heureaux. Chief among these holdings is the former Cleavland & Howell property and its equipment, on the Sullivan benches, operated formerly as a hydraulic mine. Tillison & L'Heureaux had a crew of 5 men engaged for the balance of the season rehabilitating the ditch lines, moving equipment, doing general preparatory work as well as stripping overburden. Active mining is to be started by them next spring. Realizing the short comings of the available water supply they will first strip as large an area ahead as possible and utilize as little of the available water supply

as possible for mining the gravel. Also realizing the defects in the former mining operations and the low gradient of bedrock, they plan for some mechanical method to dig the gravels and deliver them to the sluices. The dragline excavator would be very well adapted here for this purpose. For the next season at least some less costly equipment will however be used until a closer acquaintance with the ground has been made. Having boilers, hoists, etc. of suitable size, the use of a cableway excavator has been suggested and will probably be adopted at first. These operators should be successful in miningⁱⁿ this ground. Some fairly rich spots in both gold and tin were struck by the drill. It is planned to drift on some of these this winter as a check on the drilling and further to determine the extent of this better pay. Leases on some of the other ground will also probably be given to others so that the area should develop more activity in the near future. Tom O'Leary prospected and located claims this summer on upper Sullivan Creek.

Otto Hovley drift mined on Cache Creek as usual and Tillison & Benson drifted on that creek last winter. Cache Creek carries considerable tin along with the gold. Jno. Radovich & Co. with a crew of 3 men drifted both winter and a part of the summer on Miller Gulch. Tom Dean and Pete Millianic, are among those who plan to sink shafts on Miller Gulch this winter, while Nick Miljevich has similar plans

for Deep Creek. Donohue & Strand prospected and sniped on Idaho Gulch. J. Sissford continued prospecting for an old channel on the hillside of Hokeley Gulch for which he uses an automatic dam.

Buck & Hansen had a crew of 5 to 10 men engaged at their drift mining operations on Deep Creek. A new shaft was sunk there last winter, 120 feet to bedrock. Mining has since continued although this ground has been found to be very irregular, the gravel consists of little rounded wash, being mostly a mixed up debris of angular rock and clay gumbo. The gold distribution is also irregular and each clean up has shown wide variation in gold content, also in the tin which is recovered here in commercial quantities. Bedrock is also very irregular in contour, a rise of 20 feet in 50 feet being encountered at one place. No definite plan of development or mining can be followed and the operation is still considered a prospect.

About 6 miles west of Woodchopper on the other side of a low divide, is the American Creek area which is, however, generally considered as a part of the Woodchopper area. Here on New York Creek, a tributary of American Creek, H. Besonen, and Tony Styck^X, each did some open cut mining. We then come to the American Creek Dredging Co. on American Creek where the principal operation of the precinct is conducted.

The American Creek Dredging Co. operated its dredge on the lower end of the Sourdough Ass'n. this season and thawed ground ahead with water. A total crew of 24 men ~~was~~ employed. This company installed this flume dredge at the upper end of their three miles of creek holdings in 1927. The area provides but a small water supply, and while the ground was prospected with shafts the year prior, the actual existing physical conditions were apparently not closely determined, and sufficient time was not allowed to prepare the ground ahead so that dredging would not be handicapped. In other words, the dredge was installed too soon, an error by no means limited to this operation. As a result this dredge has dug more ground than could be prepared so that it has only been able to keep operating for a month or two each season, a condition which adds greatly to the cost of the operation. The ground is stated to dredge closely to the estimated gold content and the operation toward this midseason had been much improved, although full advantage was not taken of the abnormal water supply that was available this season and which could have been put to such good use in stripping ahead.

The creek deposit ranges from 12 to 18 feet in depth and was formerly mined by drifting, steam scrapers and other open cut methods. Tailings therefore cover much of the ground. Usually 4 to 10 feet of muck which contains

very little "glacier" or ice but considerable silt, along with roots, old mine timbers, etc., overlies the gravel. The gravel averages 8 feet in depth and is small to medium in size, there being no large boulders of consequence. The deposit is mostly frozen especially where overlain with muck but some thawed channels and patches exist. Bedrock is a slate, favorable to dig, although a foot or so of dark sticky clayey decomposed bedrock is dug along with a foot or so of the harder bedrock. The gold is mostly very coarse, well worn, and is distributed in the gravel and on top of the soft clay on bedrock. Magnetite, garnet, rutile, barite and much pyrite are present. The gold is coated with iron oxide. This creek is noted for its coarse gold, pieces of \$90 and \$300 having been recovered. The dredging width of the pay ranges from 175 to 300 feet, at times more. The average dredging depth is about 11 feet.

The dredge was constructed by the Yuba Mfg. Co. as Yuba No. 70, and digs an average of 1500 cubic yards a day. and the management hopes to increase this by about 200 cu.yds. It is a flume dredge with a $2\frac{1}{2}$ cu.ft. close connected bucket line containing 56 buckets operated at an average speed of 28 buckets per minute. The maximum digging depth below water level is 15 feet. The hull is of wood, 32 ft. wide, 70 ft. long, and 5 ft. deep. The dredge draws 3 to $5\frac{1}{2}$ feet of water. Power is provided by two 60 H.P. Fairbanks Morse Type Y Style

V H 1927 single cylinder diesel engine⁶, one operating the bucket line and the winches, the other the pumps. There are two pumps, one 12 inch low pressure which delivers about 3800 gals. of water per minute to the head of the flume, while a 4 inch high pressure pump provides the water for the bucket nozzles and the ladder chute. The gravel as it leaves the bucket dumps into a hopper which feeds into the head of the flume. This flume is 87 ft. long, 36 inches wide, and set on a grade of 1 foot in 12. It is equipped with rail riffles set cross-wise and lengthwise and with angle iron and steel shod hungarian riffles. The end of this flume is about 7 ft. above water level, but as the dredge is now digging down stream brush dams are constructed ahead to hold the water level of the pond yet this flume at times scrapes over the tailings. A save-all 25 sq.ft. in riffled area is provided to sluice material spilled outside of the hopper by the buckets. The two diesel engines consume 100 gals. of gravity diesel oil in 24 hours, costing 27 cents per gal. at the camp. Seven men including the dredgemaster are employed on the dredge, two 12 hour shifts being operated. This dredge started on May 19 this season, ran 35 days, but not continuously. A return to the former management was then made, ground was thawed, ahead and dredging resumed. The dredge then continued operation with good returns, closing down for the season on Sept.

6th.

This ground must be prepared ahead of dredging usually by first stripping off the overburden and thawing the gravels. The available water supply however usually permits only a limited area to be stripped ahead. Water for thawing is pumped by a 10 inch centrifugal pump, belt driven by a vertical steam engine. Steam is provided by a 40 H.P. boiler with a 30 H.P. boiler as a booster. These boilers consume $3 \frac{3}{4}$ cords of dry wood or $4 \frac{1}{2}$ cords of green wood per day. The pump while rated at 3000 gals. per minute at a 20 foot lift and a speed of 360 R.P.M., is being operated ~~at a 7 foot lift~~ ~~and~~ at a 22 lb. gauge pressure and delivers sufficient water at a total lift of 65 ft. for 900 points at an average pressure at the points of $16 \frac{1}{2}$ lbs. Each point delivers 2 gals. of water per minute to the gravel. The cost of pumping this water at the rate of 1800 gals. per minute is approximately \$20 for labor, \$40 for wood, \$1. for oil, etc., or a total of \$61. per 24 hours.

The thawing points are set at $7 \frac{1}{4}$ foot centers in square relation to each other. These points are of $\frac{3}{8}$ inch ordinary gas pipe made up in 10, 12 and 14 foot lengths, provided with an open end point, and at the top are equipped with a "T" fitted with a malleable plug for a drive head, and a short nipple for the water hose connection. The ground permits most of the points to be jetted and twisted down, usual-

ly very little driving being necessary, and can therefore be set easily and cheaply.

The temperature of the water pumped to the points ranges from 46 to 68 degrees, the upper limit holding only during the few warmest days. This water is stated to be 5 to 10 degrees warmer than the ditch water, picking up heat in the settling pond besides some from the warmth of the engine exhaust and by pump friction. Water pressure at the points varies considerable being 16 to 17½ pounds at the upper end of the area now being thawed while at some it is as low as 12 pounds. At the lower end, the pressure is up to 18 pounds at the cross head averaging about 16 to 17 pounds.

The time required to complete a thaw ranges from 16 to 20 days to 25 to 30 days, but averaging 14 to 18 days the first half of this August. Where the gravel has been stripped of all overburden thaws have been completed in 12 days. Because of the great variation in the thawing time and the small area thawed ahead of the dredge it is often necessary to hasten the thawing. For this steam is used which is provided by several boilers available for this purpose. Steam lines are laid alongside the water headers and the water points are switched over to the steam connection. Some isolated small areas are also thawed with steam. Testing for frost is easily done by driving down 5/8 inch steel bars.

A total of 8 men are employed on the thawing which includes the 2 men at the boiler and pumping plant. Several more could, however, be used. The cost of thawing has not as yet been determined. The company is now planning to suspend dredge operation for a season or delay it until late in next season so that ground can be prepared ahead and more systematic operation followed. The average gold content of the ground as based upon the prospecting done by the company shows it to be considerable higher than most ground now being dredged in Alaska. Dredge recoveries confirm this and while some problems confront the operation these can be worked out.

RAMPART PRECINCT.

Twelve small placer operations engaging 18 men are reported as having been conducted in the Rampart area during 1929. Among these were one hydraulic operation with 4 to 5 men, 6 groundsluicing and shoveling-in operations using automatic dams with 8 men, 4 winter drift operations with 5 men, the others being of a prospecting nature. A prospecting and small open cut operation was also reported as conducted on Bear Creek which heads on the northerly slope of Roughtop Mt. in the Hot Springs precinct and drains into the Yukon about 30 miles below Rampart. The placer gold output of the precinct is small, but has been quite consistent for many years, this year being around \$10,000.

Eugene Swanson conducted the largest operation in the precinct by hydraulicking on Hunter Creek in the vicinity of Dawson Creek, a tributary. Jack McKenty groundsluiced on the Clemens ground near the lower end of Hunter Creek. On ^LLittle Minook Creek, Ott & Tyman used an automatic dam and shoveled-in on No. 1 above; B. Jones mined by the same method on Jno. Duncan's claim, No. 8 above, as did Cunningham & Larkin below Discovery. Adolph Mueller prospected and did assessment on No. 2 above. Tom Antonsen mined on ^LLittle Minook Jr. using an automatic dam, as did F. Hawley on ^LState Creek. Small winter dumps were taken out by drifting by Crockett & La Porte on Hoosier Creek; Jack McKenzie, and M. Ohrbeck, on the Idaho Bar; and Chas. Allen on Hunter Creek.

Joe Egglar is reported to have prospected on Bear Creek during the summer and finding coarse gold did some groundsluicing and shoveling-in. Similar mining was done on this creek by several prospectors years ago, apparently not with very encouraging results however. This creek and others head in the north slope of Roughtop Mt., a granitic mass in contact with limestones, schists, slates, etc., lying to the north of the Tofty placer area in the Hot Springs, and cuts across a geological formation favorable for the development of gold placer as well as tin.

Big Minook Creek has in the past been placer mined at a number of localities along the creek bed and the

benches. Much of its gold has been derived from the local bedrock, this relatively long creek with its tributaries having eroded quite a large area containing favorable geological formation. Its better placer has, however, been limited to certain areas. Several old high channels at one time cut across this area which were subsequently dissected, eroded and reworked by the streams in the development of the present drainage basin of Big Minook Creek. Remnants of these old channels remain and some like the Idaho Bar, which lies on the top of the divide between Little Minook and Hunter Creeks, contain sufficient gold to have been mined to some extent, mainly by drifting. Big Minook Creek was for many years been advanced as a dredging proposition by A.F. Schmitz and in 1922 it was announced that the Big Minook Gold Mining Co. was shipping a dredge to this locality. This, however, proved not to be the case as nothing further has since been done with the property until this season. As far as known this ground has not been given any but very desultory prospecting. Present interests had a mining engineer investigate the property this summer and it is understood that systematic drilling and investigative work has been recommended for next season to definitely determine the dredging possibilities.

FORT GIBBON PRECINCT.

Placer mining in the Fort Gibbon precinct is confined

mainly to the Gold Hill area which lies north of the Yukon River and 20 to 30 miles westerly from the town of Tanana. The Hughes area and an area south of Allakaket also lie within the boundaries of this precinct but, by reason of their location and accessibility, are considered as of the Koyukuk precinct.

Placer mining in the Gold Hill area is conducted in a very small way mainly by customary manual methods. Including a number of men prospecting, there were about 12 men engaged this season. Interest in this area was somewhat renewed several years ago by some extensive locating of claims on several of the creeks for tin, and again last fall when a discovery of tin was reported near Callands. Tin, as cassiterite, has long been known to occur along with gold in the placers on Moran, Illinois, Golden and several other streams in this area, and at certain localities has been found in encouraging quantities indicating possibilities for commercial operation. Following the reported discovery of last fall, a hand drill was sent into the area by Fairbanks interests with Moran Creek as its principal destination. As near as was learned, a little drilling was done on Illinois Creek, after which this work was suspended. These Creeks head in a granitic intrusive mass in contact with schists, limestone, quartzite and greenstone. The tin concentrates permit dressing to a high degree of purity. While found in payable quan-

tity at places, the extent or continuity of the tin occurrence has so far not been definitely determined. Some of the placer is thawed but most of it is frozen. The depth varies but is stated to average about 20 feet. Several of the prospectors report that a few holes put down in the lower reaches of these creeks have shown a little gold and tin although the best prospects were found closer to the heads. Some systematic prospecting will be required, and is apparently warranted, to determine the tin possibilities of the area.

Warren & Farrell groundsluiced and shoveled-in on a bench near the lower end of Mason Creek. This bench lies 200 to 300 feet above the level of the Creek. They state these benches are very extensive and are about 1500 feet in width on the ridges and being thawed at the lower edges keep sliding down hill into the creek, contain a good average gold content and can be provided with a good water supply by ditch from upper Mason Creek. They also claim dredging possibilities for this creek, several rows of prospect shafts having been put down in the creek bed from a point 2 miles up from Mason slough to $3\frac{1}{2}$ miles up the creek. Within this distance the creek deposit is stated to be 500 to 600 feet in width, the depth averages about 15 feet, about half of it being muck. The ground is mostly frozen there however being some thawed channels. The gravel wash is of average size and flat with no larger boulders, boulders occurring only at

the head of the creek. A clay overlies bedrock but is said to not be of the sticky variety but washes readily. Bedrock is a decomposed schist.

John Minook did a little mining on Mason Creek with the aid of an automatic dam. J. McHugh shoveled-in and prospected on Grant and Lynx Creeks and Wm. Bowers did similar work on Lynx Creek. Walter Fisher with several men sunk shafts and prospected on Grant Creek below Fox Gulch throughout the season and judging from the way he continued with this work and from indirect reports, the results obtained must have been favorable. The valley of Grant Creek is stated to be about 700 ft. wide and the creek gradient is $2\frac{1}{2}$ to 3 percent. The ground is frozen and 17 to 25 ft. deep, about 15 ft. of this being gravel. While reported to contain very few boulders, it is stated the gravels contain much sediment. Grant Creek is about 11 miles long.

J. Elliot, Frank Miller, J. McCade and Bob Kelly prospected on Moran Creek and several others are reported as being elsewhere in the district. A prospecting party composed of Minook, Elliot, McCade, Harbaugh, Harper and Dickey, equipped with pack horses and a large outfit prospected in the Big Melozi River area this summer. While no further reports of this expedition are available it is of special interest being one of the largest prospecting parties to start out in many years.

NULATO PRECINCT.

The Nulato precinct embraces a large area lying to the north of the Yukon River from above Ruby to below Russian Mission, and to the south of the Yukon, from above Ruby, down to the mouth of the Innoko River. The area north of the Yukon includes a number of the tributaries of the lower Koyukuk River and placer operations conducted there are mentioned under the Koyukuk precinct. The southeastern corner of Nulato precinct is an irregularly bounded area extending to the westerly side of Lake Minchumina. The principal placer mining area in the Nulato precinct is the Ruby district which lies to the south of the town of Ruby.

RUBY DISTRICT:

Twenty-six placer operations with 56 men engaged are reported to have been conducted in the Ruby district this year. This involves some duplication in operation and the men engaged. Seventeen of these operations with 42 men were engaged in drift mining or sinking shafts and prospecting for drifting ground, the three largest of these operations each employed but 4 to 6 men. The other operations were small open cuts. The Ruby district has from 1907 to 1927 inclusive, produced placer gold, mainly from its drift mines and a dredge operation, to the value of \$5,735,000. The production by this district has rapidly declined in recent

years being \$52,000 in 1927. The output for 1929 may be a little larger than in 1927 as there are apparently more operations being conducted this year and under more favorable conditions. Interest is still held in the tin content of the gold placers and 3 or 4 tons of tin concentrate were recovered and shipped from Birch Creek a year ago. This creek is to be drilled next season. A small amount of tin is recovered at a number of the operations but no record of it is available. Tin occurs in the gold placers on many of the creeks in this district. Big Creek and its upper tributaries were investigated several years ago but no development materialized. So far no tin placer has been found of sufficient extent to be of commercial importance.

POORMAN CREEK:

Most of the drift mining in the district was done on Poorman Creek, where the following conducted such mining with small crews during both summer and winter in most cases - Jack Shropshire, Baldo Forno, Wm. Ferry, Jack Wolf, Geo. Vadder and Dennis Coyle. Drift prospecting and shaft sinking was done by Mattson & Campbell, Harry Jensen and Wm. Gragen.

LONG CREEK AND ITS TRIBUTARIES:

Coyle & Walker did some drilling on Long Creek prospecting for drifting ground. Deacon & Johnson, and L. E. Sturtevant, conducted their usual open cut sluicing oper-

ations on Bear Pup. Douglas & Sherman, and McCalvey & Kellogg open cutted on Greenstone Creek. Gus Hansen drifted on McKetchum Creek.

OTHER CREEKS:

Wm. Midgley drifted on Flat Creek, Geo. Bittles drifted on Tamarack, Ernest Warner took out an open cut on Glacier, Jno. Robinson, was on Timber, and Jno. Wolf prospected with a shaft and drift on Wolf Creek. W. D. McCarty on Spruce Creek was reported as not mining but as planning to resume there this winter. Purpapa & Kolkosky, and Chas. Hansen drifted on Trail Creek. Thomas Scott, and Gallagher & Augusta, prospected on Diamond Creek, as did Jno. Flanagan on Flint and Trail Creeks. Pilback Bros. prospected on Big Creek planning to drift this winter. Warren & Farrell did not mine in this district this year but have ground on Birch Creek which they plan to drill next spring. They report this ground to average 60 feet in depth, 40 feet of frozen gravel being covered by 20 feet of muck. Prospecting done here last year disclosed good prospects of tin and gold. One hole went \$1.00 in gold and about 0.3 lbs. of tin concentrate to the sq.ft. This tin concentrate is stated to be gray in color and of high purity.

KOYUKUK RIVER BASIN REGION.

The Koyukuk River Basin Region embraces a very

large area extending from the Arctic slope of the Brooks Range on the north, to the Yukon River on the south, including not only the entire drainage basin of the Koyukuk River, but also other streams some of which drain into the Arctic Ocean and others which empty into the Yukon River. The principal placer mining is in the Koyukuk mining precinct which includes mainly the upper portion of the Koyukuk Basin with its two main mining localities, the Wiseman-Coldfoot area and the Bettles-Wild River area. Placer mining is also being conducted in the Hughes or Indian River area and while this area legally lies within the Fort Gibbon precinct, and the lower portion of Koyukuk River Basin is a part of the Nulato precinct, the placer activities in those areas will be considered as of the Koyukuk precinct. This precinct was visited this summer by Irving Reed, who provided the following information.

About 35 placer mining operations using drifting, hydraulic and groundsluicing and shovel-in methods, with 42 men engaged were conducted in the Koyukuk River Basin during 1929. There were also 16 prospecting or other non-producing operations with 23 men engaged. There was considerable multiplicity in activities by many of these miners and prospectors. The Koyukuk precinct including also the Indian River area has produced about \$5,200,000 in placer gold during the period 1900 to 1927 inclusive. Placer min-

ing in the precinct is now at a very low ebb and the production for 1929 is estimated by Reed as probably not exceeding \$30,000. Considering the number of men interested in placer mining this is a small output, although many of these are prospecting and some development may materialize from their present efforts. The mining areas are however very remote and isolated, the cost of supplies ~~are~~^{is} high, ample water supply under suitable head is generally not available at the principal placers, and while extensive placer ground occurs at the many localities, conditions do not permit the mining of any but the higher grade gravels.

Supplies for the camps are taken by small river steamers from Nulato on the Yukon River up the Koyukuk River as far as Bettles. Here they are transferred to gasoline powered or horse drawn scows and so transported 75 miles further up the River to Wiseman, the principal settlement. The river trip ^{from} Bettles to Wiseman is often made with much difficulty, usually because of lack of water or too much swift water depending on its stage. A tractor trail leads from Bettles to Wiseman via Coldfoot and between Hughes and Indian River and Utopia Creek but the condition of these trails is bad and does not permit a lower freighting cost. The only surfaced road in the precinct runs from Wiseman for 8 miles up the Wiseman Creek valley towards Nolan Creek. In general, these trails are soft and boggy during the summer.

The freight rate from Nulato to Bettles is \$65 per ton, and from Bettles to Wiseman it is \$140 per ton. From the River points it must then still be packed or sledded to the distant mines. Wiseman now has a good airplane field and is best reached by the traveller by plane from Fairbanks, this trip requiring about two hours. Freight is also carried via plane to Wiseman for 40 cents per pound. The wage scale of the precinct ranges from \$6 to \$7 per day and board, or is often figured at \$10 per day without board. Wood around Wiseman costs \$16 to \$17 per cord.

WISEMAN-COLDFOOT AREA:

NOLAN CREEK & TRIBUTARIES:

Nolan Creek and its left limit tributaries, Fay, Archibald, and Smith Creeks, are and have been for sometime the principal gold producers of this precinct. Nolan Creek is about 5 miles long, its bed being filled with silt, gravel, etc., to depths up to 40 ft. at the mouth of Webster Gulch and deepening downstream this alluvial wash becomes 330 ft. in depth near Wiseman Creek. In the development of the valley the old higher lying deposits have been eroded leaving gravel benches along its walls, and several levels of bedrock, or channels, exist in the present valley floor. One of these levels or stream channels lies about 20 ft. below the present level of the surface of the creek. An old dissected gravel channel has been traced along the left limit of the

valley from the mouth of Fay Creek, where it lies about 200 ft. above the creek level, to a short ways below the mouth of Smith Creek where its elevation is about 50 ft. A small section of a lower high channel is also found on the right limit of this creek just above the mouth of Acme Creek. Where these old high channels have been cut through and eroded by the tributaries, the gold bearing placers in the creek below were much enriched. The original source of this placer gold was apparently Smith Dome as most of the creeks heading into or flanking this mountain are gold bearing and were good producers. While there are extensive placers in this area which under average conditions would support profitable operation, their mining is further restricted by the small available water supply. This supply is not only small but must be used intermittently and even then is divided between the various operators, at times necessitating the allotment of this water to their alternate use. Spring and fall are therefore the main periods for mining, there often being little or no water available for mining during the drier midsummer period.

H.J. Foley, Chas. Irish, Ed Marson and H.S. Wanamaker drift mined on the Grim Fraction opposite No. 6 below Discovery on Nolan Creek starting this operation in the fall of 1928. Geo. Eaton, H.S. Wanamaker, J.C. Allen, and John Wooll drifted during the winter on No. 4 below Discovery

this work being begun in the winter of 1925-1926. Both of these operations are small but are rated as the largest of the drift mines in the precinct.

The old high channel deposit on the left limit of Nolan Creek was mined by Earl Workman & H.S. Wanamaker, opposite the lower end of No. 5 below Discovery below the mouth of Smith Creek; by Capt. E.G. Rowden with 3 to 4 men employed on the claim opposite No. 3 below; by Henry Pingel and one man opposite the upper end of No. 5 below; and by John Wooll and one man opposite No. 1 below and just above Archibald Creek. These operations are all conducted by groundsluicing and hydraulicking, all using a small intermittent water supply by splashing. Six inch canvas hose outfits with 2 or $2\frac{1}{2}$ inch nozzles are used, the head of water at the various locations ranging from 20 to 85 ft.

H.S. Wanamaker & John Hurley groundsluiced in the creek bed of Smith Creek and dug more ditch in preparation for next season's mining. Robert McIntyre opened up a new pit by groundsluicing and hydraulicking on the high bench on the right limit of Fay Creek, about 1000 ft. above its mouth, and Hugh Boyle mined on the right limit bench opposite No. 2 Creek claim about $\frac{1}{2}$ mile above the mouth of this creek. Jno. Hurley did similar mining on the right limit bench about $1\frac{1}{2}$ miles from the mouth of Smith Creek, working on two bench levels, the lower one being about 150 feet above the

level of Smith Creek, and the other about 50 feet higher. Peter Dow & James Tobuck prospected on Nolan Creek last winter by sinking two shafts at a point about $\frac{1}{2}$ mile above the mouth of Fay Creek.

HAMMOND RIVER:

The lower two miles of Hammond River has been one of the best gold producers in the precinct, ranking next to Nolan Creek in this respect. Conditions for mining are similar to those on Nolan Creek, past operations having been conducted in the high bench or channel deposits and in the river flats. There was but little activity on this river this year. Thomas Brady groundsluiced and shoveled-in on the high bench on the right limit opposite No. 7 above, just below the mouth of Swift Creek, using an intermittent water supply. E.M. Collins did similar mining and prospected in an old open cut in the high bench opposite No. 1 above. Capt. E.C. Rowden with an outfit of two 60 H.P. boilers and a hoist with 3 to 5 men employed sank a shaft last winter to prospect the ground at the lower end of Discovery claim.

VERMONT CREEK:

Vermont Creek is a right limit tributary of Hammond River, about $3\frac{1}{2}$ miles in length, and in the earlier days was among the larger gold producers. In 1929, however, but one operation was conducted there. V. Watts and C.K. Harvey hydraulicked and shoveled-in just below the Forks on No. 1

above Discovery suspending work about August first.

OTHER CREEKS:

On Gold Creek, Geo. Maglos & V. Neck drifted during the winter on No. 3 below. This winter V. Neck plans to open up and drift on No. 4 below, and G. Maglos will drift at a place further up the creek. Patrick Kelleher ground-sluiced and shoveled-in on Discovery.

A. P. Ness, who has mined on Gold Bottom Creek for several seasons did not resume this work this season, no mining therefore was done on this creek.

Buckeye, Swift and Plunge Creeks have not been mined for several years. Linda Creek was also idle. James Kelly drilled on lower Jenny Creek in 1928, where a little pay had been found some ten years ago. The results of this drilling were not encouraging. Pat Kelleher prospected on California Creek by sinking shafts on Discovery bench, right limit.

Hans Christensen & Philip Mayhan prospected with shafts on the right limit of Jim Pup Creek. Christensen with 2 men did a little drifting in ground 73 feet deep on Wakeup Creek from 1926 to 1928 and last winter he prospected on the high bench between Wakeup and Jim Pup Creeks.

Attention was drawn to Bettles River and some of its tributaries last year when a native discovered gold in the canyon of Bettles River below Garnet Creek. A small

OPHIR CREEK:

Meier Bros. had a small crew engaged in hydraulicking and other mining, and Hard & Wilson mined with a cableway excavator.

OTHER CREEKS:

Thompson & Gray hydraulicked on Spruce Creek; and Jack Weir did preparatory work for hydraulicking next season; Victor Hill drifted and groundsluiced on Victor Gulch; Frank McGaffery prospected and drifted on Beaver Cree^K; R.A. Anderson drifted and groundsluiced on Anvil Cree^K; and M. Krone prospected on Hunch Creek.

TOLSTOI DISTRICT:

The principal mining in this district was done in the Cripple area where one steam scraper, one cableway excavator, and two hydraulic operations were reported as active with about 12 men engaged. Several men were also prospecting in the area.

On Cripple Creek, Hard & Wilson operated a cableway excavator plant; Greenberg & Jones a steam operated scraper, and Sid Paulson operated a hydraulic plant. Wm. Cridgely hydraulicked on Montana Creek, a tributary of Colorado. Jno. Vick, Jno. Factor and M. Krone prospected on Colorado Creek, and there were probably several others prospecting in the area that were not reported.

stampede from Wiseman followed, the stampeaders cooperating to prospect the ground. Cabins and an airplane field were built and a wing dam was constructed across the river last winter for the purpose of diverting the stream the following spring. The springs floods however took out this dam but another attempt is to be made this winter. Mule, Pine, Eight Mile and Garnet Creeks also Wolf and King Creeks, tributaries of Big Lake, were prospected in 1927 by John R. Laane. The only operation in this area was conducted on Rooney Creek by James R. Rooney, who groundsluices and shovels-in the creek gravels in the summer and in the winter takes out a small dump from the left limit bench.

Knute Ellingson & Wm. Gilbert prospected in the deep channel on Sheep Creek last winter for pay left by former operations and were apparently successful in this for they moved in an outfit this fall and planned to drift this ground this winter. Confederate and Union Creeks were never important producers and while Martin Christensen mined on Confederate Creek in 1928, no mining has since been done on these creeks. On Minnie Creek, L.G. Lawson dug a ditch and hydraulicked and groundsluiced in the creek bed this season.

The American Koyukuk Mining Co. of Alaska has been prospecting in the Wiseman area for several years and recent-

ly completed its 3 mile ditch bringing about 250 miners inches of water from Wiseman Creek. They have been prospecting by groundsluicing out two open cuts at a place about one mile north of Wiseman on the extreme left limit of the Wiseman Creek Valley where it opens out into the Middle Fork of the Koyukuk River Valley. It is reported that this work had reached a rim paralleling the Middle Fork River and good prospects in gold were found there. The gold is fine although some pieces up to 10 cents were found. From 3 to 5 men are employed on this work.

J.L. Wilson mined by open cutting in the high channel on the right limit of Emma Creek just below the mouth of the canyon, and did a little drift mining during the winter. John R. Laane prospected on this creek just below the upper end of the canyon. While Porcupine Creek was one of the earlier producers it has never returned much better than wages. Stanich Bros. groundsluiced and shoveled-in on this creek during the summer and in the winter took out a small dump on Discovery claim. Jno. Popovich did similar mining below Discovery and M. Angelich did some shoveling-in. Thomas Kovich shoveled-in in the creek bed of Twelve Mile Creek and last winter he and M. Angelich sank a prospect shaft on the left limit bench. It is reported that most of the holdings on this creek are under option to Sam Dubin who plans to prospect them for hydraulic mining possibilities. No mining has

been done on Clara, Rose and Kelly Creeks for several years. On Myrtle Creek, Knute Ellingson & Wm. Gilbert hydraulicked at a place about 2 miles above its mouth, and Dan Aston groundsluiced and shoveled in further up this creek. No mining is being done on Slate Creek.

Tramway Bar is a high bench deposit located on the left limit of the Middle Fork of the Koyukuk River about 32 miles downstream from Wiseman. It has been mined some since the early 90's. V. Watts was the only one there this season, he doing some groundsluicing and shoveling-in this fall. Gold Bench is another well known high bench deposit. It is located on the right limit of the South Fork of the Koyukuk River about 8 miles directly south of Tramway Bar. John Meshap is doing a little mining and assessment there. Capt. E.F. Rowden has moved a drill to Meshap's ground and plans to prospect it this winter.

W.R. Etherington plans to prospect this winter on Mosquito Fork River above Siwash Creek. No one is mining on Davis Creek. Mascot Creek, a one time good producer is not being mined or prospected. John R. Laane however did some prospecting on Blue Cloud Creek which enters Seattle River just below Mascot Creek. Washington Creek, a tributary of Seattle River was never a profitable producer, although some mining was formerly done there. J. Hood & L. Carpenter plan to prospect this creek this winter.

BETTLES-WILD RIVER AREA:

While the Wild River area has not been an important gold producer, it has been a persistent small producer for over 20 years. This year but 3 or 4 very small open cut and prospecting operations were conducted in this area, which is more remote and more difficult of access than most of the other placer areas in this precinct. Birch, Rye, Jay, Bourbon, Seward, Lake and Tobin Creeks, all of which drain into the Wild River, have all been former small gold producers, although all of them are now deserted.

Ben Sirr, and Frank Smith, each groundsluiced and shoveled-in the creek gravels this summer on Spring Creek. Over the divide on Surprise or Summit Creek, C.R. Creasy mined and prospected this summer. In putting in a bedrock drain on Discovery claim, Creasy found a six pound piece of gold bearing quartz stated to have assayed 3 ounces in gold and a \$14 nugget besides considerable other gold. He also sank a 20 foot ^{very} shaft on No. 1 above in which he obtained a/good prospect. The formation on this creek is a micaceous and carbonaceous schist cut by dikes of greenstone and porphyry. It is interesting to note that Creasy and F. Smith found a gold bearing quartz vein about a mile above Discovery, and Eli Hanson also located a 2 foot vein between the head of this creek and Spring Creek. Joe Matthews prospected on Two Cent Creek the former part of this season obtaining encouraging prospects

but none up to that time which could be considered to be pay.

HUGHES-INDIAN RIVER AREA:

The placer mining area on Indian River lies 16 miles distant by tractor trail from Hughes on the Koyukuk River. Freight rates to Hughes from Nulato are $2\frac{1}{2}$ cents per pound, and from Hughes to Indian River, 10 cents. Utopia Creek is about 25 miles from Hughes, the freight rate from Hughes to the camps on Utopia Creek being 12 cents per pound. This area makes a very small gold production, very little mining being done in it.

R.B. Norris & C. B. Frank hydraulicked on Indian River from 1924 until early summer of this year when the operation was temporarily discontinued. The gold here is very fine and flaky but is exceptionally high grade being valued at \$19.80 per ounce. The distribution of the gold in the gravels is however very irregular. The bedrock is a granite and many large granite boulders exist in the wash. The depth of the ground averages from 12 to 20 feet, from 6 to 10 feet of which is muck. These men also did some open cut work and groundsluicing on lower Utopia Creek.

Clarence Berry had a drill at work on Indian River below the Norris & Frank operation, prospecting the ground to determine its dredging possibilities. The work began in 1928 and continued until this spring when the project was abandon-

ed. Two other men are reported to have prospected on lower Indian River this season.

J. C. Hackett, prospects and does a little mining on Utopia Creek each year, as did Norris and Frank. The formation on this creek is mainly a schist. The ground averages about 20 feet in depth, about half of which is muck. The gravels are not as bouldery as those on Indian River.

Black Creek is about one mile long and the four claims on it are owned by Jos. Hoagland who groundsluices and shovels-in. The ground is about 20 feet deep, about 12 feet of this being muck. The paystreak is but about 15 feet wide.

In the Hogatza River Basin, Ernest McCleod drilled on tributaries of this river which head in the Zane Hills, and Walter Simpson and Robert Smith prospected during last winter on a tributary in the same vicinity. Huntington & Swanson prospected on the ~~river~~ branches of the Koyukuk River, a short distance above the mouth of the Hogatza River. James Justin prospected this season at the canyon on the Kanuti River.

CHANDALAR PRECINCT.

Four small placer mining operations with 10 men engaged are reported to have been conducted in this precinct in 1929. There were also 8 other men reported as prospecting, some of who recovered a little gold. The placer gold output of the Chandalar in 1929 was consequently very small, probably not exceeding \$2,000 or so. From 1900 to 1927, inclusive,

this precinct has produced \$365,000 in placer gold, practically all of this coming from Little Squaw, Big, Tobin and Dictator Creeks. Drift mining has been the most productive, although some of the shallow deposits which were mined by manual open cut methods have yielded a fair proportion. The main placers are deep, the paystreaks have been irregular and not continuous for any distance, and other conditions for drift mining have generally been adverse to extensive profitable operation. The remoteness of the placers, the high cost of supplies, and lack of nearby fuel and timber, have handicapped prospecting and operation. It is stated in general that drifting ground in the area must carry \$2.00 or more in gold per sq.ft. of bedrock to be considered pay. The accessibility of the area has been improved by the cutting through of a road from Beaver on the Yukon River to Caro, the main mining settlement, a distance of 75 miles. This road is, however, stated to be rough and difficult to travel being really nothing more than a winter road. From Caro to Big Creek via the Middle Fork it is 35 miles. It is 45 miles from Caro to Little Squaw Creek. The freighting rate from Beaver to Little Squaw is 15 cents per pound during the winter and 40 cents in the summer. Wood and timber must be hauled in for a long distance to Little Squaw Creek, costing \$16. to \$20. per cord there. Some years ago the cost of wood at one camp was reported to have been \$40. per cord.

Probably the most extensive and most profitable operation in this area was that conducted some years ago on the bench of Little Squaw Creek by Fred Smith. The pay here was, however, limited mainly to a few claims, but reported to have averaged well over \$2.00 per sq.ft. This ground varied from 30 to 70 ft. in depth, the gravels being unfrozen and wet during the summer. It drained as the water level of the creek lowered in the fall and was therefore mined during the winter months. Carlson, Buckley & Amero in 1924 sank a shaft 164 ft. to bedrock through solidly frozen ground on Discovery Claim on Little Squaw Creek, two claims below the rich ground mined by Smith, and struck on a spot of pay. Two claims below Discovery, Little Squaw Creek enters the flats of Lake Creek. The upper 80 ft. cut by this shaft was a mixture of muck and large rocks, which overlaid 84 feet of heavy gravel. The main pay was found in the 3 to 3½ feet of gravel lying on bedrock but at that locality was restricted to a width of about 25 feet with low grade gravels to either side. The gold was coarse and shotty. A small area was drifted yielding \$2.30 in gold to the sq.ft. A year later these men took in a large stem^a plant and other equipment but apparently the ground did not develop as hoped for.

Buckley, Carlson & Amero, with a crew of 3 to 5 men, however, conducted drifting operations on Little Squaw Creek this year, this being the principal drift mine in the pre-

cinct, although it is reported mining will be discontinued after this season due to high costs. Oscar Otterson put down a prospect hole on Little Squaw and did a little drifting. Manuel Mello prospected on his claims.

O.J. Nicholson installed an automatic dam on Big Creek where he ground sluiced and shoveled-in, and also did a little drifting during the winter. This ground is 15 to 20 ft. deep and wet. Arthur Newton and 1 man mined on this creek in 10 to 12 foot ground with an automatic dam. Ellis Anderson was to sink another prospect shaft on Tobin Creek. Wm. Danielson prospected on the East Fork of the Chandalar. Chris Olson put down a 135 foot hole on the Middle Fork of Dictator Creek but according to reports found adverse conditions for drifting and no pay. A group of miners from the Hot Springs district sent two men into the precinct this summer to investigate the flats around the junction of the Chandalar and Christian River. It was stated fine gold could be panned from almost anywhere on these flats which were purposed as a possible dredging field. The result of this investigation is not known. Mason Bros. were reported as prospecting and doing some mining on the Arctic slope.

OTTER PRECINCT.

The Otter precinct is better known as the Iditarod district where the placer mining operations are conducted

and its main settlements are located. The boundaries of the Otter precinct are, however, so designated that the placers in the Moore Creek area; and those on Crooked, Donlin, and other Creeks in that vicinity which drain into the Kuskokwim River and are known as the Georgetown area; legally lie within the Kuskokwim precinct. These areas by reason of their accessibility will continue to be considered as being a part of the Iditarod district.

Seventeen placer operations with 102 men engaged are reported as having been conducted in the Otter precinct in 1929. There were probably also several other small mining or prospecting operations conducted of which no word has been received. The mining methods used in the district are very diversified, including most of the various kinds of placer mining conducted in Alaska, excepting drift mining, none of which was reported this year. The operations include 2 dredges with an average total of 32 men engaged, one dragline excavator with 12 men, one combination hydraulic-dragline-shovel operation with 4 men, one Bagley scraper operation with 5 men, 10 hydraulic operations with 46 men, and several small open cut operations using automatic dams. Hydraulic elevators are used at 3 of the hydraulic plants.

The placer gold output of this precinct will probably exceed \$200,000 this year, as the season was a good one for

water and the dredges did very well. About 4 years ago it was generally believed that these dredges had practically completed the dredging of all of the available profitable dredging ground. New areas of pay were then developed by prospecting the ground adjoining that dredged and improvements were made in dredge operation whereby costs were lowered. As a result these dredges have since experienced some of their most successful seasons and still have a considerable dredging life ahead of them. The Otter precinct has produced from 1910 to 1927, inclusive, \$20,113,000 in placer gold, being exceeded only by the Fairbanks precinct, and the Seward Peninsula, which, however, includes among its five important producing precincts several that have greatly exceeded the Otter production, namely the Cape Nome and Council precincts.

Freight rates into the mining areas are high, as freight brought to Holy Cross on the Yukon River via either Nenana or St. Michael, must then be taken up the Innoko and Iditarod Rivers to Iditarod, a distance of 400 miles from Holy Cross. The small shallow draught stern wheel steamers or gas driven boats with barges used for this are usually operated under difficult navigating conditions. From Iditarod, this freight is taken over a road by truck to Flat, a distance of about 8 miles. Most of the camps in this area lie ~~within a radius of 7 miles from Flat and~~ *are reached by road. Moore Creek lies 12 miles easterly from Flat by trail. The* Crooked Creek-Donlin Creek area is reached from Flat via trail although

some supplies are taken there via Georgetown on the Kuskokwim River. In spite of the high freight rates and the adverse water and other conditions some of the operations must meet, mining in the precinct has been generally successful.

OTTER CREEK:

The Riley Investment Co. operated its $3\frac{1}{2}$ cu.ft. combination type diesel engine driven dredge, digging across Otter Creek from Discovery bench to and down the right limit. This dredge has been operated on this creek each season since 1914. In 1925, the 110 H.P. diesel engine on this dredge was replaced by a new 125 H.P. Enterprise solid injection diesel engine which consumes an average of about $4\frac{1}{2}$ gals. of diesel oil per hour. A small size DeLaval cream separator Model 150 was also put in use for purifying the used lubricating oil, removing carbon, water, foreign oil, etc. It was reported that 30 barrels of lubricating oil were formerly used during an average season, which was reduced to 8 barrels the first season this method was followed. This company was one of the first to use water under natural temperatures for thawing frozen ground. While the details of recent practice are not known, about 4 years ago the spacing of the thawing points was increased from 10 ft. to 15 ft., the average time to complete a thaw then became about 20 days and the cost of thawing was reduced

to 5 cents per cu.yd. Favorable conditions for thawing exist and the entire operation is well conducted.

The Northern Alaska Dredging Co. operated its 3 cu. ft. combination type diesel driven dredge on Otter and Flat Creeks. This company acquired the townsite of Flat a few years ago and moved the town to another location, having prospected that area and found the Flat Creek pay to continue under the old town. The company has since been dredging this area, very good results being reported. The ground is thawed with water.

Pete Miscovich conducted his hydraulic operation# on Discovery Claim on Otter Creek using a hydraulic elevator, and Martin Rosyln mined by the same method on Discovery Bench. Frank Salen hydraulicked on Granite Creek. Fred Lucher mined with the aid of an automatic dam on Malumute Pup.

FLAT CREEK:

Hydraulic operations were conducted on this creek by the Alpha Mining company on the Happy New Year Claim; by Sakoff & Agoff on the Upgrade Ass'n., and by Paul Wobnig on the Idaho Assn. Dave Strandberg mined with a Bagley scraper on the Madden Bench.

CHICKEN CREEK:

The Chicken Mining Co. engaged 14 men during the period of water supply in operating its hydraulic plant on Chicken

Creek. This property is located on the southern slope of a high divide, the Upgrade Ass'n. and other placers at the head of Flat Creek being on its northern slope. This operation is conducted well to the head of the creek where water is provided mainly by melting snow and rainfall and consequently is available for mining for a period of only 6 to 8 weeks or so during the average season. The deposit ranges 15 to 25 ft. in depth, the creek gradient is steep and the deposit is quite high grade. Even with the short mining season available a considerable gold production is made each year. Capt. Becker had one man with him mining by the use of an automatic dam and shoveling-in on Bonanza Creek, a tributary of Chicken Creek.

HAPPY CREEK:

Olson, Lindstrom and Palmgren mined on Happy Creek using hydraulic methods in combination with mechanical means. The details of this operation have not been received, although according to others, the gravels are hydraulicked into the boxes when water is available for this and the tailings are stacked with a small gasoline engine driven shovel. When the water supply is low the gravels are dug and delivered to the sluice boxes by this machine which as stated has about a 1/2 cu.yd. bucket and can be converted and used as a dragline excavator when so desired.

WILLOW CREEK:

Jules Loranger & Co. operated a dragline excavator on the Loranger property on Willow Creek. Details are lacking but as the Frank Manley dragline excavator was used and somewhat similar ground was mined as that worked by Manley and later by Johnson & Co. on the Free Gold Ass'n. bench on Willow Creek, the present operation was no doubt conducted somewhat along the same lines. Two shifts were worked by Loranger & Co. this season with 12 men engaged. It was expected to mine a large area of ground this season which after being stripped of muck and top gravel leaves from 2 to 6 ft. of gravel and a foot or two of soft/^{slate}bedrock to be dug and delivered by the excavator. The former dragline excavator operation conducted on this creek is described in detail in U.S. Bureau of Mines Bulletin No. 259, p. 109-112. The interested reader is also referred to the use of a similar machine in combination with hydraulicking on Walker Fork in the Forty Mile precinct as described in this report under that precinct.

Boulanger & Co. did not mine their property on Willow Creek this season but are reported as planning to resume hydraulic operation there next year.

MOORE CREEK:

In the Moore Creek area, Wm. Kashinen ("Billy, the Finn") hydraulicked on Nevada Gulch, a tributary of Moore

Creek, with a crew of 6 men. This was the only operation reported from this area.

GEORGETOWN AREA:

Barney Walsh hydraulicked on Donlin Creek; and T. Boulanger mined on Crooked Creek using a hydraulic elevator. A total of 6 men were engaged. No other placer activity was reported in this area.

INNOKO PRECINCT

Placer mining in the Innoko precinct is conducted principally in the Tacotna-Ophir area, and to a small extent in the Cripple and the Tolstoi areas. These three areas are generally known as the Innoko district, the last two named however are distant from the former, and are often referred to as the Tolstoi district. The Innoko precinct produced \$4,000,000 in placer gold from 1907 to 1927, inclusive, Boob Creek in the Tolstoi district also producing some platinum as a by-product of gold placer mining. The gold output in 1927 was \$244,000. While there was considerable activity in 1929, the output probably did not reach \$200,000.

The Innoko district or the Tacotna-Ophir area receives most of its supplies via the Kuskokwim River and McGrath. From McGrath they are taken by gasoline driven boat and barge up the Tacotna River to Tacotna, a distance of 60 miles. A good road leads from Tacotna to Ophir, a distance

of about 24 miles. From this main road, a branch road goes on to Yankee and Ganes Creeks, and another goes up Little Creek. Some supplies are also brought from Holy Cross on the Yukon River, from where they are taken up the Innoko River to Cripple in small stern wheel boats, thence by horse drawn scows or by poling boats to Ophir. This route to Ophir is however a difficult and costly one. The district can also be reached by the traveller by trail from Flat in the Iditarod district, connecting with the road at Ganes Creek, a distance of 80 miles; or by trail from the Ruby district. Airplane travel from Fairbanks to McGrath or Tacotna is, however, recommended to the traveller as the quickest and best means, this trip requiring about three hours.

TACOTNA-OPHIR AREA:

Nineteen placer operations engaging 71 men are reported to have been active in this area in 1929. These include 4 dredge operations with about 34 men, 1 steam slip scraper operation with 7 men, 1 cableway excavator with about 6 men, 3 ^{hydraulic} operations with 7 men, and 10 operations with 17 men engaged in small open cut mining, prospecting, assessment work, etc., 4 of these operations also doing a little drift mining. There were probably also a few others engaged in prospecting and mining on a small scale that were not re-

ported. Two of the dredges were operated for about half of the available season, the others operating only a short time.

YANKEE CREEK:

The Flume Dredge Co. operated its flume dredge on upper Yankee Creek until August 29, when it was shut down for the season. The company then started its dredge on Little Creek. It is stated the ground for the dredge on upper Yankee Creek has been practically all dug, but this dredge may be moved to the lower part of this creek. This dredge is identical in size, design and operation to this company's dredge on Little Creek. They are of the straight flume type with open or link connected bucket line with $2\frac{1}{2}$ cu.ft. buckets. Each has a daily digging capacity of 900 to 1000 cu. yds. They were formerly driven by distillate engines but a few years ago these were removed and a 60 H.P. Fairbanks Morse, Style V.A. diesel engine installed on each dredge. Each engine consumes about 50 gals. of 24 gravity diesel oil in 24 hours, this oil in 1926 costing 68.7 cents per gal. delivered at the dredge. A large reduction in the power cost has resulted. Ed Nollette, Wm. Goss, and Joseph Dubois, prospected, mined a little or did assessment work.

GANES CREEK:

The Guinan & Ames dredge formerly operated on Ganes

Creek and prior to that on Glacier Creek on Seward Peninsula, was acquired this year by Gibbs, Peck & Co. and operated by them on Ganes Creek, digging downstream just above Spaulding Creek. According to reports, the season's dredging was brought to an unfortunate close after 32 days of operation by the breaking of the engine shaft. This dredge is driven by a 60 H.P. semi diesel engine. The bucket line contains 2 cu.ft. buckets and is of the open, or link, connected type. This dredge was originally a combination revolving screen, flume, and conveyor type, but was converted into the straight flume type when brought to Ganes Creek.

Hans Erickson leased the dredge of the Innoko Dredging Co. on Ganes Creek and operated it there for 22 days this season. It is stated that about \$1000 was recovered each day this dredge operated. Difficulty in bringing sufficient wood to the dredge is stated to be the reason for the short operation. This dredge was formerly operated on Greenstone Creek in the Ruby district, then purchased by the Innoko Dredging Co. moved to Ganes Creek, and reconstructed and placed in operation there in 1923. The company operated it but a short time and after several years of idleness was operated under lease by Frank Joaquin, and this season as stated. This dredge is of the combination type with a revolving screen, two flumes, and

a conveyor. It has a close connected bucket line with $3\frac{1}{2}$ cu.ft. buckets. It is driven by two 75 H.P. Morris condensing steam engines. An average of 8 cords of wood are consumed per day. The ground dredged is 10 to 13 feet deep and excepting a few local areas is practically free of permanent frost. The gravel is loose, practically free of clay, and of average size. The gold distribution is very spotty and erratic and the gold is very coarse, large nuggets being common. Reich & Carpenter and C. Baker, mined and prospected on lower Ganes Creek and reported finding high grade ground. John Stevens took out a small winter dump which he sluiced during the summer.

LITTLE CREEK:

The Flume Dredging Co. prepared ground ahead of dredging on Little Creek during the first half of the season, starting dredging there about Sept 1, after the company had shut down its dredge on Yankee Creek and transferred its crew to the Little Creek dredge. Some of this ground is frozen and has handicapped dredging in the past. This season a water thawing plant of about 100 points was placed in operation.

N. Vibe mined on Little Creek using a steam operated slip scraper, a crew of about 7 men being engaged. F. Speljack mined by hydraulicking with a hose outfit on the right limit bench.

The only operation reported as active in the Tolstoi area was that of Harry Madison who drifted on Esperanto Creek but Ed Enholm who has in the past been hydraulicking on this creek, a tributary of Madison Creek, was probably also engaged in mining. Some mining may also have been conducted in a small way on Eldorado and Boob Creeks.

KUSKOKWIM RIVER REGION.

The Kuskokwim River Region embraces an exceptionally large area, the entire drainage basin of the Kuskokwim River as well as some Coastal area at its mouth. It includes the Mt. McKinley, Kuskokwim, and Bethel Mining precincts in which considerable placer mining has been done in the past but which at present is conducted principally in the Bethel precinct although numerous small open cut and prospecting operations are being carried on in the other precincts at many widely separated localities. All supplies come from the States via small ocean steamer to Bethel from where they are taken up the River to the various settlements by small river boats and barges. There are but about three sailings a season to Bethel and while the region is generally considered as being one of the most isolated in Alaska and is difficult to get into and out of, the freight rates to Bethel

in 1926 were \$22.50 per ton, and \$22.50 from Bethel to McGrath. There has probably been little if any change in the rates since then. Recent word concerning placer activities in the region is lacking in most instances and such as is available is no doubt very incomplete. The discovery of platinum bearing placers in a new area in the Goodnews Bay ~~area~~^{district} and its commercial production therefrom have created much interest. The enormous expanse of country has a widely differing geological formation. Gold and platinum placers and lode deposits of various minerals occur at many localities. The difficult accessibility of many of these localities and the fact that many of the placers are thawed, or partly thawed, and wet, has been a great handicap to prospecting.

MT. MCKINLEY PRECINCT.

The Mt. McKinley precinct centering around McGrath has in the past been a good producer of placer gold although this can be credited mainly to the former dredge operation on Candle Creek. This dredge has lain idle since its last operation in 1926. A little placer mining is still being done on Candle and Carl Creeks, but most of the present mining, consisting of some small open cut and prospecting operations, is being conducted in the Nixon Fork area on Hidden Creek, Nixon Fork and

near vicinity. Considerable prospecting in the precinct is reported.

KUSKOKWIM PRECINCT.

Prospecting and a little shoveling-in constitutes the placer activity reported in this precinct. Apparently the principal operations were those conducted on Donlin and Crooked Creeks in the Georgetown area as reported under the Otter precinct. In the Sleitmute area prospecting and at times a little mining is done on the Swift, Tatlawiksuk, Hoholitna, Holitna, Stony and other rivers and their tributaries in that area.

In the Napaimute area, Brink Bros. took out an open cut on New York Creek near Napaimute, Dahl & Wilson mined on Marvel Creek, a tributary of the Aniak River, while several others were no doubt similarly engaged elsewhere in the area.

BETHEL PRECINCT:

Included in the Bethel precinct are a number of placer areas, chief among which are the Tuluksak-Akiak and the Goodnews Bay districts.

TULUKSAK-AKIAK DISTRICT:

The principal placer operation conducted in this district in 1929 was that of the New York Alaska Gold Dredging Co., on Bear Creek, a tributary of the Tuluksak River. This company operated its dredge during the season em-

ploying a total of 15 to 18 men. Reliable sources report this will probably be the last season of operation for this dredge in this district. This dredge machinery and other equipment was landed at Bethel in 1925, taken by river boat to the landing at the Forks of the Tuluksak River, from where it was freighted cross country during the following winter by tractor haulage and sleds to the dredge camp at Nyac. Nyac is about 95 miles by river from the Indian camp at the Forks, 45 miles in airline. While winter has afforded the better conditions for freighting from the Forks, summer transportation is carried on by poling boats up the Tuluksak to the second landing, from where a wet tundra trail leads for 18 miles to the foothills camp. From there a tractor road leads to Nyac, 15 miles distant. Several years were first spent in drilling this area, the gold distribution being erratic and check sampling was practically impossible. The creek deposit dredged averaged 10 to 12 feet in depth, moss or soil covering being either lacking or up to 4 feet thick. Drilling was stated to have shown some deeper channels. The gravels are of loose washed average sized material with but few boulders. All of this ground is free of perpetual frost. Bedrock is favorable to dig. The gold is fine to medium in size, large nuggets being uncommon but at times recovered.

The dredge is a combination type with a revolving screen, two flumes, and a conveyor. The main details are as follows: Wood hull 38" by 73 by 5 $\frac{1}{2}$ ft; draught 4.5 ft; anchorage by two spuds; close connected bucket line containing 61 - 4 cu.ft. buckets; maximum digging depth below water level 20 ft; revolving screen 16 ft. long; 5 ft. in diameter, and has 2 $\frac{1}{2}$ inch holes; conveyor is 80 ft. long from center to center and has a 30 inch belt. The distributor under the screen is 84 by 120 inches and is fitted with angle iron riffles. Each flume is 80 ft. long, 30 inches wide, and is paved with cast iron riffles. The save-all area is 27 sq.ft. One 12 inch pump supplies water to the flumes, one 8 inch pump supplying the screen nozzles, with a 3 inch pump for the bucket nozzles. Another 3 inch pump is also available for general use. Two 75 H.P. two cylinder Pacific Diesel engines provide the power, consuming 160. gals. of diesel oil per day, this oil in 1926 costing 41 $\frac{3}{4}$ cents per gal. at the dredge. The dredge at that time was operated on a three 8 hour shift basis and while the normal daily digging capacity was rated at 2600 cu.yds. this average had not yet been realized.

Two placer operations were conducted on Canyon Creek, a tributary of the Kwitluk River, where Anderson Bros. and Herman Oman groundsluiced and shoveled-in. Sluice box

concentrates from the Oman operation were analyzed in 1926 by Paul Hopkins of the U.S. Bureau of Mines at Fairbanks showing them to contain a little cinnabar and some gray lead carbonate besides the usual minerals of magnetite, ilmenite, rutile and garnet. The presence of platinum was also indicated but no assays were made for it due to the very small sample sent in.

GOODNEWS BAY DISTRICT:

Former placer mining in this district was done at Wattanus, Olympic, Bear Creek and near vicinity, these creeks draining into the Goodnews River. No recent word has been received of this area which is now probably practically deserted. A low divide separates this area from the Arolic River area to the north, where a number of miners prospected and did a little mining in 1926 and later, on the Arolic River and its tributaries Row Kow, Trail, Butte, Faro, Fox and others. Hansen, Fall & Wicklund at that time got together extensive holdings and did some preliminary prospecting with a hand drill to investigate the dredging possibilities. This drill was found to be too light for the work but the results obtained were reported to be encouraging but only indicative. Ten holes were put down on the Arolic River between the Gap and Snow Gulch. A hole drilled below the Gap went 32 feet in gravel, 22 feet being reported to be pay with bedrock not

reached. More drilling was done the following season but apparently nothing definite developed. A little mining has since been done on Kow Kow and Butte Creeks, where besides gold, a small amount of platinum was recovered. Most of the prospectors in this area have however since been attracted to the new platinum bearing area lying about 30 miles to the south.

This new area lies between Goodnews Bay and Chagvan Bay in an area where ^{the} formation is reported to be a dark igneous rock. Details of the formation and the placers are lacking. The placers are, however, stated to contain platinum with little or no gold present. The black sand concentrates are mainly magnetite with little or no chromite. The occurrence is therefore an unusual one. In 1928, it is unofficially reported that 7 men mined in this area producing 130 ounces of platinum associated apparently with some iridium or osmium as it was stated it was sold at a premium over the prevailing price of platinum at that time. This production was made mainly by Chas. Thorsen mining on Fox Gulch, Ed. St. Clair on Squirrel Creek, T. Thompson on Platinum Creek, and a miner on Clara Creek.

Thirteen men are reported to be mining by open cut methods in this area this year and others are prospecting. A platinum production exceeding double that of last year was expected. Ed. St. Clair & Joe Shangey, mined on

Squirrel Creek; T. Thompson, George Wickert, Fritz Walters, and Fred Moeck mined on Platinum Creek; Garthe & Sampson and Chas. Thorsen were on Clara Creek; Neal Corrigan & Ed McCann on Discovery Fox Gulch; and Wicklund & Haroldson prospected on Salmon Creek with a hand drill. Jim Ryan is also reported to be prospecting in the area.

SEWARD PENINSULA.

The occurrence of placer gold on the Seward Peninsula was known in 1865, although it was not until 1897 that the first recorded production was made. The great gold rush to Nome took place in 1900 when the development and mining of its extensive and rich placer actually began. From the beginning until 1927, inclusive, the Seward Peninsula has made a recorded production of placer gold and its alloyed silver valued at \$90,500,000, and no doubt a considerable additional amount was produced, especially during the earlier days, that was not recorded. The main portion of this production was made by the mines operated in the Cape Nome, the Council and the Fairhaven mining precincts, although its other precincts, the Port Clarence and the Koyuk were also large producers. These mining precincts embrace numerous placer districts which will be later recorded. During the four years prior to 1923, the annual gold production reached the lowest

stage in its history, dropping to \$1,088,500 in 1925. Notable development for large scale dredging operation was however underway during this period in the Nome district and while this dredging was started in 1923, full operation was not reached until 1926. The gold output of the Seward Peninsula in 1926 was \$1,873,000, although the following two years again showed a reduced production. The U.S. Customs report for the Port of Nome up to Nov. 1, states that the gold shipped from that port during 1929 up to that time was valued at \$1,663,182, an increase of more than \$650,000 over the shipments made up to the same date in 1928. It also reports the shipment of 56 tons of placer tin in 1928. While the total gold production in 1929 is not definitely known at this time, it is known to be much larger than that of the previous year, this being attributed to some extent to the increased water supply available because of a wetter season but mainly to the increased production of the large dredges operated at Nome. Increased production this year does however, not indicate the true condition of the industry for the production curve is gradually on a general decline and while there ~~is~~^{are} still a relatively large number of operations underway, their number is diminishing and it must be realized that the dredging operations during recent years have been responsible for between 85 to 90 percent

of the gold output of the Seward Peninsula and that the principal dredging areas are being rapidly depleted.

In this respect the history of the placer mining on Seward Peninsula has much in common with other placer mining localities although some of ~~the~~^{its} placers have been very rich and the distribution of gold placer has been widespread. The best of these placers have been mined and with their passing the tenor of the placers worked have become gradually less so that under the conditions existing it becomes increasingly more difficult to mine them profitably, especially in the outlying areas where because of greatly reduced activity, roads and trails have gone into disuse or obliteration, the former settlements are no more, and in general, such areas hold but little hope for future improvement. Nome and the other Seward Peninsular ports are closed to navigation from about the latter part of October until about the middle of June. This has some bearing on the length of the mining season for many of the operations, the cost of supplies, etc., yet the cost of supplies delivered at the various ports is quite nominal. The freight rates from Seattle to Nome and some of the other ports are given in the Transportation tables in the general report and have shown little if any change for some years. This freight must at all of these ports be lightered from the ship's side at an-

chorage to the shore for which an additional charge ranging from \$5 to \$12 per ton is made. Storms which rise suddenly are characteristic of Norton Sound and Bering Sea and when these prevail the unloading of ships may be delayed for periods up to a week and more. The lighterage at Nome and other ports is done by local concerns. Regular weekly service is maintained during the season between Nome and St. Michael, via Bluff, Golovin, etc., by a small diesel boat, and other boats of similar and smaller size are operated between Nome, Teller, Candle and other points. Airplane travel to and over the Seward Peninsula has been a wonderful aid to the traveller who can now be flown to practically any part of it.

The mining season except for the small amount of winter work, normally ranges from 75 to 150 days, depending however upon seasonal conditions and the method of mining. Some of the smaller operations do not realize but a month or two of this season. The dredging^g season ranges from 75 to 125 days in most of the districts, although at Nome longer seasons are generally realized especially by the large operation there which in 1924 operated one of its dredges for 220 days. This being the Alaskan record until recently. The frozen ground conditions encountered in Northern Alaska in the early spring cannot be economically combated by most methods of mining nor is it practical

to continue operation after the hard freezing weather of the late fall has set in.

Placer mining on the Seward Peninsula is done mainly by dredging, hydraulicking, and groundsluicing and shoveling-in. A little drift mining is still being done, although this is conducted on a very small scale and the production therefrom is very small. The high cost of fuel and the more favorable conditions for hydraulic mining have placed this method next to dredging in importance. Mechanical operation is limited mainly to dredging because of the fuel situation. Seward Peninsula is barren of tree growth excepting some scattered timber in its eastern part consequently all lumber is brought in from the States, as are coal and oil. Coal is shipped in in sacks, mainly from British Columbia and Utah and sells for around \$30 per ton at the yard at Nome. Gasoline, distillate, and diesel oil is used to provide power, this being shipped in in cases and drums, although one large company at Nome obtains its supply from oil tank steamers and pumps it to its tanks on shore. Labor around Nome is paid at the base rate of 70 cents per hour without board and at some of the more remote operations on the Peninsula the rate is \$6 to \$7 per 10 hour day with board also provided. Skilled labor is paid more, the scale varying according to the kind, location and other conditions.

The following information on the current operations is mostly that obtained by Irving Reed who visited the Seward Peninsula this season. The writer investigated the placer mining there in 1926 and reported thereon in considerable detail although this report was not published. Some of this data will therefore be incorporated here.

According to Reed, there were 12 dredges operated on the Seward Peninsula in 1929 and one dredge was under reconstruction, 519 men being engaged thereby; 51 hydraulic operations were conducted with 132 men; 4 drift mines were worked by 7 men; one scraper plant was operated by 6 men; 40 shovel-in operations were conducted by 69 men; and there were 15 prospecting operations with 50 men engaged. There were also 12 men engaged in prospecting tin lode deposits, 5 men prospecting on antimony and gold lodes, and 2 men on a cinnabar prospect.

CAPE NOME PRECINCT.

The principal placer mining on Seward Peninsula is conducted in the Cape Nome mining precinct which embraces the Nome, Solomon, Kougarok, Iron Creek and Bluff districts named in the order of their importance. The principal operations in these districts were those conducted by the dredging companies in the operation of seven dredges, and by a number of hydraulic plants. One of these dredges completed its operation this season while another dredge was rehabilitated

Creek district and the Dahl and Taylor areas of the Kougarak are now taken in this way, tractors hauling it from Shelton on to Dahl, a distance of 12 miles, and on to Taylor, a distance of about 33 miles beyond Dahl. All of this freighting is now done from Nome during the summer, the rate to Shelton being \$30 per ton, to Dahl \$60 and to Taylor \$150 per ton.

The main gold production of the district has been derived from the Kougarak River above Arizona Creek, and from its tributaries Trinity, Macklin, Taylor, Homestake, Henry, North Fork, Windy, Dahl and other creeks. While some rich spots of placer have been mined, these placers have in general not compared in richness to some of those in other districts, in general being lower grade. Two dredges have been operated on the Kougarak River, the Behring Dredging Co. operating a 3 cu.ft. combination type gasoline driven dredge above Arizona Creek from 1915 until 1926, and the 2½ cu.ft. distillate driven dredge of the Alaska Kougarak Co. was operated for several years around the mouth of Macklin Creek, but has been idle since 1924. The Kougarak River is gold bearing for a length of more than 50 miles and while no mining is now being conducted on the River itself there is an extensive area of river placer on the upper Kougarak, which holds potential dredging possibilities. The Kougarak River between Arizona and Coarse Gold Creeks was prospect-

and made ready for operation next season.

NOME DISTRICT

DREDGING.

The principal and largest placer operation on the Seward Peninsula is that conducted by the Hammon Consolidated Goldfields Co., a subsidiary of the U.S. Smelting, Refining & Mining Co. This company operated its three electrically driven dredges on the Nome tundra 3 miles north of Nome, starting the season's dredging in May and continuing until the latter part of October, the longest season being experienced by the No. 2 dredge which operated from May 18 to Oct. 23, a season of 178 days. The No. 1 dredge worked westerly in the "slough-over" of the Third Beach line about on the Martin Bench claim. The No. 2 worked westerly on the Monroeville Beach line and in the "slough-over" of the Third Beach about at the Mystery Bench claim near Little Creek, while the No. 3 worked northerly above the Third Beach line at the head of Little Creek. The Third Beach line has been dredged as far easterly as Holyoke Creek, this being the easterly dredgeable limit as the maximum depth of ground that can be dug by these dredges is 85 feet. The No. 4 dredge with $3\frac{1}{2}$ cu.ft. buckets formerly operated by this company on Snake River about one mile west of Nome at the mouth of Center Creek was dismantled in 1927 having dug all of its available ground, being able to dig but 30 feet be-

low water level. The No. 2 dredge after completing the dredging of its ground will be moved to Snake River to dig a large yardage of deep ground which the former No. 4 dredge could not handle. Ground in this area is now being thawed in preparation for this dredging.

The Nos. 1, 2 & 3 dredges are all of the same screen stacker type and have a close connected bucket line containing 9 cu.ft. buckets. All have double deck gold saving tables. The Nos. 1 & 3 have a digging depth of 60 feet below water level, that of the No. 2 being 40 feet. The Nos. 1 & 2 dredges have 580 installed motor horsepower and the No. 3 has 590 H.P., the average power consumption for each dredge being about 440 K.W. Dredge operation is carried on in 3-8 hour shifts. Details of these dredges and others are given in U.S. Bureau of Mines Bulletin No. 259. Power is generated at a central plant at Nome by 6-525 H.P. Pacific Diesel Werkspoor engines direct connected to 6-525 H.P., 2300 volt alternating current generators. This current is stepped up to 11,000 volts and transmitted to the field where it is used at 440 volts.

Practically all of the ground in the major areas is frozen and is thawed with water, This water is supplied by the Klacene, Pioneer, and Seward ditches, and when conditions require it, the water for thawing is supplemented

by pumping, this pumping being done by three 450 H.P. pumping plants, each containing two 12 inch centrifugal pumps. The general thawing procedure has been mentioned in the general part of this report.

The Bangor Dredging Corp. operated its $3\frac{1}{2}$ cu.ft. semi-diesel driven dredge on Anvil Creek starting the season's operation on July 1 and continuing until Aug. 16, when the last of the available ground was dug on the upper end of No. 10 above claim. Anvil Creek has now been dredged from the lower end of Discovery claim up to where this company completed its dredging. The company is looking for another location for its dredge.

The Dry Creek Dredging Co. operated its dredge on Dry Creek on No. 3 below Discovery claim, 5 men being employed. This dredge is a straight flume type and has a 3 cu.ft. close connected bucket line operated at a speed of 25 buckets dumping per minute. The hull is 66 by 28 by $5\frac{1}{2}$ feet. Power is supplied by an 80 H.P. Venn Severin, solid injection, two cylinder, semi diesel engine which consumes an average of about 100 gals. of 24 gravity diesel oil in 24 hours. The flume is 72 feet long and 32 inches wide, set on a 10 inch to 12 feet grade and is equipped with transverse rail and cast manganese steel riffles. The average depth of ground ranges from 12 to 14 feet,

being free of permanent frost where not covered with moss and muck. Bedrock ~~is~~ dredged to ^{is} a clay. Seasonal and such permanent frost as may be present is removed during the spring by thawing with water. Water for thawing is pumped and delivered to the ground through points set at six foot centers, the average time to complete a thaw being from 3 to 5 days. The pressure of the water ranges from 20 to 26 lbs. This dredge formerly had a 2 3/4 cu.ft. bucket line, open link connected, and operated at a speed of about 17 buckets per minute by the same engine as now used. This dredge it is now claimed will dig about 2200 cu. yds. per day, conditions for its operation being very favorable and very low dredging costs are realized.

The Lomen Reindeer and Trading Co. operated its 5 cu.ft. electrically driven dredge on No. 10 above Discovery claim on Osborne Creek this season starting its first dredging operation there on July 17. About 17 men were employed by the company, some of who were engaged in doing some hydraulicking on the benches which was done for prospecting purposes. This ground was formerly mined by Lee & Swanberg who took out pits with a hydraulic elevator, both above and below where the dredge is. The bedrock is irregular ^m contour, the depth of the gravel ranging from 4 to 12 feet. There is practically no overburden and the gravels are free of permanent frost. At the present local-

ity of the dredge a clay bedrock is causing some difficulty with the gold saving. This clay bedrock does however, not continue beyond No. 16 above from where schist bedrock continues on up the creek. Some good results are expected from dredging the right limit benches where former hydraulic operation is stated to have yielded good returns without reaching bedrock. This dredge was formerly operated on Solomon River for a period of ~~over~~^{over} 20 years. It was first known as the Three Friends dredge and steam operated, later as the Eskimo dredge, etc., experiencing numerous changes in ownership and changes in power equipment. The last few years on Solomon River it was owned by and operated for or by the Lomen Reindeer and Trading Co., who last winter moved this dredge to Osborne Creek. It has been provided with a new hull but otherwise is much the same as when on Solomon River. This dredge is of the stacker type but is equipped with shaking screens. Its bucket line contains 64-5 cu.ft. close connected buckets. It has a digging depth of 20 feet below water level. Its normal digging capacity is about 3000 cu.yds. per day. Electric power is generated in a shore plant where the generator is driven by a 200H.P. Dow-Willans diesel engine.

The Hastings Creek Dredge Co. remodelled and put in shape the old Anderson dredge which was originally built on Moss Gulch and moved to Hastings Creek in about 1915 where

it has lain idle for many years. Four men are engaged on this work and the dredge is to be operated in 1930. This dredge was formerly of the stacker type and operated by distillate engine. As now reconstructed it is a straight flume type and has an 85H.P.Venn-Severin diesel engine. The digging ladder will be lengthened and equipped with a close connected line of 3 cu.ft. buckets. The dredge is now on No.5. below claim and will dig downstream, a life of about six years been claimed for the operation. The ground is free of permanent frost.

HYDRAULICKING:

Stewart Bros. hydraulicked in the creek bed on Monument Creek, 11 men being engaged. This ground is 12 to 13 feet deep, but about one foot of muck covering the gravels which contain boulders up to 18 inches in maximum dimension. Bedrock is a schist but limestone occurs lower down the creek, a 35 foot bed of it apparently being the cause of the small canyon which developed there. Water for the operation is brought in from Sledge Creek through a 5 mile section of the old Snake River ditch. This avails but about a 10 foot head ^{at} the present workings. Two lengths of 16 inch boxes are used, these being set on a 12 inch grade. The tailings are stacked with a $\frac{1}{4}$ cu.yd. Sauerman bottomless scraper operated by an Ersted-Fordson tractor. The gold is about the size of wheat with some nuggets up to \$50

being found. Some Scheelite is ^{recovered} ~~present~~ in the sluice box concentrates.

Phillip Defonville with 3 other men hydraulicked on No. 7 below on Gold Bottom Creek. The ground is 3 to 6 feet deep, one foot of which is muck. Water is supplied by a two mile ditch from Silver Creek. One $2\frac{1}{2}$ inch nozzle is used in piping into the boxes, and a $2\frac{1}{2}$ inch nozzle is used for stacking the tailings. The head on the giants is about 100 feet. This season's work is stated to be preliminary to more extensive operation next year if the results come up to expectation.

Louis Washenweng & Henry Calkins hydraulicked on Nekula Gulch and Anvil Creek, a total crew of 4 being engaged. Fred Barnofski mined alone by hydraulicking on the Third Beach about $\frac{1}{2}$ mile east of Hastings Creek.

OTHER MINING:

Groundsluicing and shoveling-in was done by S. Sansouci just north of the present beach about one mile east of Jess Creek; by Charles Miller, and by Lorens Wendell on the beach just west of Jess Creek; by Joe Neuhauser on Grass Gulch; and by Henry Lind on Specimen Gulch.

B.F. Gillette & Ed Anderson operated a $\frac{1}{2}$ cu.yd. slip scraper about $\frac{1}{4}$ mile east of the city limits of Nome and about 200 feet back from the beach. The ground is frozen and averages about 18 feet in depth. The pay lies on a

false bedrock which is about 18 inches above the level of mean high tide. The overburden is groundsluiced off to within 2 to 3 feet of the bedrock, the pay being scraped into the boxes.

The only drift mining reported to have been done in the Nome district was that done during the winter by Jake Topolsky on the right fork of Dexter Creek; and by John Abrahamson on the Third beach about $\frac{1}{2}$ miles east of Hastings Creek. Both of these men worked alone. Topolsky also shovels-in during the summer.

PROSPECTING:

Prospecting for a westerly continuation of the Third Beach line beyond Little Creek is still being carried on, the contention being that this continuity has been well outlined by past drilling. Gold has been found in some of these drill holes which approaches payable quantities although in this there is apparently no regularity or extensive continuity. A difference of opinion exists as to whether this is a beach line or an off shore lagoon, both may be the case, although while much drilling has been done over a large area the true condition is still obscure. In 1926 and up to last year Otto Halla did much drilling around Little Little Creek obtaining some good prospects on which some underground work was done. This work is stated

to have encountered 10 to 12 feet of beach sand which carried good values in gold in the lower 3 to 4 feet. Some contend this is a section of a bar or sand pit on the outer edge of a lagoon. Several years ago Chas. Brown drilled numerous holes between Sunset Creek and Penny River and claimed to have found the Third Beach there.

A.E. Boyd prospected this year with a 6 inch Keystone drill about 1000 feet east of the head of Little Little Creek. A line of drill holes runs from this point northwest about 2000 feet to Little Creek. The surface of the ground here is practically level, the depth of the drill holes put down first was 34 feet, the center holes 65 feet and the following 40 feet. The material pumped from these holes contained much blue mud with sand.

The Steward, Lobe, Boyd Development Co. drilled on the Third Beach west of Snake River where they have obtained options on the Berger and Sullivan ground on Evening Gulch, the Marine No. 2 Ass'n., and other ground. They repaired the old 4 mile Wild Goose ditch from Sunset Creek and in 1930 plan to use this water to sluice out an open cut across this beach. A mechanical tailing stacker (Grant) is to be used for handling the tailings.

Chas. Kennedy & Felix Brunner put in a drain across the tundra about a $\frac{1}{2}$ mile east of Nome where they plan to prospect by shoveling-in the same pay streak now being

mined and prospected by Gillette with a scraper.

E.L. Blake prospected by sinking shafts on the left limit of Cunningham Creek and on the divide between there and Grass Gulch. Chas. Niebuhr prospected by sinking a shaft and drifting on the right limit of Dry Creek; Chas. Butler prospected on Rock Creek^K; Chas Madsen on Buster Creek; ~~Chas. Madsen on Buster Creek~~; and Chas. Jensen on Fred Gulch, a left limit tributary of Stewart River. John "Arctic" Smith shoveled-in and prospected on Arctic Creek and Cripple River, and John Mitchell did the same on Cripple River.

SOLOMON DISTRICT.

The Goldsmith Dredging Co. operated its 2 $\frac{1}{2}$ cu.ft. flume dredge on Solomon River employing 9 men. This was the only dredge active in this area this year. This dredge was constructed at the mouth of Coal Creek, a tributary of Solomon River, in 1926, and started its dredging that fall. Since then it has dredged upstream on Solomon River for a distance of about 1 $\frac{3}{4}$ miles, reaching the upper limits of the dredgeable area last fall. The dredge was then dismantled, hauled back downstream a distance of about 4 miles and reconstructed there this summer. It then resumed digging, working upstream. The company owns 25 claims on Solomon River above Butte Creek, and on Coal Creek, these being located 10 miles up the River from tidewater. Seven

of these claims have been dredged. The placer on the River is shallow ranging from 3 to 12 feet in depth, averaging about 7 feet. Some high hard reefs of bedrock cut across the creek at various places. The deposit is mainly of loose washed light gravel with but few boulders, and beyond the creek bed is covered with a shallow depth of muck and moss. The ground is free of permanent frost, excepting occasionally in the deeper moss covered flats and points, which will however thaw after being stripped of overburden. The bedrock is a schist and fractured limestone. The gold ranges from fine to coarse in size. The main gold distribution is somewhat spotty although the maximum width of the dredging pay is stated to be 400 feet. The Solomon River valley in this vicinity ranges from 250 to 600 in width.

This dredge as original constructed had a hull 36 by 83 by 4 feet in size and was constructed of light material. A light draught was desired and obtained although this was found not practical. The new hull is of heavier construction and is 30 by 70 by 6 feet in size. The bucket is of the close connected type and contains 48-2½ cu.ft. buckets which dump at an average speed of 23 buckets per minute. The dredge is stated to have dug an average of between 1800 to 2000 cu.yds. per day during last season. The maximum digging depth below water level is 10 feet. The ma-

terial brought up by the buckets is dumped directly into the head of the flume which is of steel, 100 feet in length, 36 inches wide, set on a 12 inch grade, and equipped with rail riffles set both cross and lengthwise. No undercurrent is used. There are two wooden spuds. A 12 inch pump provides the water for the flume, and a 4-inch pump is available for general purposes. Power is provided by a 120 H.P. Fairbanks-Morse "Y" type diesel engine. A 10 H.P. semi-diesel engine is available for general purposes and a 6 H.P. distillate engine drives the generator for the lights.

J.J. Keenan prospected ground on lower Solomon River by drilling for the Solomon Valley Dredging Co. It is reported that this company plans to resume its dredging operations there next season. The dredge of the Solomon Valley Dredging Co. has been idle for several years. It was formerly the Flower dredge which was operated on this River some years ago. The present company acquired this dredge in 1926 and reconstructed and operated it at its present location that year. The ground then dug ranged from 10 to 15 feet in depth, was free of permanent frost, and contained light to medium sized gravel with no overburden. The dredge is of the flume type with line anchorage. The bucket line is open link connected and contains 33-2½ cu.ft. buckets. The flume was 58 feet long, 30

inches wide, and set on a 12 inch grade, but was later lengthened. A 9 inch pump provides the water for sluicing. A 50 H.P. Atlas semi-diesel engine drives the winches and pump, a 35 H.P. engine of the same kind and make drives the bucket line.

A. Nylan & A. Mattson prospected with a hand drill on Shovel Creek for the Shovel Creek Dredge Co., of which they are part owners. This dredge was last operated in 1927 after having dug upstream to the mouth of West Creek at the lower line of No. 4 below Discovery. This dredge is of the straight flume type and is driven by two 35 H.P. Scandia semi-diesel engines. The bucket line contains 52-2 $\frac{1}{2}$ cu.ft. buckets in close connection. Anchorage is by spuds. The dredge has an average digging capacity of 1500 cu.yds. per day. The placer on Shovel Creek is shallow ranging from 6 to 9 feet in depth and contains lightwashed, easy digging material, free of permanent frost. The dredging season on this creek is usually less than elsewhere for this creek glaciers badly each winter due to successive breaks of the ice and overflowing of the creek. Some winters this ice builds up to depths of 15 to 20 feet and more and must be removed before dredging can begin. Pending the results of this prospecting, it is planned to resume operation with this dredge next season.

HYDRAULICKING:

E. W. Quigley with 6 other men employed conducted hy-

draulic operations at the mouth of Big Hurrah Creek on the St. Michaels Bench and Discovery claim. Water for the operation is supplied by a 9 mile ditch from the East Fork of the Solomon River. Operation formerly conducted by Mr. Quigley in the creek bed utilized a 10 inch hydraulic elevator. The present work consists of piping the gravels over the side of the boxes. Three 3 inch giants are used under a 210 foot head, one in the pit, one for stacking tailing, and one set opposite the pit near the head of the boxes is used both for piping the material into the boxes and for stacking. Four lengths of sluice boxes, 3 feet in width, are used in the set-up. The ground averages about 12 feet in depth, there is no overburden, and no permanent frost. The wash is of medium size. Bedrock is a schist. The principal gold distribution is at or in bedrock, the gold being ~~fairly~~ coarse, with nuggets up to \$30 to \$40 in size. A nugget worth \$700 has been recovered. As soon as this area has been mined, or within another season or two, operation will be shifted to the left limit benches on Solomon River just below the mouth of Big Hurrah Creek.

Joe Dieckman, working alone, hydraulicked on Big Hurrah Creek about 2 miles up from its mouth. A 2½ inch nozzle under a 20 foot head is used for piping the material into the head of the boxes. John Mellon conducted hydraulic operations on Willow Gulch, a left limit tribu-

tary of Solomon River, after spending several years in preparation such as hydraulicking out a drain 500 feet long and 50 feet wide down Willow Gulch. Water is obtained through a 3 mile ditch from Uncle Sam Creek. This placer is stated as evidently being a portion of the former Solomon River channel, now lying between the head of Willow Gulch and Moran Gulch. The gravel in this channel is about 12 feet in average depth and is covered by 12 to 30 feet of muck. It has been prospected by many shafts, about 1500 feet of this channel being found suitable for hydraulicking.

OTHER MINING:

Andy Neuberg groundsluiced and shoveled-in a pit 300 feet long and 12 feet wide, at the mouth of Jerome Creek, one man assisting him. The deposit averages 9 feet in depth and is not frozen. About seven feet of muck and sand is groundsluiced off leaving the lower 2 feet of fine gravel to be shoveled-in. The gold is fine and flaky. John Starr did similar mining by himself on West Creek, Chas Anderson shoveled-in on No. 6 below bench on the left limit of Solomon River; O.J. La Mountain did the same on No. 7 below bench. Fred Cook shoveled-in and prospected on Penny Creek, and Alfred Hanson prospected on Kasson Creek, a left limit tributary of Shovel Creek.

KOUGAROK DISTRICT:

Placer mining in the Kougarok district is conducted in two main localities, one area centering around the upper Kougarok River, its tributaries, and its main settlement, Taylor P.O., and one around Dahl on Dahl Creek, a tributary of the Kougarok. It also includes such streams as Dick, Humboldt, and other creeks which lie northerly and over the divide from the head of the Kougarok River. This district is one of the most remote on the Seward Peninsula being located in its central part and accessible only by land routes. Freight was formerly taken into the upper Kougarok or Taylor area, via Teller where it was loaded directly onto scows from the ocean steamers, and then towed up Grantley Harbor, Imruk Basin and beyond to Davidsons Landing, at a cost of \$15 per ton. From there it was hauled by team to Taylor, a distance of 45 miles, or to near by camps, for \$60 per ton during the winter and \$200 per ton in the summer. In the earlier days of more activity this freighting was done for about half this price. The rehabilitation of the old Seward Peninsula Railroad as a tram for light haulage by gasoline driven cars, pupmobiles, etc., has recently brought about a change in the freight route. This tram is open to public use and runs from Nome to Shelton a distance of 86 miles. Freight for the Iron

ed with a gasoline operated 4 inch drill during 1926, some good prospects, although spotty, were obtained and while no dredging activity developed therefrom, this area and that lying above Macklin Creek appear to be the most worthy portions for further consideration. Extensive bench deposits, some of which have been mined, occur along the Kougarok River and its tributaries. Many ditches have been dug by former operators and include such ditches as the 15 mile North Star ditch running from Taylor Creek to Gold Creek, the 10 mile Lane ditch on Henry Creek, the 9 mile Kougarok Mining & Ditch Co. ditch, the 8 mile French ditch and others. This is indicative of the extensive mining operations which were formerly conducted in the district. Mining is now however at a low ebb although conditions indicate that an improvement can be expected. Henry Creek and Humboldt Creek were prospected this season for dredging possibilities.

Wells Bros., Chas. Nelson & Isadore Fix, conducted a hydraulic operation this season on Merritt Gulch, a small tributary of Henry Creek. Two giants with 3 inch nozzles were used in the pit for piping into the head of the boxes, and a giant with 3 inch nozzle was used for stacking tailing. Four lengths of 24 inch boxes were used in the set-up, these being equipped with pole riffles stripped with iron. Water was obtained from a $3\frac{1}{2}$ mile section of the former

Taylor Creek ditch bringing the water from Lillian Creek. A 1500 pipe line, 20 to 12 inches in diameter delivers the water to the giants. The ground averages 12 feet in depth, 7 feet of muck overlying the 5 feet of frozen gravels. About 9600 sq.ft. of area was mined this season, 4 men being engaged in this work.

Laurin Bros. hydraulicked on Macklin Creek, the gravels being piped into the head of the boxes for which 2 small giants were used in the pit and one was used for stacking tailing. Water was obtained from a $3\frac{1}{2}$ mile ditch under a 150 foot head. Four men were engaged.

Nicon & Bodis hydraulicked on Dick Creek at its junction with Bryan Creek. Water is obtained by a $1\frac{1}{2}$ mile ditch ~~which~~^{and} is delivered under a 35 feet head to the one giant used in the pit to pipe the material into the head of the boxes. The tailings are stacked by a Grant mechanical stacker which is a small bucket elevator device similar to a gravel loader, and which is operated by a small gasoline engine. An average of about $3\frac{1}{2}$ feet of gravel is overlain by about 8 feet of muck, this muck being stripped ahead. Three men were engaged at this operation.

Groundsluicing and shoveling-in was done by Harry Gavin on Harris Creek; H.R. Ahrens a short ways below Gavin; and by John Donovan on Willow (or Mascot) Gulch. Geo. Thomas rocked on the left limit of the Kougarok a-

bout $\frac{1}{2}$ mile below Taylor Creek. Jud Chidester built a small ditch and groundsluiced and rocked on the right limit of the Kougarok opposite Taylor Creek.

Wm. Sinhold prospected during the winter on lower Homestake Creek on the Jumper Bench. Sinhold, F. Miller, and Jerry Sullivan plan to start a hydraulic operation there next season, having begun the construction of a dam and ditch this fall.

The Henry Creek Gold Dredging Co. had 5 men employed on prospecting lower Henry Creek with a 4 inch hand drill this season. Pending the results of this work, it is planned to move the Behring Dredging Co. dredge to this locality and start dredging next season. J.R. Sloan prospected during last winter on Moberg Gulch, a small left limit tributary of the Kougarok River opposite Henry Creek.

W. H. Suksdorf with 8 men engaged prospected with a 5 inch gasoline driven drill on Humboldt River, from about 5 miles below to 5 miles above Ferndale Creek. This ground is free of permanent frost and averages about 18 feet in depth. About two feet of muck covers the gravel. Besides gold, the gravels are stated to contain much tin, it being claimed the ground will average about three pounds of cassiterite to the cubic yard. The bedrock is a schist

The creek valley averages about 400 feet in width. This prospecting is being done to determine the dredging possibilities.

Jerry Sullivan shoveled-in on No. 3 above on Humboldt Creek, this claim lying about $3\frac{1}{2}$ miles above the mouth of Ferndale Creek. The ground is about 9 feet deep and is stated to carry good values. In 1926, Mr. Sullivan, who had been mining in this locality above Ballarat prior to that time for six seasons, informed me that from a pit about 5 feet deep and estimated to contain about 100 cu. yds. he had, besides the gold for which he was mining, recovered from 50 to 75 pounds of tin concentrate. An assay he had made of these concentrates reported a tin metal content of 65 percent.

In the Dahl area, Al Carey & John Kanari shoveled-in on No. 5 above on Dahl Creek after the 20 to 40 feet of muck overburden have first been groundsluiced and piped off. A $2\frac{1}{2}$ inch nozzle attached to a short line of pipe by a canvas ^{hose} was used for stripping. About 5 feet of very fine gravel was shoveled into the boxes. Bedrock is a clay, characteristic of much of the ground in this area. The ground is solidly frozen. The lower end of Dahl Creek from No. 6 above down to about 3 miles below No. 11 above claim on Quartz Creek, and elsewhere in that vicinity formerly yielded a large amount of gold, some rich spots of placer being

found and mined. The geology of these placers is unusual as the benches and in places the creek gravels, consist mainly of small subangular quartz fragments and finely crushed clayey quartzose material. It is thought that this was laid down over an extensive area under marine conditions, this area at one time no doubt being an inland sea connected with Imruk Basin. A prospect shaft was sunk to a depth of 187 feet, some years ago, on the left limit bench of Dahl Creek near its mouth. It was sunk entirely in this material which contained many shells. The bottom of this shaft is well below sea level and even then did not reach bedrock. Upstream from No. 6 above claim on Dahl Creek, the bedrock is a slate and schist and no pay of consequence has been found above this point. Paul Rasmus conducted his usual shoveling-in on lower Dahl Creek.

K.L. Graven groundsluiced and shoveled-in by himself on Wonder Gulch, a steep short tributary of Coffee Creek, about 4000 feet long. The pay streak is 60 to 70 feet wide and contains coarse rough gold. About 14 feet of muck overlies the 6 feet of small flat gravel, all being solidly frozen. Bedrock is a schist containing many small quartz stringers. The operation is dependent for water on the direct run-off of the rain and melting snow. About 2400 sq. ft. of bedrock was mined this season.

Harvey Grant & Isadore Fix purchased the Jensen hold-

ings on Eagle Draw, a small right limit tributary of Coffee Creek and prospected on it this season by shovelling-in. Mining operations are to start here next year. Chas. Roosevelt (Olson) dug a ditch and prospected by himself at the head of Eagle Draw on No. 4 above Bassett's.

IRON CREEK-AMERICAN CREEK DISTRICT.

The Iron Creek area is reached via the tram from Nome, the Iron Creek station being 60 miles distant from Nome. Grant & Geo. Laiblin groundsluiced and shoveled-in on Dome Creek, the head of Iron Creek, on No. 3 above, about 3/4 mile above the canyon. The ground is 6 to 7 feet deep in the creek and 12 feet on the benches, all being gravel and free of permanent frost. Stanley Horton shoveled-in by himself on No. 4 above on Iron Creek in ground about 10 feet deep. Robert Benson hydraulicked alone on Benson Creek, a small tributary of Iron Creek. Colman Griffin prospected on Sherrette Creek and around Mt. Bendeleben.

The American Creek Mining Co. (Barney Rolando, Mgr) conducted hydraulic operations on American Creek about 12 miles up from its mouth. This is a right limit tributary of the Niukluk River above the Casadepaga River and hence actually is a part of the Casadepaga district which is in the Council precinct. Supplies are however obtained via Iron Creek, being hauled from there by tractor for a distance of 8 miles to this operation. One 3 inch nozzle

is used in the pit for piping into the head of the boxes and a 2½ inch nozzle is used for stacking tailing. Water is obtained by a 5 mile ditch and delivered to the giants under a 115 foot head.

BLUFF DISTRICT:

No placer mining is reported to have been conducted in this district during 1929. Formerly, the principal placer mining there was done on Daniels Creek which enters Norton Sound at Bluff. This creek has yielded a large amount of gold from a relatively small area, some rich placer having been mined. Eldorado, Silverbow, Swede, Koyana and several other creeks in that area have also been productive but of much smaller amounts. The only mining activity reported this season was some prospecting done on a cinabar lode deposit near Bluff. In 1926, considerable interest was again drawn to this district by the discovery of an elevated beach line just east of Koyana Creek. This discovery was made by Merritt & Chittick. This beach deposit is elevated 5 to 7 feet above high tide and located about 75 feet back from the present shore line. The total maximum thickness of the deposit is 50 to 60 feet. The lower 10 to 25 feet is of typical beach gravel and gray sand with thin interbedded bands of ruby sand, and is overlain by gravel mixed with angular rock fragments and soil.

The gold was very fine, the largest piece found being worth 7 cents. A heavy white sand obtained from pannings proved upon analysis to be cerrusite, or lead carbonate. Considerable work was done by driving cross cut adits and drifts into the deposit along bedrock and the material therefrom was sluiced yielding a small amount of gold. The main gold distribution was found to be confined mainly to a width of 20 to 30 feet, paralleling the beach line. This beach deposit is apparently the result of the erosion and ^{re}concentration by the sea of a high channel of gravel containing some gold which followed down the left limit of Koyana Creek and entered the sea at this vicinity. Much prospecting and staking was done by many for 10 and more miles along the beach and an attempt was made to mine at the Discovery, but nothing of consequence materialized.

The Allen Mining Co. operated a cableway excavator plant in 1926 at the mouth of Daniels Creek in mining the beach placer under the sea and along the present beach. The plant was the largest of its kind in Alaska including the washing plant. A $1\frac{1}{2}$ cu.yd. heavy toothed excavator bucket was operated on a $\frac{7}{8}$ inch traction cable over a span of 400 to 500 feet. A 125 H.P, six cylinder gasoline engine operated the cableway excavator. A 75 H.P. diesel engine operated a 10 inch pump which supplied the water for sluicing. One clean up of 2800 buckets is stated to have yielded \$1456 in

gold. This and other clean-ups indicated an average gold content of the material mined of 45 to 50 cents per cu.yd. One pit off-shore was mined to a maximum depth of 20 feet below the 5 foot average depth of sea water covering it. The operation was a financial failure.

COUNCIL PRECINCT.

Placer mining in the Council precinct which includes the Council and Casadepaga districts is at a comparatively low state, the principal operations being conducted by 3 dredges, 3 or 4 hydraulic operations, and a small number of shovel-in and prospecting operations. The transportation of freight to the Council district is via Chinik on Golovin Bay and up the Fish and Niukluk Rivers, the river transportation being by small gas boat and scows and at times part way by poling boat. The mail and travellers generally go from Solomon at the mouth of the Solomon River, up the Solomon River and East Fork, down the Fox River and over to Council. The freight rate from ship's side at Chinik or Golovin to Council is \$35 per ton. Freight and travel to Casadepaga district is via the Solomon River and over the divide into the Casadepaga River valley over a rough road. The freight rate from Solomon ranges from \$40 to \$50 per ton during the summer.

COUNCIL DISTRICT:

The Ophir Gold Dredging Co. operated its 3½ cu.ft. stack-

er dredge during this season on No.19 above on Ophir Creek, 12 men being engaged. About 4 years ago this company acquired the dredge and holdings of the Wild Goose Mining & Trading Co. which conducted the operation of two dredges and did much hydraulicking on this Creek for so many years, The present company started dredging operations in 1926 with the former No. 1 Wild Goose dredge. This dredge is generally driven by electric power generated on shore by a hydro-electric plant which receives its water power from the old Canyon ditch. The installed electric motor horsepower on the dredge is 140. A 160 H.P. Washburn gasoline engine is installed aboard the dredge for use during the period of low water. Resort to this was not required this season.

The North Star Dredging Co. conducted dredging operations at the mouth of Ophir Creek working along the right limit bench opposite No. 3 below claim. The company is composed of three partners, Mebes, Stine, and Gumm, and in addition to them 8 men were employed. This dredge and property was formerly that of the Northern Light Mining Co. The dredge is of the flume type having an open link connected bucket line with $2\frac{1}{2}$ cu.ft. buckets and is driven by two 35 H.P. distillate engines.

Shaw & Gracie hydraulicked on No. 7 above on Ophir Creek, the total crew being 4 men. This is stated to be the last season for this operation. Thos. Piletich and one man

hydraulicked on a bench on Albion Creek.

Mining by shoveling-in was conducted by the following lone miners: M. Peterson on No. 13 Bench, Harry Matson on No. 10 Bench, and Nate Dimon on No. 3 & $3\frac{1}{2}$ above, on Ophir Creek; Wm. Brookins on Sweetcake Creek; Robt. Larch on Rock Cree^K; Anton Haakonson on Tony's Gulch. M. Obradovitch and Marko Martin shoveled-in on a bench on Sweet Cake, and Fred Durocher and one man did similar mining on No. 1 claim on Aggie Creek.

CASADEPAGA DISTRICT:

The Casadepaga Mining Co. Inc. operated its dredge on the Casadepaga River about $\frac{3}{4}$ mile below the mouth of Ruby Creek. Nine men were employed. This $2\frac{1}{2}$ cu.ft. distillate driven flume dredge was formerly operated by the Casadepaga Mining Co. Inc., the Peck interests, lower down on the Casadepaga River where it closed its dredging operations near the mouth of Canyon Creek several years ago. While the same company name is reported as operating this dredge this year at its new location about $3\frac{1}{2}$ miles above Canyon Creek, it is also reported that this dredge was acquired from the former company and this year's operations were conducted by James Connors. The present operators lease the ground being dredged from Gaylord, Kester, Nelson, & Allson and includes Ruby Creek, which is to be dredged. Sufficient area for 5 seasons of dredging is claimed. The

width of the present dredging pay is stated to be about 100 feet, the gravel is free of permanent frost, from 4 to 12/^{feet}deep, and free of overburden. The gravels contain mostly small material with a few limestone and other boulders. Bedrock is mainly a schist, with some limestone beds.

S.M. Gaylord conducted hydraulic operations on a right limit bench of the Casadepaga River below Rover Creek, 7 men being engaged. The water is obtained from a small ditch 1½ miles long and is used in the pit under about a 45 foot head for piping into the head of the boxes with a 2½ inch nozzle. Tailings are handled with a Sauerman bottomless scraper. The ground is 12 to 14 feet deep, there being about 2 feet of gravel, the rest being muck overburden. It is all frozen. Bedrock is a schist, the bedrock level of this bench being about 12 feet above the level of the river. Preparatory work, stripping of overburden, etc., has been conducted here each season beginning in 1926. This is the first season that actual production was reached.

KOYUK PRECINCT.

Freight for the Koyuk precinct or Dime Creek district is transported by the local small coastal vessels to the "Landing" on the Koyuk River from where it is hauled 7 miles to the camps on Dime Creek. Haycock is the principal settlement. While Dime Creek has been and still is the principal producer of the precinct, mining is also done on Sweep-

stakes Creek, a tributary of the Peace River, and on Bear Creek, a tributary of the West Fork of the Buckland River. Of particular interest is the platinum occurrence in the placers mainly on Dime and Bear Creek and from which a creditable production has been made. The platinum production in recent years has however been very small due to restricted operations and the depletion of the higher grade ground.

Porter & Pfaffle dredged on No. 4 above on Dime Creek, a total crew of 5 men being employed. This dredge was formerly operated on this creek by the Dime Creek Dredging Co. and prior to that had been operated on Warm and Elkhorn Creeks in the Council district. This dredge is of the straight flume type with an open link connected bucket line containing $33-1\frac{1}{2}$ cu.ft. buckets, which dump at an average rate of 19 per minute. The maximum digging depth below water level is 12 feet. The flume is 62 feet long, 20 inches wide, and has rail riffles. Power is provided by a 25 H.P. distillate engine, which consumes about 70 gallons of distillate in 24 hours. This distillate costs 60 cents per gallon at the dredge. This is the smallest and lightest dredge operated in Alaska. It has done some very creditable work and will under average conditions dig about 400 to 450 cu.yds. per day. The ground being dredged is 17 to 18 feet deep, 9 to 10 feet of which is gravel, the balance being muck. Originally, the creek gravels were but about 6 feet in average depth,

where the muck have been eroded and washed away. This was later filled in with tailing from placer operations to a depth practically level with the top of the muck banks. This creek gravel is stated to have originally been free of permanent frost but owing to the deep filling of tailing it is now all frozen. The muck and gravel are all frozen. Bedrock is a blocky andesite or "Diorite" about a 3 foot depth of it being dug by the dredge in order to make a good recovery. The muck and overburden is groundsluiced off ahead of dredging. The gravels are then thawed with water delivered to the ground through 3/4 inch open end pipe points spaced at 8 foot centers in square relation to each other. The gravel contains much ice, driving of the points is fairly easy, and from 7 to 8 days are required to complete an average thaw. Water for thawing is supplied by two ditches, one a high line, 2 $\frac{1}{2}$ miles long, which delivers the water under a 50 foot head, and a low line ditch from Eldorado Creek which provides a 35 foot head. The gold is in very flat small grains resembling Durham tobacco in size and shape. Its fineness is 960. Platinum occurs in the ratio of one half of one percent of the weight of the gold recovered. This dredge was operated for two weeks only in 1928, then digging an average of 350 cu.yds. per day. This season dredging began on July 27. It is contended there is sufficient ground to keep the dredge in operation for 6 to 7 more seasons.

Leonard & Johnson conducted hydraulic operations on the upper end of No. 5 above, and on No. 5 Bench, right limit of Dime Creek. The ground is about 7 feet deep, 2 feet of which is gravel. Two No. 2 giants with $1\frac{1}{2}$ to $2\frac{1}{2}$ inch nozzles are used alternately in the pit and one giant stacks the tailing. Water is supplied by a $2\frac{1}{2}$ mile ditch bringing it from Dime Creek under a 50 foot head. One shift only is worked by the 3 men engaged.

Wm. & August Olson hydraulicked on No. 1 above bench, first tier, left limit, on Dime Creek, using 3 small giants alternately in piping off the overburden and gravel to within a few inches of bedrock. The remaining gravel and from one-half to one foot of bedrock is then shoveled into the sluice boxes. One of the giants stacks the tailing. Al Hogberg with one man hydraulicked on No. 2 above Bench on Dime Creek using one small nozzle in piping all of the placer into the head of the boxes. The ground averages about 6 feet in depth, about $3\frac{1}{2}$ feet being gravel.

Rylander & Jorgeson, with two other men employed, drifted for a period of four months last winter on No. 1 below Bench, 3rd tier, left limit, on Dime Creek. The pay was confined to a height of about 3 feet.

Frank McCoy operated his hydraulic plant on No. 8 claim about 5 miles down from the head of the Right Fork of Sweepstakes Creek. Two 3 inch nozzles are used, one in the pit, and one for stacking tailing. The material is piped into the

head of the boxes which consist of two lengths. Water is supplied by a $1\frac{1}{2}$ mile ditch under about a 150 foot head. The placer averages 10 feet in depth, being all of gravel with but few boulders, and free of permanent frost. Several streaks of clay are interbedded in the gravel. The pay streak is stated to be about 150 feet wide, the gold which ranges from fine to coarse being distributed mainly in the lower 2 feet of gravel and on and in the blocky decomposed andesite. Operation was stopped about the middle of this season due to lack of water. From 3 to 5 men were engaged. This operation lies about 14 miles from Haycock, summer freight rates to it being 6 cents per pound.

Sam B. Smith with one man hydraulicked on the left limit bench of Sweepstakes Creek about 6 miles up from its mouth using a small nozzle under a 15 foot head for piping off most of the material after which the remainder is shoveled-in. A little platinum occurs with the gold.

Porter & Abraham hydraulicked on No. 5 below on Bear Creek. Four giants with 3 to $3\frac{1}{2}$ inch nozzles are alternately used in the pit and one is used in the bedrock drain below the end of the boxes. for blowing out the tailings and stacking them. Three lengths of boxes are used. Water is supplied under a 160 foot head by a 3 mile ditch bringing it from Cub Creek. The deposit is all of heavy wash and thawed. Bedrock is a partly decomposed andesite. The gold

is fine, a very small amount of platinum occurring with it, This mining is conducted in an older channel on the left limit of the present creek, the width of pay being stated to be widening and now being about 400 feet. This season eight pits, each 80 by 100 feet, were mined. Two shifts were worked, a total crew of 8 men being employed. The average mining season is stated to be 120 to 130 days. It is 22 miles to Haycock.

FAIRHAVEN PRECINCT.

Two districts are considered under the Fairhaven precinct, the Candle and the Inmachuck. Freight for the Candle district is brought by steamer from Seattle to Kotzebue Sound, where it is lightered from the boat at the settlement of Keewalik. It is then taken to the head of the bay and up the Keewalik River to Candle City. Small coasting vessels also call at this port during the open season on 10 day service. From Candle City a graveled road follows 6 miles up Candle Creek to Patterson Creek. Freight from Seattle is landed at Candle City for about \$28.50 per ton. These steamers land freight for the Inmachuck district at Deering located at the mouth of the Inmachuck River. A graveled road leads for 25 miles up this river to the principal mining operations.

CANDLE DISTRICT:

The Keewalik Mining Co. operated its dredge on No. 1

below on Candle Crsek at the mouth of Jump Creek. About 40 men including a superintendent and general manager were employed. The placer is all frozen, that now being mined having an average thickness of 4 to 6 feet of gravel, elsewhere up to 12 feet, covered by muck ranging from 6 to 40 feet in thickness. Bedrock is a schist, from 3 to 4 feet of it being dug by the dredge. The gold is distributed mainly on and in the bedrock which has decomposed to a sticky clay causing considerable loss of gold as this dredge is not adapted to handling and washing sticky clayey material. The muck overburden contains much ice and by groundsluicing and hydraulicking is comparatively easy to strip off. The remaining portion of the placer is thawed with water delivered through points. The thawing points are of 3/4 inch single extra strength pipe, with open end, or slightly upset point with a 5/8 inch opening. These points are put down at 16 to 18 foot centers in equilateral triangular relation and are set 6 to 8 feet into bedrock, it being stated the thawed area in the bedrock around each point coned sharply or diminished in size and therefore to obtain a complete thawing of this bedrock this deep setting is done. The average time to complete a thaw is about 12 days. Water for thawing and hydraulic stripping is provided by the 36 mile ditch, formerly the Candle Alaska Hydraulic Gold Mining Co. ditch. Under full ditch head a pressure of about 45 lbs. is available at the

thawing points. It is stated the greatest economy in water consumption for this type of ground has been found to be when used at about 30 lb. pressure, although the higher pressure does more rapid thawing. The average width of the dredgeable area is stated to be about 300 feet while at Jump Creek it is up to 700 feet, the dredgeable length of Candle Creek being 12 to 14 miles.

This dredge known as the No. 1. Keewalik is of the flume type and has a close connected bucket line containing $3\frac{1}{2}$ cu.ft. buckets. Its maximum digging depth below water level is 16 feet. Anchorage is by spuds. Power is provided by two 50 H.P. Western distillate engines. This dredge was originally constructed and operated on the Kugruk River. The No. 2 dredge, a distillate driven flume dredge with $1\frac{3}{4}$ cu.ft. buckets in an open link connected line, was last operated on No. 16 above on Candle Creek in 1926, when these dredges and property were under option and operated by the Golden Center Mines, Inc. This dredge prior to this time dredged some shallow creek gravels from No. 4 below to No. 8 above. It is too small and light for further dredging on this creek.

The Keewalik Mining Co. also prepared for future hydraulic operation on No. 12 above Bench and other benches on the left limit of Candle Creek. A 2800 foot line of 30 inch pipe has been laid across the creek from their ditch

which is on the right limit. This bench lies about 100 feet above the creek level so but about a 50 foot head will be available at the nozzles.

L.A. Sundquist conducted a small hydraulic elevator operation on No. 19 above on Candle Creek just below the mouth of Patterson Creek. A 2 to $2\frac{1}{2}$ inch nozzle is used in the pit to drive the material to the elevator and another giant is used for stacking the tailing from the elevator. A head of 90 feet is available for hydraulicking. In ground averaging about 20 feet deep, 7 feet being old tailings which overlay about 13 feet of gravel containing muck streaks, all being frozen, two pits were mined this season, 8700 sq.ft. in area. Three men constituted the crew.

C.A. Lindberg hydraulicked on the left limit bench channel of Patterson Creek, 3 men being engaged. Two $2\frac{1}{2}$ inch nozzles are used under a 50 foot head. The ground is 15 feet deep, 5 feet of gravel being covered by muck. About 15,000 sq.ft. were mined this season. A Nordling & O. Swanson hydraulicked on No. 10 above on Patterson, 4 men being engaged. Ed Hanson hydraulicked by himself on No. 15 above on Candle Creek. J. Little hydraulicked alone on Glacier Creek. T. P. Rous with one man mined during the earlier part of the summer with a hydraulic elevator

on Jump Creek. Water is obtained from Jump Creek under a 90 foot head. The deposit consists of 16 feet of muck and 10 feet of gravel. About 10,800 sq.ft were mined this season.

Henry & Jerry Coffin operated a hydraulic elevator on Discovery Claim on the Kugruk River about $\frac{1}{2}$ mile above the mouth of Chicago Creek. Water for the elevator is supplied by pumping with a 4 inch DeLasalle centrifugal pump driven by a 35 H.P. Continental engine. A giant with 1 $\frac{3}{4}$ inch nozzle is used in the pit, the water for it being supplied by a 3 inch pump of the same make and which is operated by a Fordson tractor. Gasoline costs about 21 cents. per gallon landed at the beach at the mouth of the Kugruk and it is stated that both engines can be operated for about \$7 for 10 hours. The ground averages about 12 feet in depth, 3 to 5 feet being sand and silt which overlies the gravel. One pit was lost this spring by the river flood. The present pit is 60 by 100 feet. The procedure is quite unique and apparently some rich ground is being mined.

D. L. McDonald took out a small dump by drifting by himself on No. 10 above Bench on Candle Creek. Individual shovel-in mining was done by J. Murphy on the left limit bench opposite No. 7 above on Candle Creek, and by

J. Reëdin on the same bench opposite No. 8 above. R. Lisson had a small crew prospecting during August by drilling on Quartz Creek, a tributary of Candle Creek. C.R. Patterson prospected on Willow Creek, and Wm. Leavitt prospected on Gold Run Creek.

INMACHUCK DISTRICT:

The largest hydraulic elevator operation now conducted in Alaska and one of the larger placer mining operations conducted in Alaska other than by dredging is that of A. V. Cordovada. This operation has been conducted on the Inmachuck River each season for many years and this year was on the No. 6 Fraction and No. 5 $\frac{1}{2}$ below claims. Four No. 2 giants are used in the pit for driving to the elevator where the material is elevated 40 feet by an elevator with a 9 inch throat and 4 inch nozzle to the sluice boxes. Tailings are stacked by two No. 2 giants. Ten lengths of sluice boxes 48 inches wide are used. Water is supplied by the 40 mile ditch bringing the water from Imruk Lake and delivering it under a head of 300 feet at the giants. This is the ditch built by the Fairhaven Water Co. in the early days and is among the notable Alaskan ditches. A maximum head of 560 feet is obtainable from this ditch but this head is cut down to better suit the present requirements and conditions.

The ground mined is 20 to 25 feet deep, being all gravel and without permanent frost. In 1928, about 110,000 sq. ~~ft.~~^{ft.} of bedrock was mined and in 1929 about 140,000 sq. ft. Twenty two men were employed this season, 10 of these working in the pit and seven being engaged on the ditch and penstock.

D. H. Hoogendorn hydraulicked on the left limit bench opposite No. 5 below Hannum on the Inmachuck River, 4 men being engaged. Three 3 inch nozzles are alternately used in the pit in piping into the head of the boxes and the tailings are stacked by a 3 inch nozzle. A high channel paralleling the Inmachuck River is being mined, averaging about 15 feet in depth. There are many boulders, the wash in general being heavy but without frost. Water is obtained from Adams Lake by a 2 mile ditch and a 1/2 mile pipeline, the available head being about 150 feet.

Groundsluicing and shoveling-in was done by Benson & DeBuhr on No. 5 above on Cunningham Creek and also by Onas. Nichol. John DeBuhr will also continue this winter with his prospecting under the lava beds on the right limit bench opposite the Globe Ass'n. on the Inmachuck River.

The Inmachuck Sublava Mining Co., H. L. Stull, con-

tinued prospecting the old high gravel channel which is overlain by a deep covering of lava. This company has been engaged on this work during the past four or more years, the present work being conducted on the Lucky Dutchman Bench opposite No. 3 below Pinnell on the right limit of the Inmachuck River. Most of this work is done in the winter, 5 men being usually engaged. Five shafts ranging from 132 to 203 feet in depth have been sunk and one incline 380 feet long has been driven. Under this thick lava capping is encountered frozen gravel 6 to 16 feet in thickness. Bedrock is a schist. Some encouraging gold prospects have been reported to have been found but no actual mining has as yet been reported as having been conducted. A small Ingersoll-Rand air compressor driven by a 10 H.P Economy distillate engine supplies the air to operate a "S 49" Jackhammer which is used in sinking through the lava. The cost of sinking these shafts is stated to be about \$30 per foot, and \$15 per foot for the incline.

PORT CLARENCE PRECINCT.

The principal placer mining in the Port Clarence precinct is that conducted in the Cape Prince of Wales and Cape York areas where the placers are being mined mainly

for their tin content. These areas produce the major portion of Alaska's placer tin output, as well as possessing most of its known tin bearing lodes. While no dredging has been done in the precinct for a number of years, N.B. Tweet dismantled and is moving the old Sunset dredge, formerly on Sunset Creek, to Dese Creek where he expects to have it ready for operation next season.

N.B. Tweet with 3 men employed hydraulicked in Coyote Creek, water being obtained from that Creek by a $\frac{1}{2}$ mile ditch. This plant was installed in 1926 and operated each season since then. Hans Thorson with 3 men shoveled-in on Gold Run Creek, and Ole Martinson, and Henning Johnson, each working alone, shoveled-in elsewhere on this creek. Fisher Baldrige and one man shoveled-in on Windy Creek. B. K. Postlethwaite and Harry Dobson prospected and shoveled-in on Burke and Budd Creeks.

The other mining and prospecting conducted in the precinct was in tin bearing placers. George Waldhelm conducted the largest of these operations, employing 13 men this season. This operation is on Goodwin Gulch, a head tributary of Goodwin Creek which runs into Lopp Lagoon. This ground was formerly mined by H. J. Christensen by shoveling-in, then leased by George Waldhelm, who in 1926 installed a small hydraulic plant and started its operation. In less than two months time

about 11 tons of tin concentrate were recovered. According to Mr. Waldhelm at that time, Goodwin Gulch is a short and narrow gulch, having an average grade of about 200 feet per mile. The placer is bouldery and averages about 3 feet in depth, bedrock being a granite and schist. Prospects of 1 to 4 pounds of cassiterite to the pan were common and seldom showed less than 2 ounces. No gold is present. The cassiterite occurs in the gravel in sizes ranging from a fine sand up to pieces 6 and 8 inches in maximum dimension. It varies in color, being white, buff, gray and black. Some iron pyrite is present, but the concentrates can be dressed to a high degree of purity. The placer prospected on this creek ranges from practically bare bedrock to 10 feet or so in depth in the banks, the average depth being about 5 feet over a maximum width of 150 feet. The grade of Goodwin Creek is about 50 feet to the mile. Water for hydraulicking has been provided on the Gulch by a 3 mile ditch from which a 1/2 mile^{of}/pipe carries it to the No. 1 giant under a head of 100 feet. The tin concentrate is sacked and hauled to the beach at Tin City about 2½ miles distant, from where it is shipped to Seattle enroute to Singapore. In 1924, when H. J. Christensen mined there with 10 men engaged in groundsluicing and shoveling-in, 17 ½ tons of

concentrates were produced and shipped to Singapore, the returns therefrom showing a tin content of 73.8 per cent. In 1925, 389 bags of concentrates were produced and shipped, the smelter returns showing a net weight of 18,345 pounds with a tin content of 74.8 percent, which according to the smelter was the highest grade of tin ore received by them in many yeras. This tin was purchased by this smelter on Dec. 9, 1925, for \$7,775.27. on the basis of the London price of tin metal per ton of 2240 pounds, less the smelting charge. Handling and wharfage charges at Seattle, freight and marine insurance from Seattle to Singapore, interest and 5 percent commission charges, amounted on this shipment to \$716.94. The cost of mining, preparation and shipment to Seattle is not known.

According to Irving Reed, the Waldhelm operation is now conducted by shoveling the gravel into cars, these being run to the sluice boxes and there dumped. Five lengths of 16 inch boxes are used. Water for sluicing is pumped from a sump, a 25 H.P. Fairbanks-Morse diesel engine providing the power. A 1 mile ditch which delivers water under a 50 foot head is used for groundsluicing when water is available, this supply being dependent upon the rainfall and melting snows. The depth of ground now being mined is 4 to 5 feet, bed-

rock here being a blocky limestone. Most of the placer for this operation has now been mined and another season or two will probably bring it to a close. The production in 1928 was 34 tons of tin concentrate and about the same amount was expected to be produced in 1929. These concentrates average about 72 percent tin.

H. J. & Thos. Christensen shoveled-in on Goodwin Gulch above the Waldhelm operation, this placer averaging about 5 feet in depth and stated to average about 45^(?) pounds of cassiterite to the cubic yard mined. No additional labor is employed. About two more seasons of mining remain.

Duncan McLean with one man shoveled-in on Cape Creek, a small gulch running down from the Bartell North Star Lode east of Tin City. The ground is 3 to 4 feet deep and all gravel. Bedrock is a limestone, at some places a schist. The cassiterite occurs as a coarse sand. This operation produced 4½ tons of concentrate in 1928, and about 6½ tons in 1929 when about 2250 sq. ft. in area was mined. The operation has about five more seasons work ahead.

Hill Bros. prospected and tested tin placer by shoveling -in on First Chance Gulch, a tributary of Cape Creek, and also on Josephine Gulch. They plan to dig a 1 mile ditch from First Chance Gulch and start hydraulicking on Josephine Gulch next season. T. A. Peterson had two men prospecting and doing assessment work on Tin and

Cape Creeks. M. A. Domingos prospected and did assessment work on Iron Creek, a tributary of Sutter Creek, and also on Sutter Creek.

ST. MICHAEL PRECINCT.

Placer mining in this precinct was formerly done on the Ungalik River and its tributary Bonanza Creek, located near the former settlement of Bonanza, about 160 miles east of Nome and about 80 miles northeasterly of St. Michael. No placer mining is reported to have been done here for some years although a large number of claims have been patented and are awaiting dredge development. Information obtained at Nome in 1926 was that Frank Shaw has for a number of years been engaged with the aid of several other men in sinking shafts and drilling on the Ungalik River and Bonanza Creek. According to reports obtained from various sources, a large yardage of high grade dredging ground is contended to have been proven on Bonanza Creek and the upper unit on the Ungalik, with almost an equal yardage of partly proven dredging ground indicating a slightly lower gold content. On Bonanza Creek for a length of 5000 feet and a width ranging from 150 to 400 feet, the pay gravel averages 6 feet in depth and is mostly free of permanent frost. On the upper

unit of the Ungalik, pay has been found over a width of 800 to 1000 feet, the placer being 8 to 14 feet deep and partly frozen. Below, on the lower unit of the Ungalik, a very large yardage of commercial placer is stated to have been proven and an equal ~~7/7~~ or greater yardage has been partly proven. Prospecting in this lower area has shown pay for a maximum width of 2200 feet, the placer being 12 to 20 feet deep and partly frozen. It is stated conditions for dredging are very favorable. The holdings reach to tidewater where conditions are favorable for the lightering ashore of supplies from ocean vessels, Judging by these reports, it appears that this area possesses one of Alaska's greatest known potential dredging fields and should so become the scene of large scale dredging operation in the near future.

NOATAK-KOKUK PRECINCT.

This precinct which is the largest and most remote of the Alaskan mining precincts lies northerly and northeasterly of the Seward Peninsula and excepting a small strip at its south extremity is entirely within the Arctic Circle. In its greater area it therefore has an Arctic climate although in its southern half the climate is quite comparable to that of Interior Alaska. Placer min-

ing has been conducted in the precinct for many years, mainly in the Noatak and Kobuk River basins, although during the past fifteen years and more, the operations were much diminished in number and conducted on a small scale. The total gold production of the precinct is not definitely known and while it has not been sufficient to rank with that of most of the other Alaskan placer mining precincts, it has been a creditable one. Some of the first placer mining in the precinct was done in 1898 on Lucky Six Creek, a small headwater tributary of the Noatak River. Some good gold prospects have been reported at different times to have been found in the Noatak River Basin, but its remoteness and inaccessibility have been the main handicaps to its prospecting. About 10 natives are reported to have done a little mining on Lucky Six Creek in 1929, but further than this there was no mining activity in this area. Gold bearing gravels have also been found in the Selawik River Basin although no mining is reported to have been conducted there. The geological formation in the Selawik Basin is stated to be similar to that of Seward Peninsula and is therefore considered as affording a good field for prospecting.

The principal, and practically all of, the placer mining in the precinct is being conducted in the Kobuk

River Basin in two general localities known as the Shungnak area and the Squirrel River or Kiana area. Considerable interest has recently developed in the Shungnak area where extensive gravel deposits are being drilled and prospected to determine the dredging possibilities. The mining operations/ⁱⁿthese areas are conducted on a small scale by hydraulicking and groundsluicing and shoveling-in. The production for 1929 did probably not exceed \$10,000. Many of the rivers and creeks in the Kobuk River Basin are reported to be gold bearing, many of which have been the scene of mining, especially the shallower gravels which have been quite extensively mined. Some of these placers are deep and mainly unfrozen and wet and therefore cannot be properly prospected except by drilling. Some drilling has been done from time to time on some of the creeks, although the equipment used is stated to have generally been too light and otherwise not adapted for this work. Some profitable mining is reported to have been done along th Shungnak River and elsewhere, where the ground conditions have not permitted the reaching of bedrock, in most cases mining was carried only to about the water level. It is such placers which are now being investigated for dredging. Conditions for large scale hydraulic operations are also reported to exist in this area.

A great handicap to prospecting and to possible development in the precinct is its dependence upon water transportation which is available for only about three months during the summer. While the Kobuk River is free of ice by around June first, the ice pack does not leave the Kotzebue Sound until a month or so later. By around October first, navigation is again closed. This means that all supplies must be taken into the country a season in advance. The Kobuk River is navigable for about 500 miles and it is stated a good sized boat can go up this river almost to Shungnak. Freight from the States is delivered to the ship's side at Kotzebue Sound by the freight steamers, the first of which reach this port about the later part of July of each year. The freight is lightered ashore and from there taken up the Kobuk River to the various settlements in launches with barges. Freight rates from Seattle to Kotzebue average about \$35 per ton, and from Kotzebue to Shungnak, or Long Beach \$15 to \$30 per ton. Airplane service from Fairbanks or Nome has been a wonderful means of reaching these localities, good landing fields being available at Kotzebue and at Shungnak. The airplane trip from Fairbanks to Shungnak takes about $3\frac{1}{2}$ hours, the trip by trail with dogteam requires not less than 32 days. The climate in the Kobuk

River Basin is stated to be comparable to interior Alaska and the mining season about the same as at Fairbanks, although because of accessibility and location the full available season can hardly be utilized by the average operation.

SHUNGNAK RIVER AREA:

A number of prospectors have been active in this area during the past two years, and in 1928, Wm. James, Chas. Maxwell, and M. Garland prospected on the Shungnak River, a large left limit tributary of the Kobuk River above Ambler River. They reported pay gravels on the right and left limits of the Shungnak River and the sinking of 35 holes in the river flats whereby they prospected about one mile of ground in which the pay was 1000 ft. wide. These holes ranged from 4 to 35 feet deep going only to water level and none reaching bedrock, as the ground is deep, unfrozen and wet. A large volume of very good dredging pay is claimed to have been prospected, the gold being distributed from the grass roots down. Realizing that drilling would be the only proper way to thoroughly prospect this extensive area, they interested the Northwest Alaska Mines Co. in this. This company took a light Star drill outfit and other supplies into this area this summer and this fall started drilling the broad river

flats of the Shungnak below the canyon. Some encouraging results have been reported, although it is stated that considerable drilling and other prospecting will have to be done before the real possibilities can be determined. From 6 to 9 men are engaged on this work. J.H. Miller and Joe Barker prospected during this summer on the upper Shungnak River.

Dahl Creek is a small right limit tributary of the Kobuk River, heading in the Cosmos Hills below the Kogoluktuk River. Shungnak P.O. and the native settlement of Long Beach ~~is~~^{ore} located at the mouth of this creek. Lewis Lloyd groundsluiced and shoveled-in by himself at a place about two miles up from the mouth of Dahl Creek, while Michael Tuohey about three miles above Lloyd, and Fred Johnson about four miles above Tuohey, mined in a similar way.

Ruby Creek, a gold producer in the earlier days was not mined this season. Riley Creek another early producer was also inactive. The Kogoluktuk River, a large tributary of the Kobuk cuts across the same formation as other producing creeks, although no pay has been found in the canyon or on the river itself. Lynx Creek, a tributary of the Kogoluktuk is being mined by Herman Paul who groundsluiced and shoveled-in. Wesley Creek

is reported to cut a formation favorable for placer, although the ground is thawed and wet and no one has yet sunk a hole to bedrock on it. A 40 foot hole from which 30 feet of drifting was done, is reported to have been put down on Cosmos Creek, although no pay was found. These and other creeks in this area head in the Cosmos Hills which are considered as being the source of the gold in the placers.

Frank R. Ferguson operated his hydraulic plant as usual on California Creek, a left tributary of the Kogoluktuk River. From 4 to 5 men are employed at this operation which is the principal producer in the Shungnak area. Paul Primer groundsluiced and shoveled-in on Aggie Creek, a small tributary of the Ambler River. Al Curry, Wildman, and Richard Varnell, prospected on Reed River, a large right limit tributary near the head of the Kobuk River.

SQUIRREL RIVER-KIANA AREA.

The principal placer mining in this area is done on Klery Creek, which has been the largest producer of gold in this precinct. Klery Creek is a large tributary of Squirrel River which enters the lower Kobuk at the town of Kiana. Theo. Westlake & Jos. Quillan ground-

sluiced and shoveled-in on Klery Creek, as did Andrew Garline on this creek and on Jack Creek. Manual Laborero did the same kind of mining on Klery Creek and also prospected on the benches. Shorty Woods prospected on Paul Xavier's ground. Several other prospectors were also on this creek. Arthur Hansen prospected with a hand drill on ground owned by the Kotzebue Fur & Trading Co. on Central (or Centro) Creek.

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