April 17, 1962 F. DONALDSON ET AL 3,030,086

APPARATUS FOR HYDRAULIC MINING

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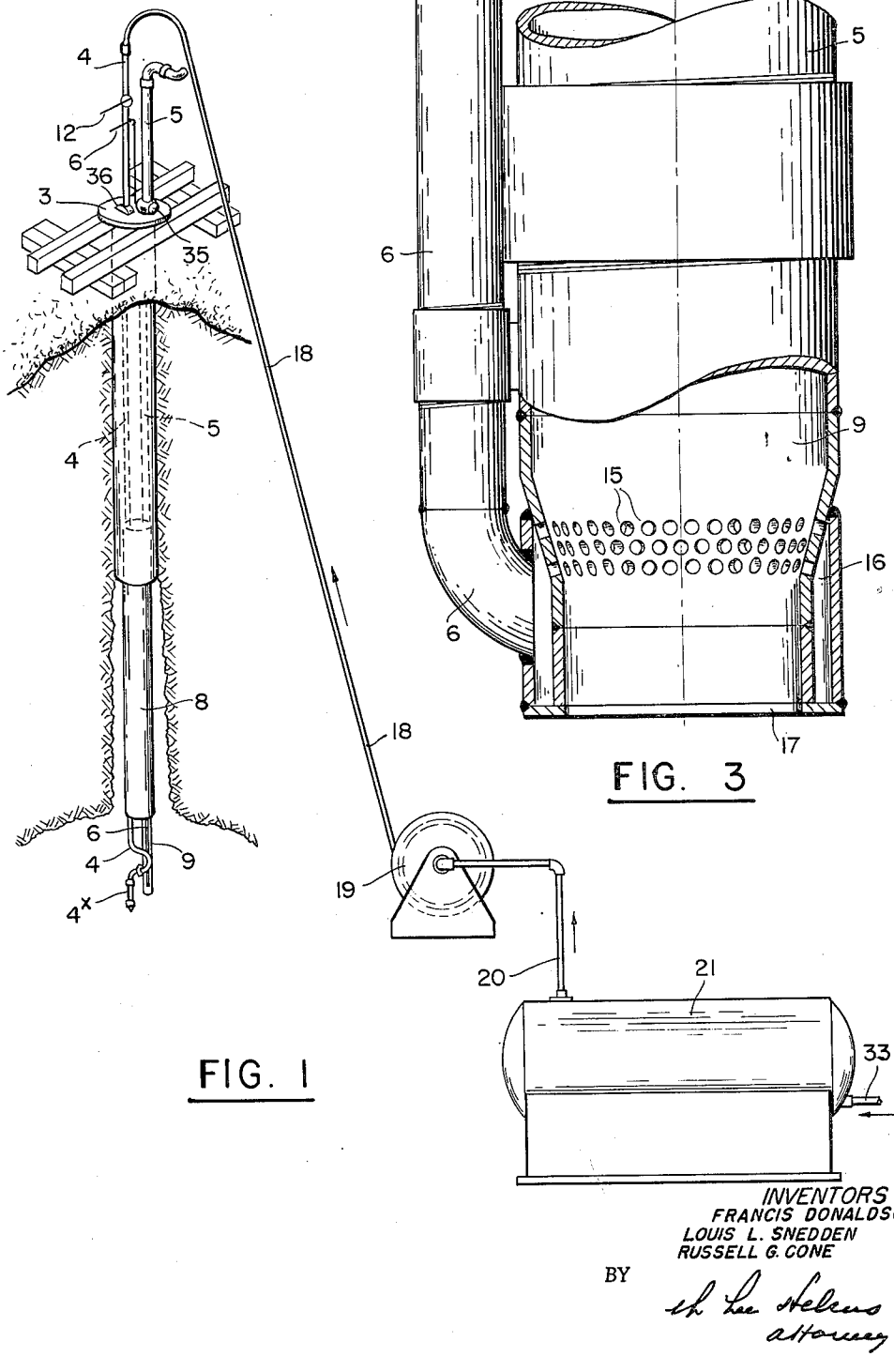


FIG. 1

FIG. 3

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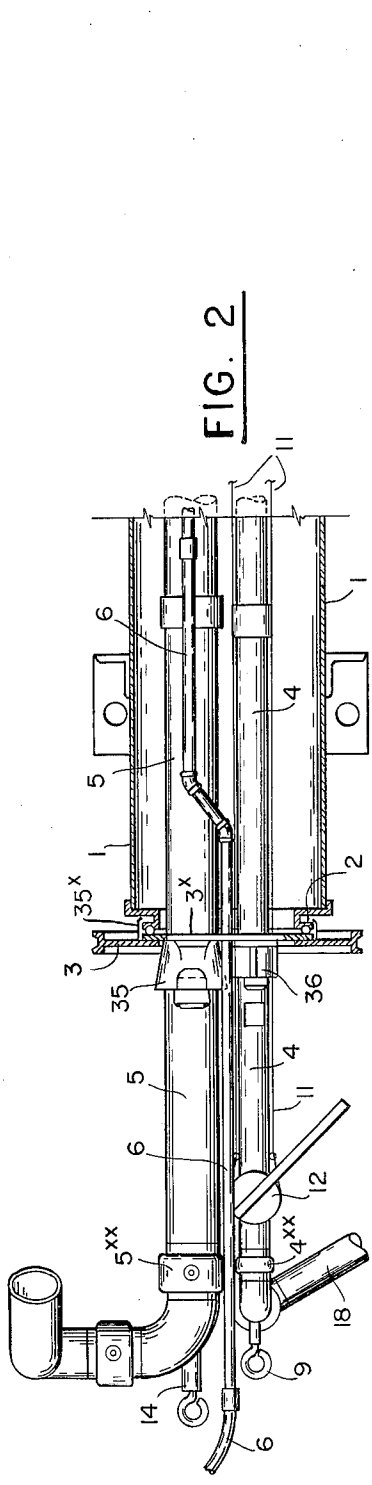


FIG. 2

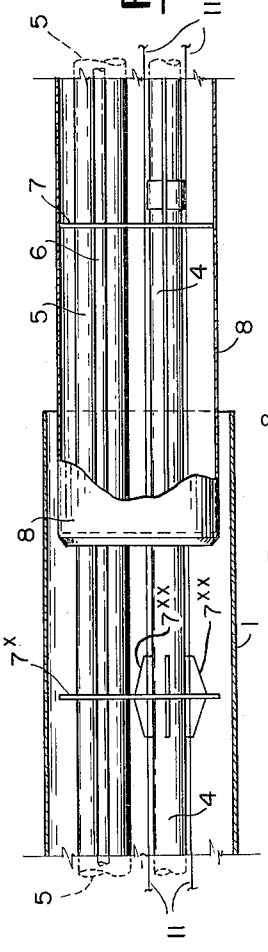


FIG. 2A

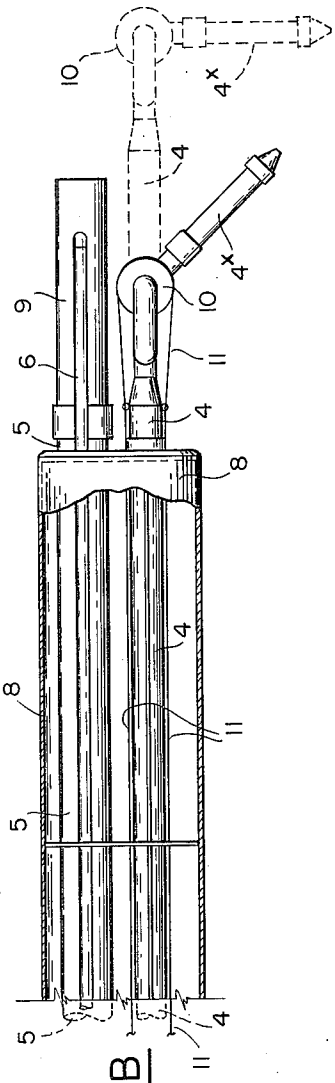


FIG. 2B

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APPARATUS FOR HYDRAULIC MINING

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1 Claim. (Cl. 262—1)

The present invention relates to underground recovery of comminuted ore brought into that state by use of the invention. The characteristic of the invention is the employment of a primary and exterior casing and a secondary tubular "holder" telescoped within the primary casing, a high water pressure jet pipe being projected through diaphragm guides in the said two members, together with an air lift with its air pipe being independently raised and lowered relative to the primary casing and the "holder," and the air lift being associated with a high pressure water nozzle which can be manipulated in an arcuate path to produce a large cavity in the area of the ore deposit. In view of the fact that the casing supplement "holder" may be rotated bodily, the apparatus is able to dig its own shaft, and the high pressure jet loosens and breaks up the ore deposit so that the air lift is enabled to remove the broken-up ore from the cavity in the ore deposit.

The invention will be described with reference to the accompanying drawings in which:

FIG. 1 is a composite view showing, in simplified form, an embodiment of the apparatus, a water chamber, which may be heated if desired, a rotary drum for carrying a high pressure conduit for flexible connection with the water-jet assembly of the apparatus, an earth formation being shown broken away.

FIG. 2 is a view, partly broken away, showing the upper portion of the well apparatus.

FIG. 2A is a like view, showing the middle portion of the well apparatus.

FIG. 2B is a view in longitudinal section, showing the lower portion of the well apparatus.

FIG. 3 is an enlarged view in elevation and partial section, showing the air lift structure for the broken-up ore.

Referring to FIG. 1 and FIG. 2, it will be seen that the well apparatus comprises a tubular casing **1**, having at its top a supporting flange **2**, and above the same is a pulley **3**, the bottom plate of which carries hooks **3x** carrying the said supporting flange **2**. As shown in FIG. 2 bearings are disposed between the top flange **2** of casing **1** and a plate **3x** forming an element of the pulley at its under face. Projected within tubular casing **1** are three primary members which are carried by pulley **3**, so that rotation of the pulley may rotate said members. These three members consist of a high pressure inlet pipe **4** for water, an outlet pipe **5** for removing the comminuted ore, and a high-pressure air pipe **6**, all of which pass through apertures in suitable diaphragms in a lower tubular holder **8**, telescoped within casing **1**.

The members of this rotatable assembly pass through diaphragms, one being shown at **7**, in an inner telescopic tubular holder **8**, through the bottom of which projects the air lift member **9**, which is a continuation of outlet pipe **5**, and also the air pressure pipe **6**. In addition the high pressure water pipe **4** projects through the bottom of tubular holder **8**, and may be raised or lowered relative to the casing and holder. The diaphragm **7x** in the casing **1** is secured to outlet pipe **5** of the air lift and serves as a guide for the pipe **4** which passes freely through said diaphragm, the latter carrying guide fingers **7xx**.

For raising or lowering the high pressure water pipe,

the latter, as shown in FIG. 2, carries a connection **9** for a cable by means of which said pipe **4** may be lowered to its dotted line position FIG. 2B, or to the level desired.

The high pressure water pipe **4** has a swivel connection with nozzle 4X, and the nozzle connection includes a pulley-disk **10**, which may be operated by continuous cable **11** leading around a hand operated grooved driving disk **12**, FIG. 2. By such means the nozzle may be swung from the vertical to angular positions relatively to pipe **4**.

To permit of the rotation of the members carried by pulley **3** and the tubular holder **8**, pipes **4** and **5** will have flexible or double swivel connections at their tops, as indicated by one swivel joint 4XX for pipe **4**, and one at 5XX for pipe **5**.

Like the high pressure water pipe **4**, outlet pipe **5** will carry a lift-cable connection, **14**, by which it may be raised or lowered with the air-lift and tubular holder.

The high pressure air lift at the bottom of pipe **5** consists of an extension of that pipe formed with rows of apertures **15** surrounded by the walls of a chamber **16**, into which high pressure air pipe **6** communicates, the said rows of holes **15** being disposed upwardly of chamber **16** and consequently well above the intake at **17**.

The water inlet for pipe **4** has a swivel connection with any suitable water feed conduit. In this case it is a high pressure hose **18**, the hose being led to a drum indicated diagrammatically at **19**. The hose will be wound about the drum and will have swivel communication with a pope **20** from water supply member **21**. This drum connection with pipe **20**, including the hose **18**, is in accordance with standard high pressure fire-engine connections with hose drums and is well known in hydraulic feeds, requiring no detailed explanation. The arrangement enables raising and lowering the well apparatus relatively to casing **1** without disconnection of high pressure water feed, and it will be understood that the arrangement in FIG. 1 is merely schematic.

It will be understood that the air pipe **6** will lead to a source of air under high pressure, and that a suitable high pressure pump will be interposed in the water feed line. Also it will be understood that the high pressure air lift, with its air pipe will be secured to the diaphragms in the telescopic holder **8** as by frictional-press engagement therewith, or otherwise. The high pressure water pipe with its nozzle may pass freely through apertures in said diaphragm so as to be raised and lowered. By raising and lowering the air lift after its claim **36** has been released the telescopic holder **8** will correspondingly be raised and lowered and will constantly afford a protective shield for the three pipes.

In the operation of the method a shaft of suitable depth will be dug into the ground overlying an ore area. Thereupon the apparatus is put into action whilst being lowered, with its casing **1**, into the ground as the high pressure water jet and withdrawal of the dislodged aggregate continues. When the overlying earth deposit is fairly friable, it will not be usually necessary to rotate the apparatus, and the nozzle may be disposed at a slight angle. When the ore deposit is reached, this is readily determined by the character of the material withdrawn from pipe **5**, and that pipe may be connected by its outer section to a recovery chamber. At this point a belt leading from the pulley **3** to a power drive therefor will effect rotation of the members within casing **1** and hence the nozzle 4X. In its rotation the nozzle may be progressively moved to and from the horizontal, and the telescopic holder **8** may step by step be lowered as the broken-up ore is removed. Before each step of said lowering, clamps carried by pulley **3** for the outlet pipe **5** and water pipe **4** are released, as hereinafter set forth. These clamps may be of any usual form and their specific construction is not

claimed herein, nor details shown. When greater depths of ore deposits are encountered, then the depth for which the initially applied well apparatus is proportioned, pipes 4 and 5 may be made longer by threaded-in sections, and the tubular holder 8 likewise may be elongated by corresponding applied sections, as well as sections added to the primary casing, if desired.

In FIG. 2 we have indicated at 35 the position of any desired form of releasable clamp between pulley member 3 and the outlet pipe 5 (the air pipe 6 being carried by said outlet pipe). In addition, we have indicated at 36 the position of any desired form of releasable clamp carried by pulley 3 for the high pressure water pipe 4. By releasing these clamps these pipes may be lowered or raised, with the telescopic holder 8 when the outlet pipe 5 is lowered or raised, and may be removed for adding sections, when required. The purpose of connecting the outlet pipe 5 to one or more diaphragms of the telescopic holder is to enable raising and lowering of that holder by applying corresponding movements, up or down, of the outlet pipe itself. However, any of the members passed through the telescopic holder 8 may be selected for securing to the telescopic holder and, of course, will accomplish the same purpose.

Having described our invention, what we claim and desire to secure by Letters Patent is as follows:

An apparatus for hydraulic mining, comprising an outermost casing and at least one tubular holder telescoped therewith, a plurality of apertured diaphragms within and carried by said tubular holder, an outlet pipe, a high pressure air pipe and a high pressure water pipe passed through the apertures in said diaphragms, one of said pipes being held by at least one of said diaphragms, whereby upon longitudinal movement of said pipe the tubular holder may be raised and lowered relatively to the casing, an air lift connected to a lower end of the outlet pipe and communicating with said high pressure air pipe, a nozzle pivoted to the lower end of said high pressure water pipe, means for operating said nozzle to move it in an arcuate path and including a cable led interiorly of the tubular holder and casing, bearing means carried by said casing at its top, a rotatable member above and engaging said bearing means, clamps carried by said rotatable member for engaging a plurality of said pipes, and means for rotating said rotatable member for imparting rotation to said tubular holder by means of at least one of said pipes in its engagement with at least one of said diaphragms.

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