June 18, 1935. W. C. HOGG 2,005,143

TAPPING FURNACE

Filed Oct. 5, 1933 2 Sheets-Sheet 1

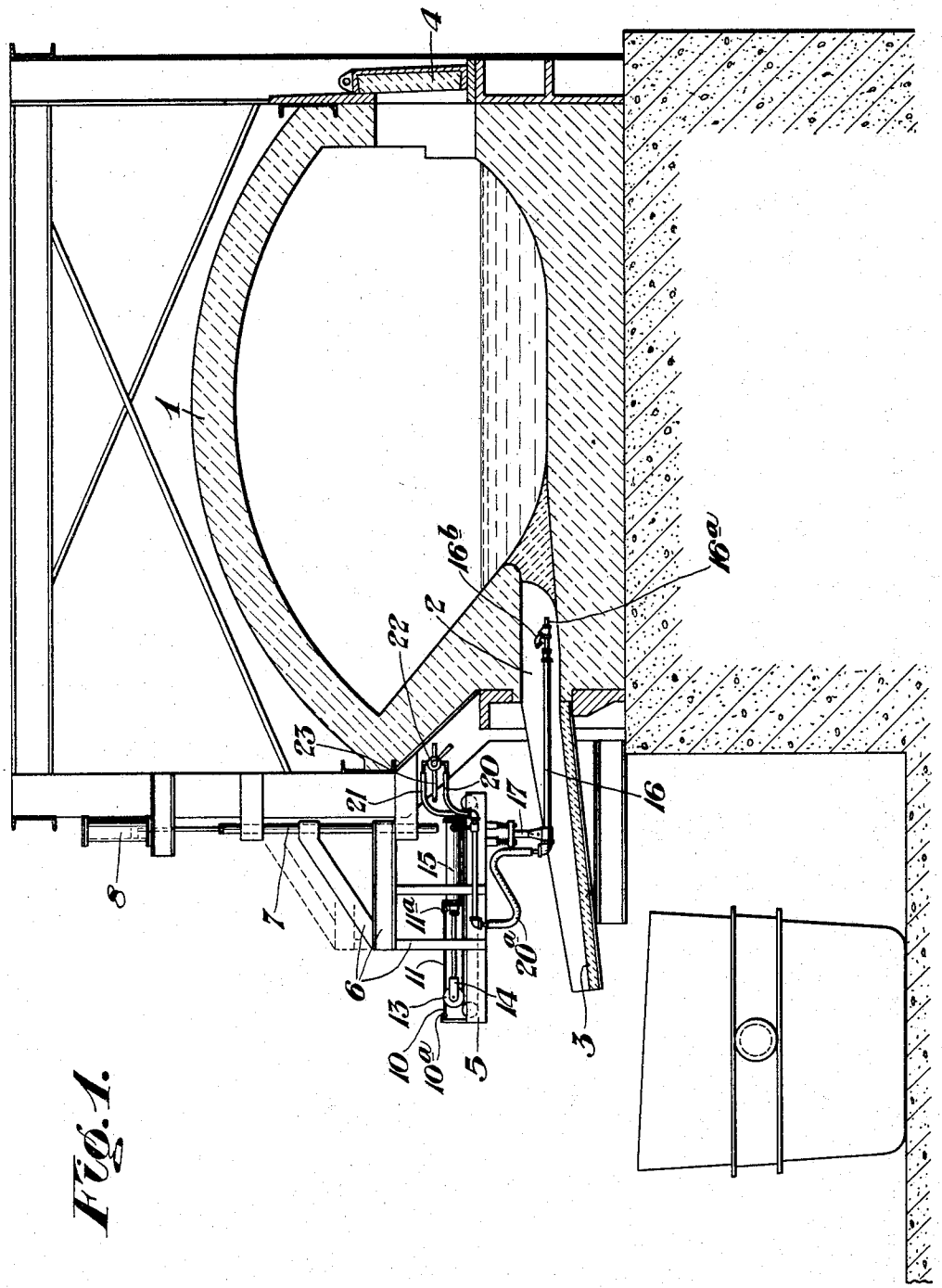

Fig. 1.

Inventor:
WILLIAM C. HOGG,
by: Ussia & Cauber
his Attorneys.

June 18, 1935. W. C. HOGG 2,005,143

TAPPING FURNACE

Filed Oct. 5, 1933 2 Sheets-Sheet 2

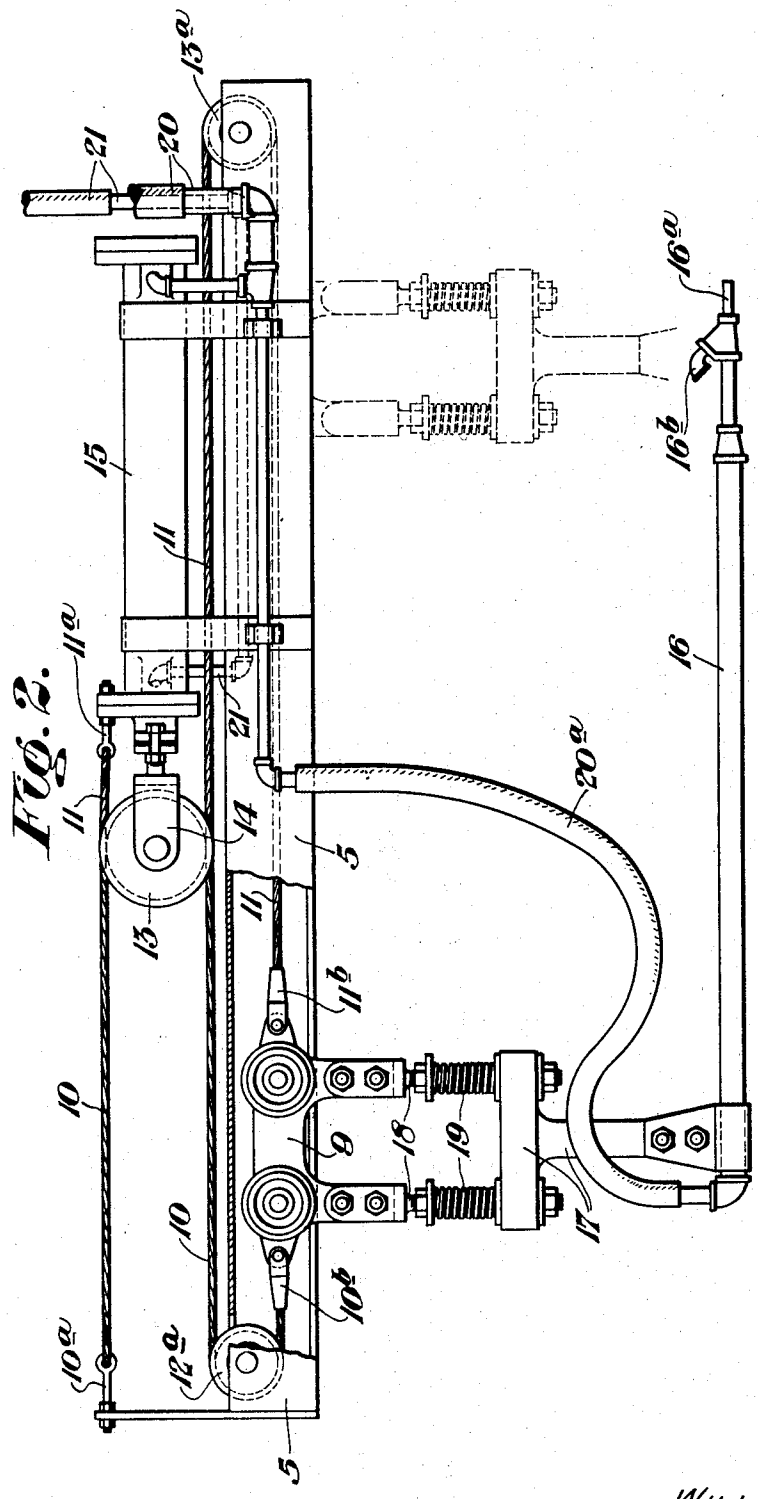

Fig. 2.

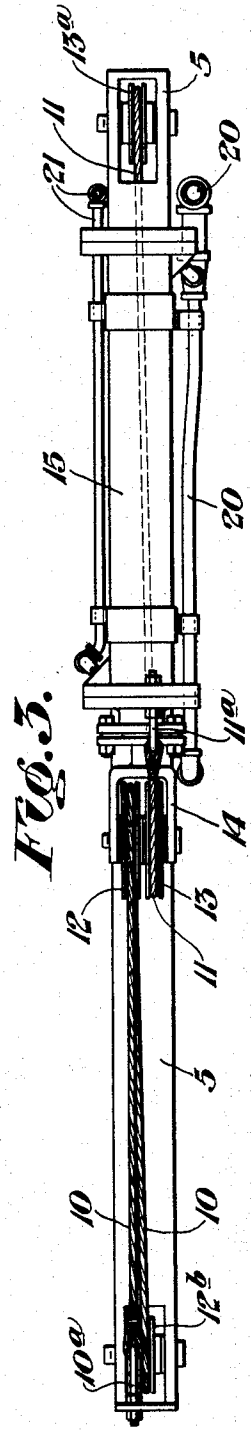

Fig. 3.

Inventor:
WILLIAM C. HOGG,
by: Ussina & Lauber
his Attorneys.

Patented June 18, 1935

2,005,143

UNITED STATES PATENT OFFICE

2,005,143

TAPPING FURNACE

William C. Hogg, Pittsburgh, Pa.

Application October 5, 1933, Serial No. 692,342

6 Claims. (Cl. 266—42)

This invention relates to the tapping of open-hearth furnaces, one of the objects being to perform such an operation in a simplified manner and so that workmen are not subjected to the usual incidental dangers. Other objects may be inferred.

An open-hearth is generally tapped by workmen who climb down into the runner-spout and pick and scrape with tools to clear its tapping-hole. When through to the shell close to the metal, these workmen leave and a long rod is thrust through the charging door. The shell is thereby ruptured and the metal flow started.

There have been several attempts to provide a substitute for the above operation. These have generally contemplated the use of drills, augers, or other cutting implements. Since the tapping-hole is generally closed with dolemite, such tools must be made of expensive tool steel. It frequently happens that the metal flows before these mechanical contrivances can be removed, this destroying the tools and thus excessively increasing maintenance costs. Also, these devices are generally relatively inflexible, so they cannot always follow the sometimes crooked tapping-hole. They have never been particularly successful.

Generally speaking, the present invention consists in the use of a compressed fluid which is impinged against the material closing the tapping-hole. Since this material is of a granular nature, relatively low pressures cause the fluid to penetrate and effect dislodgement. This idea is to be distinguished from that of using an oxygen lance such as is sometimes done when the dolemite shell cannot be ruptured. The new idea is to effect a mechanical removal of the material by compressed fluid.

The accompanying drawings illustrate a specific example of the invention, Figure 1 being a cross-section of an open-hearth furnace showing the tapping operation under way, and Figures 2 and 3 being side and top views of details shown by the first figure.

More particularly, the above illustrate an open-hearth furnace 1 of the usual type having a tapping-hole 2 which opens from its hearth to a runner-spout 3. Opposite the tapping-hole is a charging door 4. No more is described in detail because it is not needed for this disclosure.

It may be assumed that the tapping-hole 2 was filled with dolemite or other material prior to the charging of the furnace. As the furnace operations began the material next to the bath hardened with the shell forming the bottom as a whole. It is the material from the outside of the tapping-hole to this shell which must be removed to permit the metal to run when the latter is punctured by a bar thrust through the door 4.

A horizontal track member 5 is arranged adjacent the tapping-hole 2 for vertical and swinging motion. It may be mounted by a support 6 which is carried by a vertical sliding bar 7, the latter being moved by an air cylinder 8 of the usual construction.

A carriage 9 is reciprocatively mounted by the track member 5. Cables 10 and 11 each have one end fixed stationary, as at 10^a and 11^a, and their other ends fixed to opposite ends of the carriage 9, as at 10^b and 11^b. Pulleys 12 and 13 are provided each of the cables 10 and 11, the latter being reeved thereabout between their stationary ends and the carriage 9. Pulleys 12^a and 13^a are provided to reverse the direction of the cables 10 and 11 to secure a compact construction. A clevis 14 mounts these two pulleys for simultaneous reciprocation. This motion is obtained through the medium of a conventional air cylinder 15 whose plunger rod carries this clevis.

The carriage 9 horizontally mounts a pipe 16 through a bored support 17 and depending rods 18, the support 17 being free to ride upwardly on the latter. Springs 19 restrain such sliding motion yet permit flexible movement of the pipe 16.

A line 20 carries compressed fluid to both the air motor 15 and the pipe 16, the latter being by way of a flexible hose 20^a and the former being in such a manner that it effects forward reciprocation of the pipe 16 towards the tapping-hole 2. A second line 21 carries compressed fluid to the other end of the air motor 15 whereby the pipe 16 is reciprocated away from the hole 2. The two lines 20 and 21 may be controlled by a suitable air valve 22 so that each may be selectively, alternately connected to a fluid supply line 23 or released to the atmosphere. Thus, it is possible to reciprocate the pipe 16 towards the tapping-hole 2, the pipe being supplied with compressed fluid when moving toward the hole and this supply stopped when moving away from the hole.

The pipe 16 has a forwardly directed outlet 16^a and a rearwardly directed outlet 16^b, the compressed fluid being ejected through both these outlets at the same time. It is to be noted

that the pipe 16 and its two outlets may be constructed entirely from ordinary iron pipe and fittings. If these parts be destroyed by their tardy removal from the tapping-hole, their cost of replacement is not great.

In operation, the support 6 is swung around so that the pipe 16 registers with the tapping-hole 2, the assembly having been previously adjusted so that this pipe clears the runner-spout. The valve 22 is then operated so that the pipe is thrust forwardly and compressed fluid simultaneously ejected through its two outlets. The forwardly directed fluid dislodges the material closing the tapping-hole and, as the hole is progressively cleared, the rearwardly directed outlet 16b removes this dislodged material. The fluid may be under a pressure of fifty pounds or greater, seventy-five pounds having been found adequate. It is obvious that the fluid cannot rupture the shell and that there is therefore little chance of a premature delivery of the metal. Should a hard obstruction be encountered, the valve 22 may be operated to reciprocate the pipe 16 and cause the outlet 16a to stroke against the material, this aiding the fluid action.

When the hardened shell close to the metal is reached, the valve 22 is operated to remove the pipe 16 and the air motor 8 operated to raise the rack 6 so that the machine as a whole can be swung clear from the runner-spout 3. Tapping is then completed, in the usual manner. In case of unusual difficulties, the machine may be used for the introduction of oxygen, although it would probably be preferable to use the usual lance.

Where similar conditions exist in other furnaces having a filling of a granular nature in the tapping-role, the invention is applicable.

I claim:

1. A method of tapping an open-hearth furnace which includes impinging a fluid against the granular material closing its tapping-hole, said fluid being under sufficient pressure and of such character as to mechanically dislodge said material.

2. A method of tapping an open-hearth furnace which includes impinging a fluid against the granular material closing its tapping-hole, said fluid being under sufficient pressure and of such character as to mechanically dislodge said material, and creating an outwardly moving fluid flow in said hole of sufficient velocity and of such character as to remove the dislodged material.

3. A furnace tapping machine including the combination of a pipe having a forwardly directed outlet, means for mounting said pipe adjacent a furnace's tapping-hole for longitudinal reciprocation theretowards, and means for supplying said pipe with compressed fluid and simultaneously moving it towards said tapping-hole and for stopping this supply and simultaneously moving said pipe away from said tapping-hole.

4. A furnace tapping machine including the combination of a pipe having a forwardly directed outlet, means for flexibly mounting said pipe in a horizontal position adjacent a furnace's tapping-hole for longitudinal reciprocation there-towards, means for reciprocating said pipe and means for supplying said pipe with compressed fluid.

5. A furnace tapping machine including the combination of a horizontal track member arranged adjacent a furnace's tapping-hole for swinging motion, a carriage mounted by said member, cables each having one end fixed stationary and their other ends fixed to opposite ends of said carriage, a pulley for each of said cables, the latter being reeved thereabout between their fixed ends and said carriage, means for simultaneously reciprocating said pulleys, a pipe horizontally mounted by said carriage and means for supplying said pipe with compressed fluid.

6. A furnace tapping machine including the combination of a horizontal track member arranged adjacent a furnace's tapping-hole for vertical and swinging motion, means for vertically moving said member, a carriage mounted by said member, cables each having one end fixed stationary and their other ends fixed to opposite ends of said carriage, a pulley for each of said cables, the latter being reeved thereabout between their fixed ends and the carriage, a pipe flexibly mounted by said carriage in a horizontal position and having forwardly and rearwardly directed outlets at one end, means for simultaneously reciprocating said pulleys whereby said pipe may be reciprocated towards said tapping-hole, and means for supplying said pipe with compressed fluid when moving toward said tapping-hole and for closing said supply when moving away therefrom.

WILLIAM C. HOGG.