adaptation to cooling "hot" grain. The following table has been prepared from actual measurements and practice:

Total square feet iron heating surface	591
Total square feet iron cooling surface	887
Total square feet iron surface inside of cylinders	1,478
Total square feet grain surface exposed to air currents	1,212
Total cubic feet air drawn through the grain per minute	7,338
Total lineal feet traversed by grain during operation	600 to 1,200
Time of passage	15 to 30 minutes.
Total weight of iron work complete, about	19,000 lb.
Total horse power required	18
Cost of drying grain for one day of 24 hours:	
4 tons of coal at $2.25	$9.00
2 men, fireman and foreman, two days each, $1.50	6.00
Cost of motive power at 50 cents per H. P.	9.00
Oil, etc.	50
	$24.50

Results—5,000 bushels dried at a cost of less than one-half cent per bushel.

Cost of cooling "hot" grain for one day of 24 hours:	
One foreman, 2 days' time, at $1.50	$3.00
Motive power	9.00
Oil, etc	50
	$12.50

Results—10,000 bushels at a cost of one-quarter of one cent per bushel.

It requires a space 48 feet long, 24 feet wide, and 12 feet high, but these can be reduced somewhat when necessary. In order not to injure the grain, the time required for the removal of moisture can be increased by adding a series of return conveyers, by which the grain, after it has passed through the first drier and cooler, is returned to the head of the second set, and so on until it has passed through the whole gang. Its passage can be retarded to any extent by bringing up the discharging end nearly to a level.

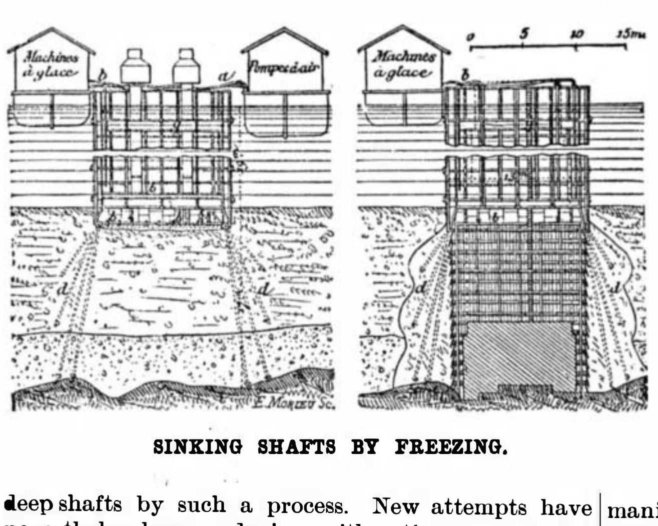
The maker claims superiority on the following important points: Economy of operation, drying and cooling in one operation, simplicity and durability, requiring no expert labor, perfect results, ability to use any kind of fuel, frictional instead of cog gearing, cool and clean operating room, and no extra-hazardous insurance rate.

Machines furnished only by the patentee, Mr. Stanley E. Worrell, Hannibal, Mo., who will supply further information upon application.

THE SINKING OF SHAFTS BY FREEZING.

The sinking of mine shafts by freezing was first practiced by Mr. Poetsch at the Archibald Mine. The method consists in driving into the earth, around the perimeter of the shaft, a series of pipes that are closed at the bottom and that contain other pipes. A freezing mixture forced into the inner pipes ascends through the annular space and is forced by a pump to a refrigerating machine in order that it may give up the heat recovered and then begin the same travel again.

Mr. Poetsch's experiment, as conclusive as it was, was performed upon a shaft of 18 feet depth, only, sunk through wet quicksand. So Mr. Haton de la Goupillere, in briefly describing the operations before the Societe d'Encouragement, expressed the opinion that it would be absolutely rash to undertake to sink very deep shafts by such a process. New attempts have nevertheless been made since with entire success at the Centrum Coal Mines at Konigs Wusterhausen. Here 108 feet of quicksand were frozen in 33 days with 16 pipes analogous to the preceding. The mass solidified around the circumference of the shaft was ten feet thick. At the Emilia mine likewise a 9 foot shaft was sunk through a 118 foot stratum of quicksand.



SINKING SHAFTS BY FREEZING.

In these different operations, the temperature, which reached —19° at the bottom of the shaft of the Archibald mine during the last days of the experiment, was taken only at the moment of the observer's descent. After remaining at the bottom for a certain length of time the temperature of the air gradually rose, and when several workmen were occupied permanently at the bottom it remained at a temperature of between 0·5° and 1°. So, after quite a short period of reheating of the air, the cold caused no inconvenience to the workmen, but, on the contrary, rather braced them up.

One of the most interesting peculiarities is that the congelation is sufficient to allow the quicksand and the surrounding earth to be taken out in a single block. At the Archibald mine, for example, when the stratum of lignite was reached it was found that the earth was frozen to over a yard beneath the extremity of the pipes, and the top of the stratum was so intimately cemented to the superposed quicksand that pieces could be broken from the mass without a fracture occurring at the plane of separation of the layers.

This fact proves that the Poetsch system may be applied with equal efficacy, whatever be the inclination of the strata, since the congelation converts the earth into a perfectly homogeneous mass. It might in certain cases especially be employed in the driving of submarine tunnels, and the *Engineering News* observes that the Hudson River Tunnel would be particularly suited for the application of it, since the stratum of sand and mud at the bottom has a very uniform composition, and would permit of working at every operation over lengths of from a hundred to a hundred and fifty feet.

A close examination of the frozen portions has demonstrated that the thickness of the block of ice increases with the depth. This is due to the fact that, through the direction given the freezing mixture, the maximum of its action is exerted at the base of the pipes. There forms, therefore, around each of the latter a truncated cone of ice whose larger base is situated beneath. These truncated cones gradually increase and finally penetrate each other, until the whole earth forms but a single block of ice.

We may conclude from the results obtained that, with a circular shaft, congealed earth over a yard thick permits of the sinking of a six and a half foot shaft without lining. The pipes are driven in different ways. When the shaft is already sunk up to the level of the water, and the stratum of wet earth is not very thick, it suffices to drive the pipes into the sand by removing the latter from the interior by means of a sand pump. In wet earth of some depth, a boring machine is employed. This puts down four pipes at once. If the strata to be traversed contain erratic blocks, the latter are avoided by inclining the hole, or, if they are too large, they are traversed by a special tool.

Mr. Poetsch proposes to apply his system to the constructing of bridge piers, and has just made a contract with the government of Roumania for the construction of the twelve piers of the great Bucharest Bridge.

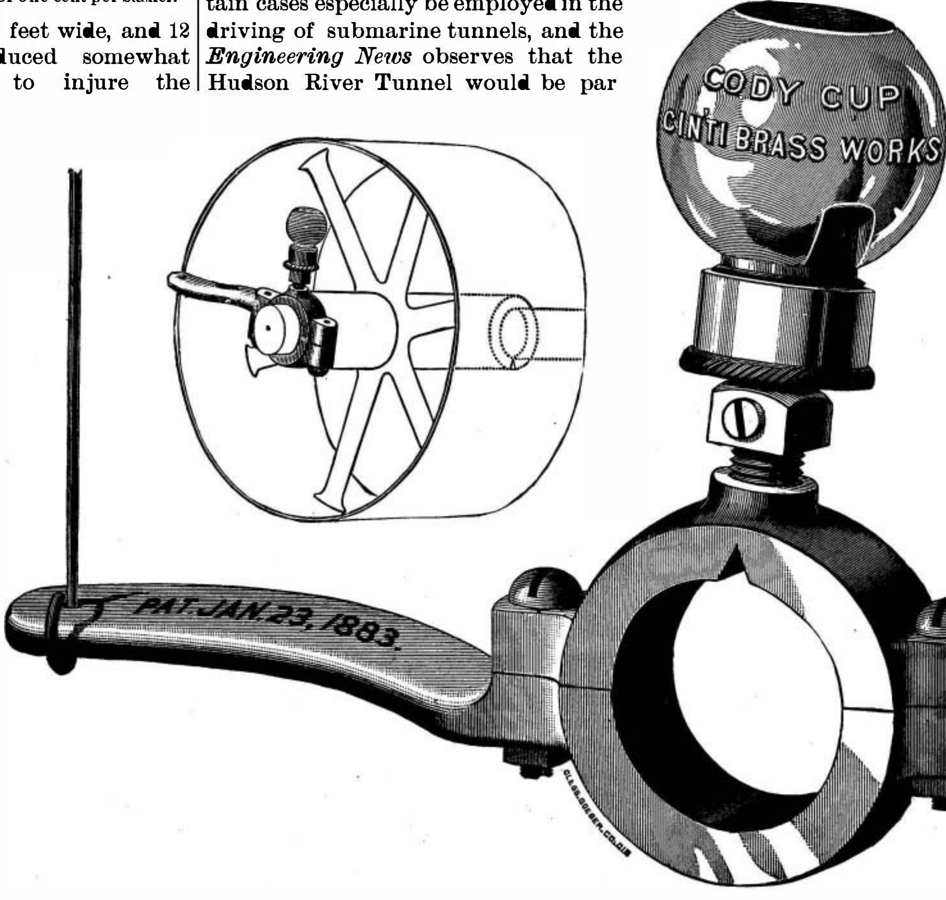
According to the *Techniker*, it is his intention to proceed by two methods. The first (Figs. 1 and 2) constitutes a combination of the compressed air and freezing methods. After sinking the working chamber by ordinary methods twelve or fifteen feet beneath the bottom, the freezing pipes will be driven beneath and around its perimeter in such a way that the whole mass contained in the cavity to be formed above the rock may be taken out in a block. The caisson will then become water tight, the air lock will be removed, and the work will be effected in the open air.

In the second process the use of compressed air will be dispensed with. After sinking an open caisson over the location of the pier, the pipes will be driven. After the freezing has been done, the water will be removed from the caisson by pumps, and the work will be performed in open air.

In order to preserve the masonry from the freezing action of the surrounding mass, it is Mr. Poetsch's intention to line the side of the cutting with a layer of straw, and to form the joints with a mortar of sand and tar or asphalt.

The experiments of Mr. L. Malo have demonstrated, moreover, that masonry with asphalt joints is susceptible of perfect cohesion.

The Poetsch method, which now appears to have entered into practice for sinking shafts in wet earth, presents the great advantage over all previous systems of allowing the cost and duration of the process to be exactly foreseen. Besides, it secures a vertical sinking of the shaft, since the operation is performed in solid earth; it completely dispenses with pumping apparatus, and does away with those special difficulties entirely that originate in the inclination of the moist strata.—*La Nature.*



LUNKENHEIMER'S AUTOMATIC LOOSE PULLEY OILER.

AUTOMATIC LOOSE PULLEY OILER.

The great obstacle which has heretofore prevented the successful oiling of loose pulleys has been that centrifugal force kept the oil away from the bearings. The oiler herewith illustrated (shown detached and in place upon the shaft in the figures) overcomes this objection, and is simple in its construction, which will be easily understood from the engravings, durable, easily applied, and very perfect in operation. In addition, it is economical, the manufacturer stating that one ounce of oil is sufficient for several months. It requires a space of three-fourths of an inch on the shaft, upon which it is set loosely so as to bear against the hub; it is kept in place by a slip collar, unless it fills up the space between the hanger and loose pulley. To keep the oiler stationary, a hole is provided in the arm to fasten a wire, which can be attached to the ceiling or wherever convenient. On wide pulleys a slot or groove should extend through the entire length of the bearing and terminate in a V-shaped notch. As this will cause a suction, prevent a vacuum, and freely supply oil from end to end of the bearing, the feed is regulated by means of a slotted screw working like a common stop cock.

Full particulars can be obtained by addressing the manufacturer, Mr. F. Lunkenheimer, proprietor Cincinnati Brass Works, Cincinnati, O.

COVER FOR COOKING UTENSILS.

The engraving represents a cover for cooking kettles or utensils lately patented by Laura M. Goodale, of Marshalltown, Iowa. Fig. 1 shows a coffee pot and Fig. 2 a kettle arranged with this cover, which is shown detached in Fig. 3. Within the lower portion of the cover,

GOODALE'S COVER FOR COOKING UTENSILS.