

Thawing with Hot Water.—This method is employed to the best advantage when the gravels are compact and contain very little sediment. Where the gravels are thawed by this method a much greater quantity of dirt can be handled by the shovellers than when the ground is thawed by either wood or steam. The method may be described as follows: A sump-hole is made at the bottom of the shaft, about five or six feet below the level of the drift, and a pulsometer or a duplex Worthington pump is installed on top of the sump-hole. The steam from the boilers is conducted through an iron pipe, down the shaft, to the pump or pulsometer, as the case may be. At the bottom of the shaft there is a small pressure pump, to which is attached a fire hose with nozzle. The water from the sump-hole is pumped on the face of the drift, and returns to the sump-hole by means of a small ditch dug along the side of the drift. The same water is used several times, and when it accumulates, as a result of the humidity of the gravels, it is pumped out of the shaft. The water is kept warm either by the fresh steam from the boilers or the exhaust from the pump or both. The duty of a No. 7 pulsometer is about 60 cubic yards in ten hours.

Thawing with Steam Points.—Steam thawing is employed in three distinct kinds of operations, drifting, open-cutting and dredging.

A "point" is made of extra hydraulic pipe, is 6 feet in length and has a bore of $1\frac{1}{2}$ inches to $\frac{3}{8}$ of an inch in diameter. They have solid standard heads, which stand the blow of a six or eight pound hammer.

The points are connected with batteries of four each, having a separate steam hose—usually $\frac{1}{2}$ -inch—and steam valve, and each battery is connected with the main steam line $\frac{3}{4}$ -inch steam hose and valve.

To do efficient work each point requires steam equal to $1\frac{1}{2}$ h.p., boiler capacity, i.e., a 30 h.p. boiler will furnish steam to 20 points. If a smaller boiler is used for this number of points, much trouble will be experienced in firing and supplying the boiler with water.

The quantity of ground that can be thawed with a steam point varies from 3 to 6 and often 7 cubic yards in 10 hours. The efficiency of the point varies according to the compactness of the gravels, the quantity of humidity in the gravels and the area to be thawed and as to whether it is in a drift or ahead of a dredge. In drifting operations the average duty of the point is 3.75 cubic yards in 10 hours.

When points are set in the face of a drift they are first driven about two feet, and allowed to remain at this length for an hour or so. They are then driven other two feet, and finally driven the full length. The points are set about three feet apart in average gravels, but only two and a half feet in compact gravels. Care has to be taken that only the pay material is thawed, otherwise waste material will have to be removed.

Thawing Ahead of Dredge.—All the dredges operating in frozen ground have steam plants for the purpose of thawing the gravels ahead of the dredge. The size of the plant depends on the number and capacity of the dredges in operation. The boilers used in operations of this kind are from 100 to 150 h.p. The steam is transmitted from the main station across the area to be thawed, by means of a main steam pipe from which there are many laterals conducting steam to batteries of 4, 6 and 8 points. All the main steam pipes are inclosed in a wooden box to avoid the condensation of the steam. The points are set from 4 to 6 feet apart and are from 12 to 15 feet in length, and are left in place for eight hours. The duty of a point under these conditions is from 5 to 7 cubic yards in ten hours.

Ground Sluicing.—This method consists of concentrating the steam on the gravels, which are thus removed by water without pressure. To successfully operate by this method it is necessary (1) to have a plentiful supply of water, (2) to operate in shallow gravels, and (3) to have a stream of sufficient grade to move the material. When the whole material from surface to bedrock is removed in this manner, the method is known as "ground-sluicing"; when only the over-burden is removed the method is known as "stripping." This work is easily done in the early spring by taking advantage of the spring floods and leading the water by several channels across the claim. The muck thaws easily and the streams soon cut down to the gravel, and then gradually widen their channels until they meet. In some cases the process is hastened by blasting out the walls of the muck channel with slow explosives. The upper portion, if barren, is removed and piled up where most convenient, and the underlying pay gravels are shoveled up or hoisted in buckets, and sluiced in the ordinary way.

Sluicing.—An abundant supply of water is essential to successful placer mining. After a winter dump has been thawed by steam points the dirt is moved to the sluice-boxes in various ways. One method is to scrape the dirt into a dump box at the head of the line of sluice-boxes. This is usually done by a steam scraper. Another method is to pump the water to sufficient elevation, so as to give a pressure to hydraulic the dirt from the dump into the sluice-boxes. When the water is convenient, however, probably the most economical mode of sluicing a dump is to place two sluice-boxes parallel to each other, on the space of ground where the dirt is to be dumped. These boxes are covered by short wooden planks or some other sufficient covering to keep clear the space through which the water runs in the process of sluicing. In the spring the sluice-boxes are gradually uncovered from one end, and the work of shoveling in, i.e., depositing the dirt in the sluice-boxes, can be accomplished by two or three men. This method obviates the necessity of employing a large number of shovelers. In order to confine the dirt within a limited area, cribbing is constructed around the dump so that the dirt is retained within easy access of the sluice-boxes. On many of the claims, however, the water for sluicing purposes, instead of being conveyed by flume from a point at a sufficient distance up the creek to give the required grade, is pumped up, and the sluice-boxes are placed high enough to carry the tailings where required, thus obviating the expense of handling or scraping tailings. During the summer the dirt or pay gravel is carried directly from the shaft and dumped into the sluice-boxes from the bucket attached to the self-dumper. By the open-cut method in shallow ground, however, the pay gravel is sometimes conveyed to the sluice-boxes by the ordinary wheelbarrow.

Self-Dumper.—The self-dumper or carrier was designed specially for the Yukon, and to meet the requirements of the miners for some light and simple machine that would hoist and convey the dirt from the bottom of the shaft or from an open-cut, to the dump or sluice-box. The carrier is operated on a single three-quarter inch cable stretched between two posts, and usually at an angle of about forty degrees, but if necessary at a much less grade. One post, about five feet high, is situated in rear of the shaft, and the other post, which is called the "gin-pole," is erected at whatever point the dirt is to be dumped. The carrier itself is worked by a single three-eighth inch or one-half inch