Oct. 22, 1957 H. B. FEHLMANN 2,810,547

INSTALLATION FOR MAKING A BOREHOLE IN A STRATUM

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Fig.1

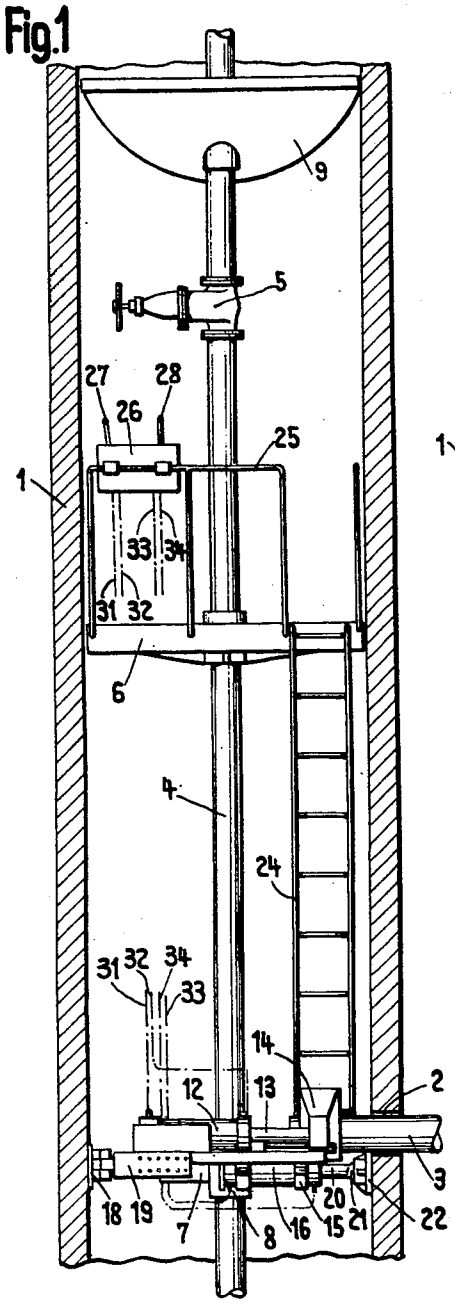
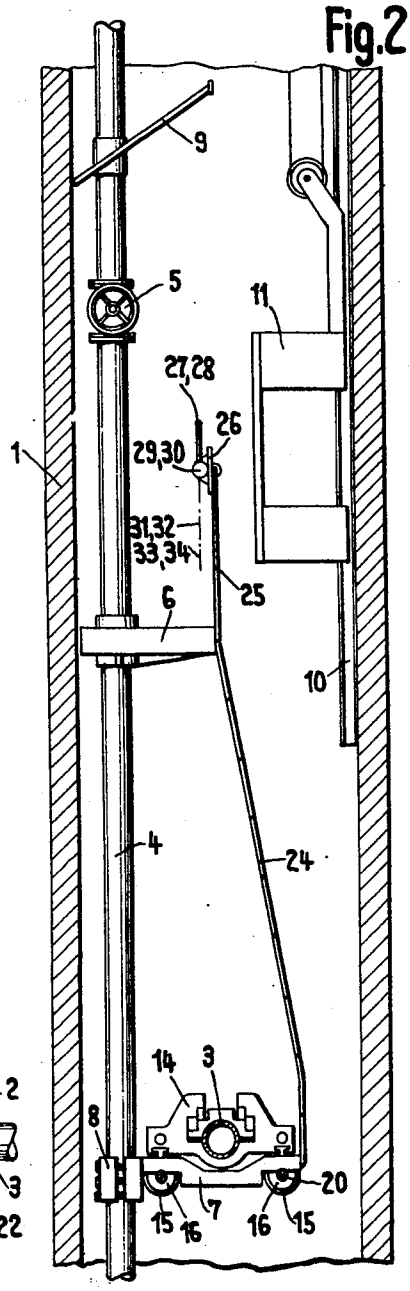


Fig.2



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Fig. 3

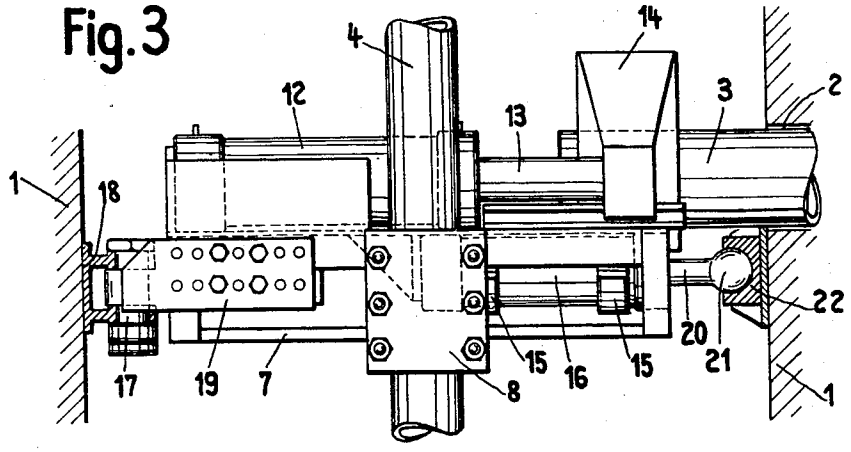
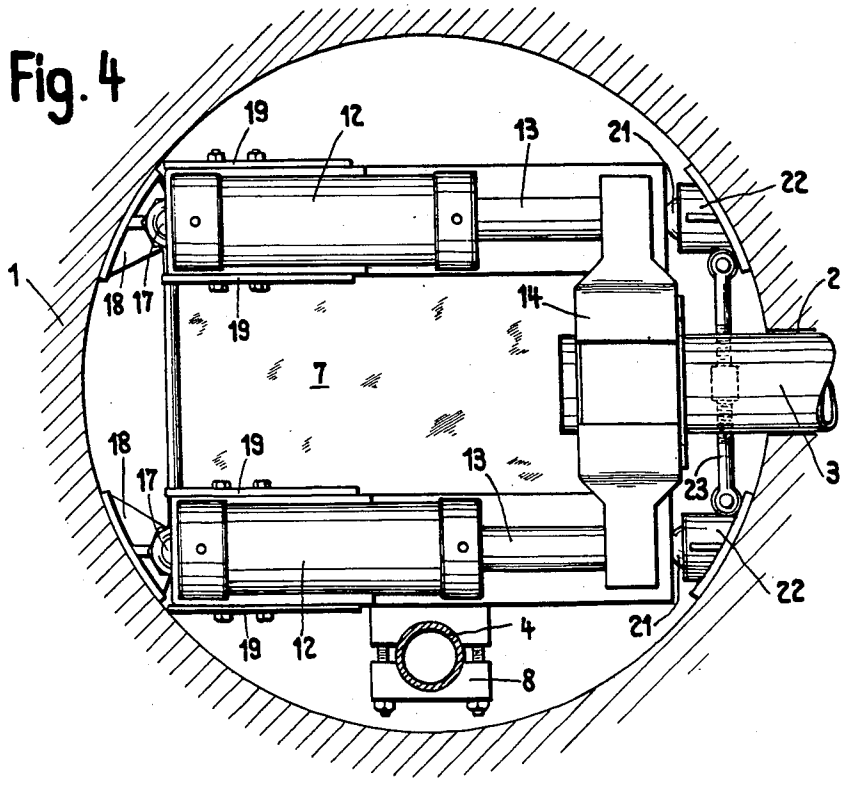


Fig. 4



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INSTALLATION FOR MAKING A BOREHOLE IN A STRATUM

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Fig.6

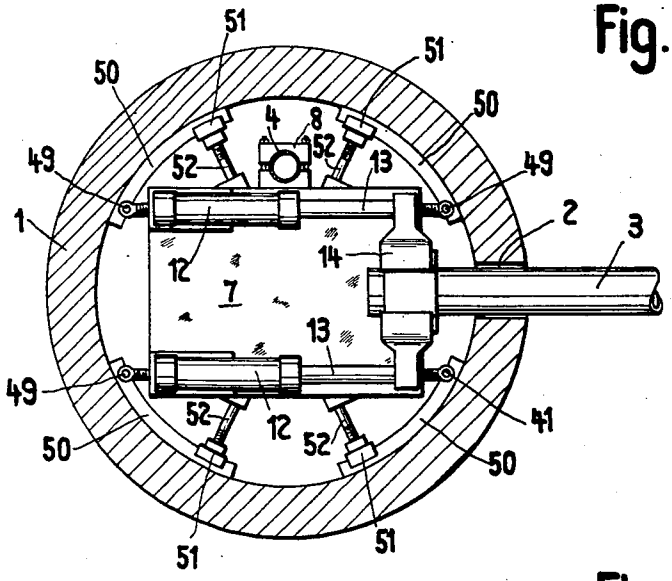
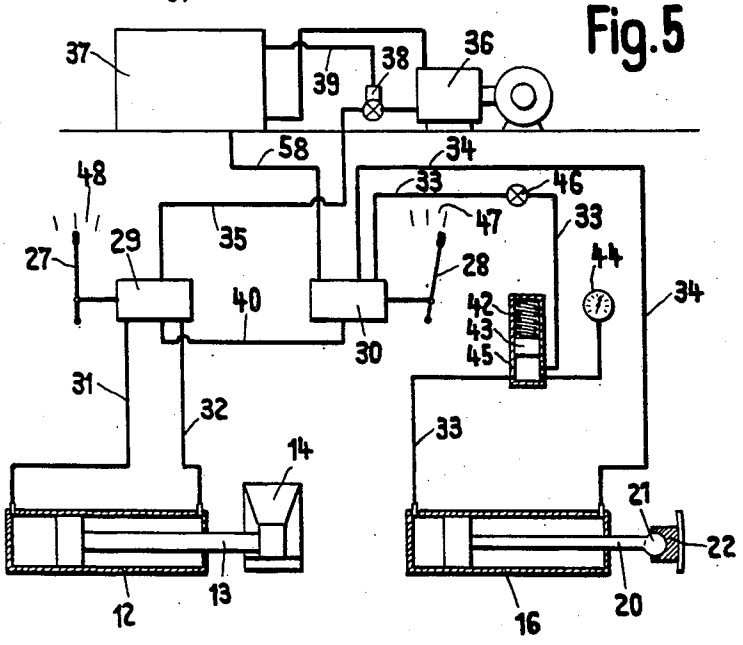


Fig.5



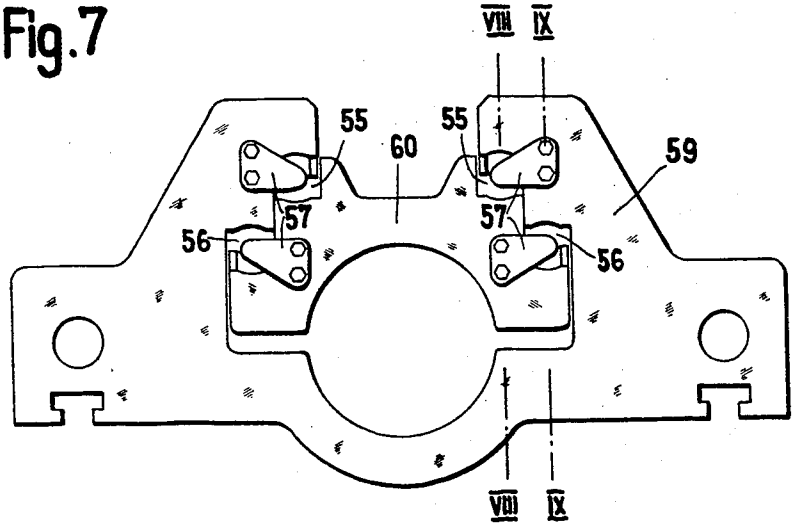
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Fig.7



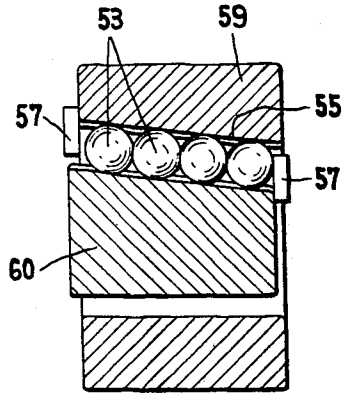


Fig.8

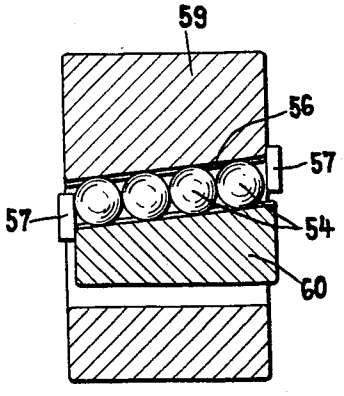


Fig.9

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INSTALLATION FOR MAKING A BOREHOLE IN A STRATUM

Hans Beat Fehlmann, Bern, Switzerland, assignor to A. G. fur Grundwasserbauten, Bern, Switzerland

Application February 24, 1954, Serial No. 412,344

Claims priority, application Germany May 2, 1953

4 Claims. (Cl. 255—1)

This invention relates to an installation for making a borehole in a subterranean formation or earth material or any other stratum across the wall of a casing sunk into the stratum, as, for instance, for making water handling installations for instance where for instance imperforate and/or perforate tubes are advanced in the stratum.

Up till now, one or more hydraulic drive presses and the control station therefor have been mounted on a single platform close to the casing floor or on the casing floor itself. Because sufficient space had to be available on that single platform or on the casing floor for the entire equipment, for the whole operating crew and for economical stroke lengths of the drive presses, boring operations could hitherto only be made in casings with large diameters of for instance three meters. Boring operations in casings with diameters of the order of two meters or less were impossible in an economical manner with the well-known installations in that there was no sufficient space available in one and the same cross section of the casing.

The invention remedies these inconveniences and allows also economical boring to be executed in casings with small diameters of the order of 1.5 meters and less, that is, down to a minimum diameter at which economical stroke lengths of the presses are just possible.

An object of the invention is to provide for an installation in which the advance set of one or more hydraulic presses and the control station therefor are distributed on two or more superposed platforms.

Another object of the invention is to distribute on said superposed platforms also a clamping device such as one or more hydraulic clamping presses and the control post therefor.

A further object of the invention is to make said superposed platforms part of a rotatable and up-and-down movable elevator.

Other objects and features will be apparent as the following description proceeds, reference being had to the accompanying drawings, illustrating by a non-restrictive way of example an embodiment of the invention, and wherein:

Fig. 1 is a partially sectional elevation of a portion of the casing and the elevator,

Fig. 2 is an elevation similar to Fig. 1 but in a plane turned by 90°.

Fig. 3 is a detail of Fig. 1 on a larger scale.

Fig. 4 is a plan view of the drive presses on a larger scale,

Fig. 5 shows the diagram of the hydraulic control of the drive and the clamping presses.

Fig. 6 is a cross sectional view of the casing and a plan view of a mechanical clamping device.

Fig. 7 is a front view of a clutch for coupling the tube to be advanced with the drive presses.

Fig. 8 is a sectional view taken along line VIII—VIII of Fig. 7, and

Fig. 9 a sectional view taken along line IX—IX of Fig. 7.

Referring now to Figs. 1 and 2 a casing 1 with a diameter of the order of 1.5 meters is sunk into a subterranean formation or earth material or any other stratum and comprises one or more orifices 2 lying on the same or different levels above the casing floor (not shown). The orifice 2 is traversed by an imperforate or perforate tube 3 which is to be advanced in the stratum by means of the installation according to the invention. An iron or steel riser conduit 4 having a valve 5 extends downwardly to a pump (not shown), for instance a borehole pump for delivering to the top the liquid such as water, oil or the like originating from the stratum and being collected in the casing 1. The upper end of the riser 4 is connected with a flexible conduit (not shown) leading to the top. An upper platform 6 is fixed to the riser 4 for instance by means of a clamping device such as a pipe clamp or the like. At a distance from the upper platform 6 a lower platform 7 is mounted on the riser 4 by means of a pipe clamp 8. The releasable clamp 8 allows changing the distance between the platforms 6 and 7 if desired. Riser 4 and platforms 6 and 7 form together a rotatable, up-and-down movable elevator which may be permanently or transiently suspended in a manner not shown on a crane or another lifting equipment arranged aboveground. In order to form an elevator, the platforms 6 and 7 may also be connected with each other by another connecting means than the riser 4. Above the valve 5 a shelter 9 is fixed to the riser 4. Referring to Fig. 2, at the side away from the riser 4 (Fig. 2) a lift 11 for people and material runs along a rail 10, this lift being of special advantage when working in deep casings having a depth of for instance hundred meters and more.

Referring particularly to Figs. 3 and 4 of the drawings, two hydraulic drive presses 12 connected in parallel to each other are mounted on the lower platform 7, the pistons 13 of which are connected with each other by means of a coupling clutch 14. With the exception of Figs. 7 to 9 this combination of drive presses and a coupling clutch is described and illustrated in U. S. Patent No. 2,687,281, filed November 7, 1950. During an advance stroke the tube 3 to be advanced in the stratum is automatically clamped fast to the coupling clutch 14 and is released from the clutch 14 during the idle return stroke of the presses 12.

Beneath the drive presses 12 two clamping presses 16 connected in parallel to each other are suspended on the lower platform 7 by means of straps 15 (Fig. 3). Clamping shoes 18 (Figs. 3 and 4) rotatable about pins 17 are fixed to the frame of the clamping presses 16 by means of perforate plates 19 in a manner to be adjustable in the direction of the stroke of the presses 16. That adjustability of the clamping shoes 18 allows the clamping device to be adapted to casings of different diameters. The outer end of the piston 20 of each clamping press 16 carries a ball 21 forming a ball joint with a clamping shoe 22 mounted on the ball 21. Referring to Fig. 4, the clamping shoes 22 of both presses 16 are connected with each other by a guide rod 23 articulated to the shoes so that appropriate contact of both clamping shoes 22 with the inner wall surface of the casing 1 is guaranteed.

Referring to Figs. 1 and 2, a ladder 24 leads from the lower platform 7 to the upper platform 6. A control board 26 fixed to the balustrade or railing 25 of the upper platform 6 comprises control levers 27 and 28 and valves 29 and 30 for the drive presses 12 and the clamping presses 16 respectively. As especially seen in the diagram of Fig. 5, flexible conduits 31, 32 and 33, 34 lead from the valves 29 and 30 respectively to the presses 12 and 16 respectively. A flexibile conduit 35 extends to the control board 26 from a delivery pump 36 provided aboveground and fed by an oil tank 37 likewise disposed aboveground (Fig. 5). The valve 5 (Fig. 1)

is easily attainable and operable by an operator staying on the platform **6**.

As shown in the drawings and described above, the various parts of the equipment are distributed in such a way on two superposed platforms **6**, **7** of an elevator that the lower platform **7** carries the drive presses **12** and the clamping presses **16**, the upper platform **6**, however, the control station and post for these two press sets.

The control operations will now be described with reference to Fig. 5. After the elevator **4**, **6**, **7** has been lowered in the casing **1** by means of the crane (not shown) to the desired level and after the elevator has, if necessary, been rotated by means of the crane until the axis of the clutch **14** coincides with the axis of the orifice **2**, the control lever **28** is moved from its middle position to the right-hand division of the graduation **47** (position in Fig. 5) while the control lever **27** for the drive presses **12** remains in the middle out of operation position. In this control position the pump **36** delivers pressure medium (e. g. oil, water) through the conduit **35** (whose pressure-reducing valve **38** is connected to a return conduit **39** leading to the oil tank **37**), further through the valve **29**, the conduit **40**, the valve **30** and through the conduit **33** to the left-hand cylinder space of the clamping presses **16** so that the pistons **20** press the clamping shoes **22** and therewith the shoes **18** onto the inner wall surface of the casing **1** whereby the elevator **4**, **6**, **7** is clamped fast on the casing in the desired position. During this "clamping" stroke of the presses **16** oil flows from the right-hand cylinder space through the conduit **34**, the valve **30** and the conduit **58** to the tank **37**. A cylinder **45** is inserted in the conduit **33** and comprises a piston **43** loaded by a spring **42** to guarantee the maintenance of the pressure in the conduit **33**. The oil pressure in the cylinder **45** below the piston **43** can be read on the pressure gage **44** and may for instance amount to 300 atmospheres.

After the elevator **4**, **6**, **7** having been clamped fast to the casing wall in the above-described manner, the shut-off valve **46** of the conduit **33** is closed and afterwards the control lever **28** is brought in line with the middle division of the graduation **47** in Fig. 5. Now, admission from valve **30** to conduit **33** is interrupted and the presses **16** are thereby secured in the clamping position. When the tube **3** is now to be advanced in the stratum, lever **27** is moved to the right-hand division of the graduation **48**. Now, the pressure medium flows from the pump **36** through the conduit **35**, the valve **29** and the conduit **31** to the left-hand cylinder space of the drive presses **12** so that the pistons **13** move the coupling clutch **14** with the tube **3** clamped fast to the latter towards the right in Figs. 1 and 4, whereby the tube **3** is advanced in the stratum. During this advance stroke pressure medium exhausted from the right of cylinder **12** flows through conduit **32**, valve **29**, conduit **40**, valve **30** and conduit **58** to the tank **37**. The advance stroke having been completed the control lever **27** is returned to the middle division of the graduation **48** whereby admission of pressure medium to the drive presses **12** is interrupted. After having released the clutch **14** from the tube **3** for instance in the manner described in the above-mentioned Patent No. 2,687,281, the control lever **27** is moved to the left-hand division of graduation **48**, that is, to the return position for the drive presses **12**. The pressure medium now flows from the conduit **35** through valve **29** and conduit **32** to the right-hand cylinder space of the drive presses **12**, while medium returns from the left-hand cylinder space through the conduit **31**, valve **29**, conduit **40**, valve **30** and conduit **58** to the tank **37**. Therefore, the pistons **13** of the drive presses **12** move towards the left in Figs. 4 and 5 and take the clutch **14** with them along the tube **3**, which remains now at rest, to the initial position for a further advance stroke. For this further advance stroke, the control lever **27** is again moved to the right-hand division of the graduation **48** so that the pistons

of the drive presses **12** together with the clutch **14** move again towards the right and the clutch **14** is again automatically clamped fast to the tube **13**, as described in the above-mentioned Patent No. 2,687,281. After the advance of the tube **3** having been completed changes as described later on with reference to Figs. 7 to 9 are made on the clutch **14** and, afterwards and if desired, the tube **3** can be withdrawn in the same manner as it has previously been advanced, while the clutch **14** now clamps in the return direction.

When the elevator **4**, **6**, **7** must be rotated and/or lifted or lowered in order to advance a tube through another orifice **2** of the casing **1**, the clamping action of the presses **16** must at first be interrupted. For that purpose the control lever **28** is moved from its middle position to the left-hand division of the graduation **47** and afterwards the valve **46** is opened. In that position pressure medium flows from the valve **30** through the conduit **34** to the right-hand cylinder space of the clamping presses **16** and moves the pistons **20** to the left in Fig. 5, while oil returns from the left-hand cylinder space through the conduit **33**, the valve **30** and the conduit **58** to the tank **37**. The clamping pressure between the shoes **18**, **22** and the casing wall is thereby done away with and the lever **28** is returned to its middle position. The elevator can now be moved.

The construction of the valves **29** and **30** does not necessitate further explanation in that it is quite comprehensible to a man skilled in the art when he follows the above description of the control operations. It is only to be mentioned that the supply of pressure medium from the conduit **35** to the valve **30** is in no position of the lever **27** interrupted by the valve **29**.

The presses **12** are connected in parallel to each other and it is the same for the presses **16**. Though the diagram of Fig. 5 is shown for only one press **12** and only one press **16**, no fundamental change is to be made in that diagram for presses connected in parallel. The difference resides only in the fact that the conduits **31**, **32**, **33** and **34** are each divided into two branches before entering the presses **12** and **16**.

The two clamping presses **16** may however also be arranged in a manner to be controllable independent from each other.

Fig. 6 shows a mechanically controlled clamping device so that clamping presses are omitted. Clamping shoes **50** are articulated to the lower platform **7** by means of pins **49**. Screw nuts **51** of the shoes **50** engage rotatable threaded spindles **52** articulated to the platform **7**. By rotating the spindles **52** in the one or the other direction for instance by means of wrenches or levers the clamping shoes **50** can be swung about the pins **49** in order to clamp fast the elevator or to release it.

Each of the platforms may also be separately rotatable and movable in axial direction and separately fixable (by clamping, for instance) to the casing wall, while the platforms may either be suspended separately or commonly on a lifting equipment such as a crane for instance. Each of these separately adjustable platforms may for instance have a clamping device as shown in Figs. 1 to 4 or 6. Also in the case of separately movable platforms the hydraulic clamping presses of each or of all platforms may be controllable separately or commonly.

While the manner of operation of the coupling clutch shown in Figs. 7 to 9 is principally the same as of the clutch shown and described in the above-mentioned U. S. Patent No. 2,687,281 it is distinguished from the latter in that it is double-acting. While the clutch of Patent No. 2,687,281 must be turned by 180° when changing from the advance to the return movement of the clutch, such turning of the novel clutch of Figs. 7 to 9 is not necessary. My novel clutch has either an exchangeable double series or two double series of transmission balls **53** and **54** respectively, the ones for the advance and the others for the return movement of the

tube 3. While the balls 53 in Fig. 8 lie in two channels 55 inclined from the top on the left to the bottom on the right and formed by the member 59 fixed to the pistons of the drive presses 12 and by the member 60 movable relatively to member 59, the balls 54 of the other series (Fig. 9) are arranged in two reversely inclined channels 56 also formed by the members 59 and 60. For the advance of the tube 3 the balls are removed from the return channels in that the corresponding stop plates 57 for these balls are unscrewed so that the balls can escape. The balls in the advance channels can then work by their elastical compressibility in the same way as described in the above-mentioned U. S. Patent No. 2,687,281. For return movement the balls are removed from the advance channels and these or other balls are inserted in the return channels.

The above described novel clutch is especially well suited in casings with small diameters where turning the clutch by 180° is very difficult owing to the small space available.

Many changes may be made in the described installation while retaining its features and operating principles.

I claim:

1. In an installation for making a borehole in a stratum, a casing sunk into the stratum, a radial orifice in the wall of said casing, a boring tube traversing said orifice and movable outwardly therefrom, a rotatable and up-and-down movable supporting structure in said casing including a riser conduit and two superposed platforms mounted on said riser conduit at a distance from each other, two hydraulic advance presses mounted on the lower of said platforms, a coupling clutch for connecting said boring tube with said hydraulic advance presses, control means for actuating said hydraulic advance presses provided on the upper of said platforms, two hydraulic clamping presses mounted on the lower of said platforms, clamping shoes swingingly connected with said clamping presses and adapted to be pressed against the wall of said casing, and control means for actuating said clamping presses provided on the upper of said platforms.

2. In an installation for making a borehole in a stratum, a casing sunk into the stratum, a radial orifice in the wall of said casing, a boring tube traversing said orifice and movable outwardly therefrom, a rotatable and up-and-down movable supporting structure in said casing including a riser conduit and two superposed platforms mounted on said riser conduit, hydraulic advance means mounted on the lower of said platforms, a coupling clutch for connecting said boring tube with said hydraulic advance means, control means for actuating said hydraulic advance means provided on the upper of said platforms, hydraulic clamping means mounted on the lower of said platforms including a clamp swingingly connected with said hydraulic clamping means adapted to be hydraulically pressed against the wall of said casing, and control means for actuating said hydraulic clamping means provided on the upper of said platforms.

3. In an installation for making a borehole in a stratum, a casing sunk into the stratum, a radial orifice in the wall of said casing, a boring tube traversing said orifice and movable outwardly therefrom, a rotatable elevator axially adjustable in said casing including two superposed platforms, hydraulic advance means mounted on the lower of said platforms, coupling means for connecting said boring tube with said hydraulic advance means, control means for actuating said hydraulic advance means provided on the upper of said platforms, hydraulic clamping means mounted on the lower of said platforms including a clamp adapted to be hydraulically pressed against the wall of said casing, and control means for actuating said hydraulic clamping means provided on the upper of said platforms.

4. In an installation for making a borehole in a stratum, a casing sunk into the stratum, an orifice in the wall of said casing, a boring means traversing said orifice and movable outwardly therefrom, an elevator axially adjustable in said casing including two superposed platforms, advance means mounted on the lower of said platforms, coupling means for connecting said boring means with said advance means, control means for actuating said advance means provided for the upper of said platforms, clamping means mounted on the lower of said platforms including a clamp adapted to be pressed against the wall of said casing, and control means for actuating said clamping means provided for the upper of said platforms.

References Cited in the file of this patent

UNITED STATES PATENTS

65,801	Elliot	June 18, 1867
140,173	Thomas et al.	June 24, 1873
1,179,491	Ammon	Apr. 18, 1916
2,143,848	Gilman	Jan. 17, 1939
2,274,431	Renner	Feb. 24, 1942
2,383,496	Nebolsine	Aug. 28, 1945
2,397,755	Schwab	Apr. 2, 1946
2,419,711	Dillon	Apr. 29, 1947
2,570,039	Stone	Oct. 2, 1951

FOREIGN PATENTS

545,319	France	Oct. 10, 1922