cable. The hoisting cable extends from the drum of the engine to the top of the gin-pole where it passes through a block and extends to the carrier, which, for example, is at the top of the shaft. The cable passes through a sheave in the carrier and extends down the shaft, passing through a block attached to the bale or handle of the bucket and then returning to the carrier, where it is fastened. When the signal to hoist is given the cable winds around the drum of the hoisting engine, quickly lifting the bucket from the bottom of the shaft to the carrier, where the handle of the block, which is attached to the bucket bale, lifts the hook in the centre of the carrier, thereby releasing the sliding latch and automatically locking the hook and holding the bucket securely in the centre of the carrier. This occupies only the fraction of a second, and the travel of the carrier is not impeded. The dumper is then pulled along the carrying cable to the point where the dirt is to be dumped. A chain is attached to the front side of the bucket, and at the end of the chain is a ring, which passes along a cable fastened at both ends and lying upon the ground directly under the carrying cable. When this ring comes in contact with a clamp, which is fastened to the cable, the bucket is prevented from going any farther and the strain on the chain overturns the bucket and the contents are emptied on the dump. After dumping, the hoising cable is slackened and the dumper or carrier rapidly travels down the cable until it reaches the top of the shaft. An eccentric hook attached to the sliding latch in the carrier strikes a ball fastened on the carrying cable. This action releases the sliding latch, unlocks the hook, and disconnects the handle of the bucket from the carrier. The bucket then travels down the shaft to be re-filled.

Costs.

Cost of complete pumping, thawing and self-dumping outfit suitable for working ten shovels (or 16 shovels if power is not required to pump).

40 h.p. Scotch Marine Water Back Boiler, return flue	$1,300.00
15 h.p. horizontal engine	375.00
6 h.p. Gould centrifugal pump (with foot valve attached)	300.00
10 h.p. hoisting engine	450.00
Self-dumping carrier and turnbuckle	100.00
200 feet ¾-inch cable	38.00
500 feet ⅜-inch cable	50.00
20 ½-inch thawing points, 8 feet long*	200.00
4 wheelbarrow bucket	60.00
10 Pan-American wheelbarrows	100.00
100 feet ⅝-inch *steam hose*	65.00
1 dozen Silver Dollar shovels	18.00
200 feet ¾inch pipe	24.00
Miscellaneous tools and fittings	125.00
	$3,205.00

* To thaw by hot water instead of steam the points would be substituted by a pump at an approximately similar cost.

The self-dumping carrier can be used with a much smaller plant, and is in general use where only five or six shovelers are employed. In a smaller plant the cost of boiler, engine and hoist is much less than the figures quoted.

The following two tables, showing the cost of sinking shafts, were furnished by two different operators on the watershed of Indian river, namely:—

Sinking by Self-Dumper.
(30 ft. deep, and 8 by 8 ft.)

1 boilerman* (one shift)	$6.50
1 pointman* (one shift)	7.00
1 hoistman* (one shift)	7.00
2 shovellers* at $6.50 (one shift)	13.00
½ cord wood (fuel) (one shift)	4.00
3⅓ cords (timbering) at $8 (one shift)	26.66
	$64.16
7 ft. thawed and hoisted in 12 hours.	
Cost of 7 ft. (including timbering)	$64.16
Cost per ft.	9.16

* These figures include an allowance of $2.00 per day per man for board, i.e., 1 boilerman at $4.50 plus $2.00.

In this case the shaft was 55 feet deep and 8 by 8 feet, and the dirt was hoisted by hand windlass.

Labor	$400.00
Timbering, 6 cords at $8	48.00
Dressing timber	50.00
Steam for thawing, at $1 an hour, 50 hours	50.00
Cost of 55 ft.	*$548.00
Cost per ft.	$9.96

* The cost of sinking this shaft was furnished by one of the most successful operators on the watershed of Indian river, and is based on the prices of the present day, the shaft having been sunk in June, 1909.

Tunnelling by Self-Dumper.
(6 ft. by 6 ft.)

7 to 12 p.m.—	1 pumpman	*$7.00
	1 helper	* 6.00
	1 fireman	* 6.50
1 to 6 a.m.—	1 engineer	7.50
	6 shovellers at $6.50	39.00
	Wood consumed, ¾ cords	6.00
	Timbering 12 ft. of tunnel, ⅔ cords	5.33
		†$77.33
6 feet of dirt excavated on each side of shaft in 12 hours.		
Cost of 12 ft.		$77.33
Cost per ft.		6.44

* Thaws 5 hours.
† These figures include an allowance at the rate of $2.00 per day per man for board.

The six shovelers take out the dirt and timber the portion of the tunnel that has been excavated. If the roof is muck, it is not necessary to timber. When the roof is gravel, the tunnel is timbered to obviate the sloughing of rocks and dirt, which would impede the progress of the work along the tunnel. It is claimed that the best method is to thaw five hours for the reason that the water becomes warm when thawing for ten hours, and as a result the roof is more liable to slough, the dirt piles up and blocks the operations of the nozzleman and the shovelers work at a disadvantage.

The following table, which was furnished by one of the most successful operators on the Indian river watershed, is taken from a 42 days' run, and shows the working cost per square foot of bedrock, i.e., the actual cost of thawing, hoisting and sluicing, the dirt being dumped from the bucket into the sluice-boxes:

Thawing Crew—	
2 pumpmen at $6.00	$12.00
2 helpers at $5.00	10.00
1 fireman at $5.00	5.00
3 cords wood at $8.00 per cord	24.00