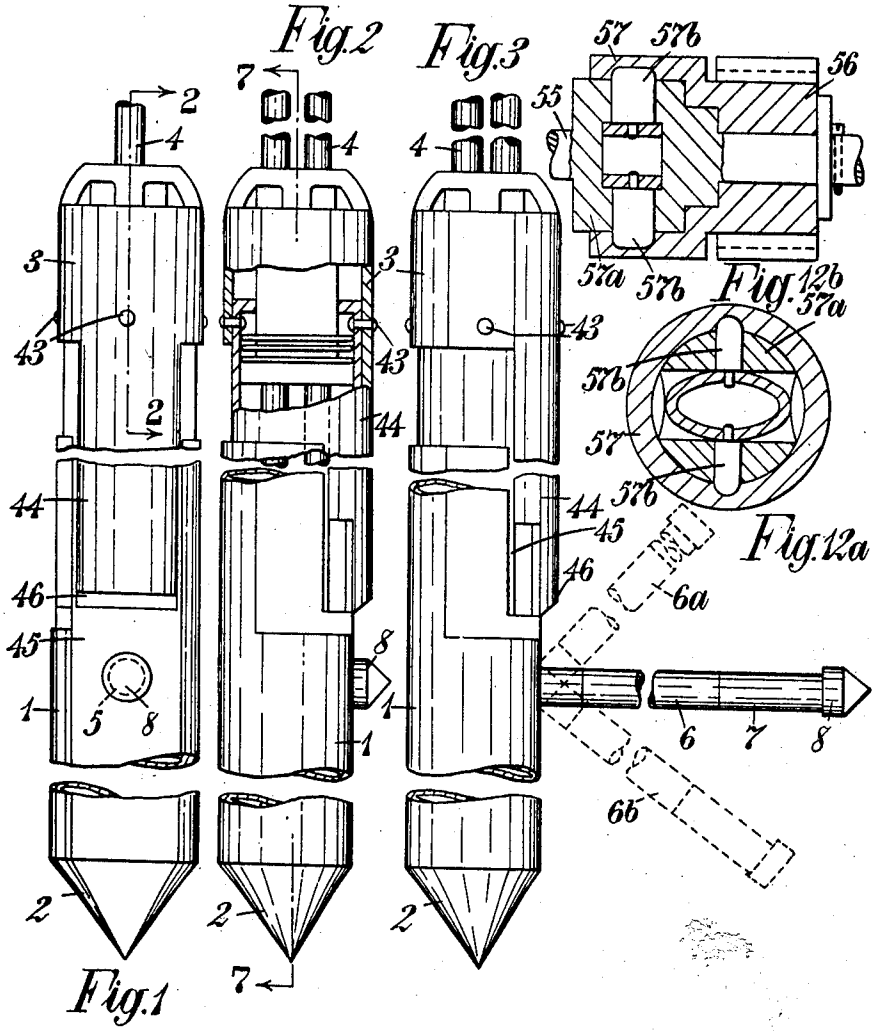
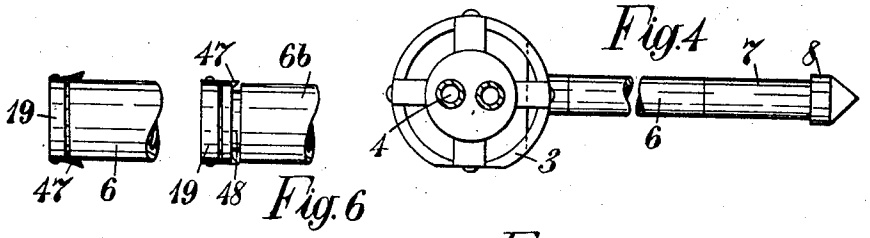
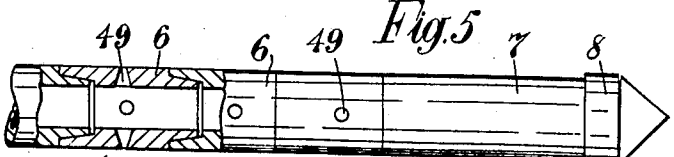
Feb. 14, 1939. V. PÉRÉBASKINE ET AL 2,147,214

APPARATUS FOR BORING

Filed Sept. 15, 1936 4 Sheets-Sheet 1







V. Pére'baskine, P. Gravirowsky & S. Nikitine
INVENTORS

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APPARATUS FOR BORING

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Fig. 7.

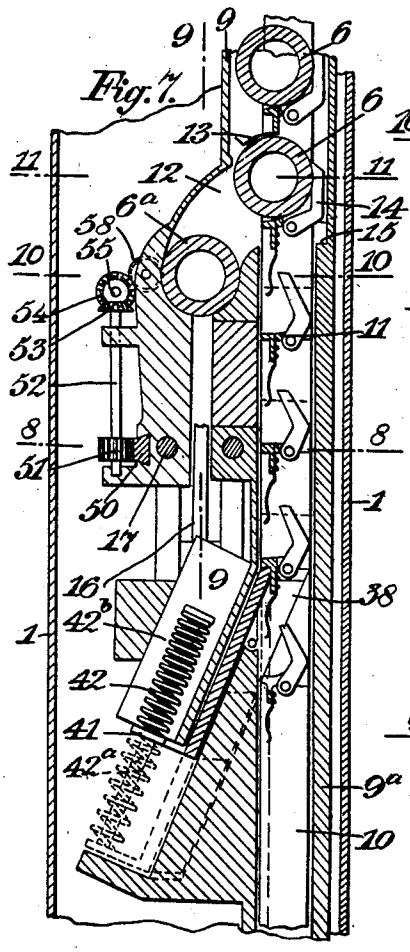


Fig. 9

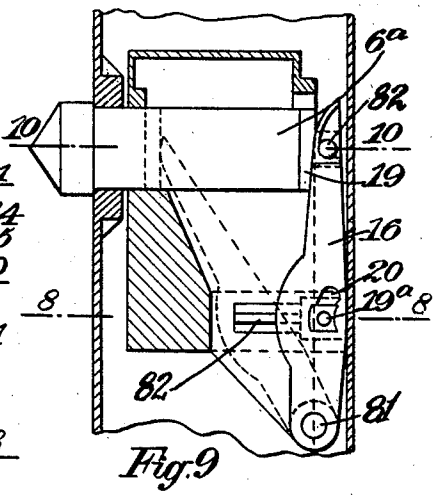


Fig. 10

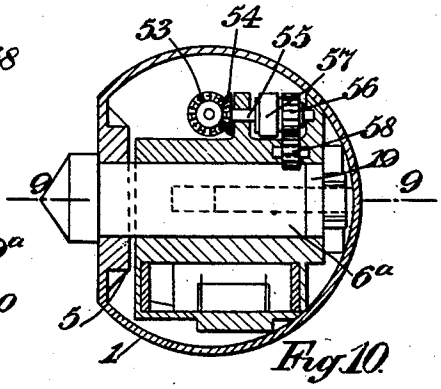


Fig. 8.

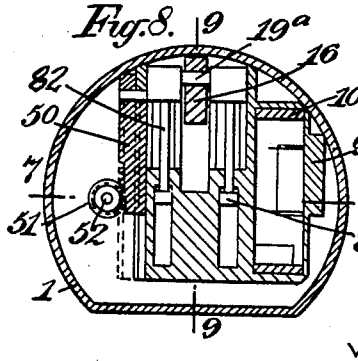


Fig. 12.

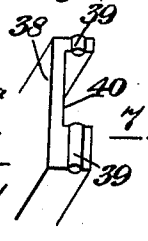
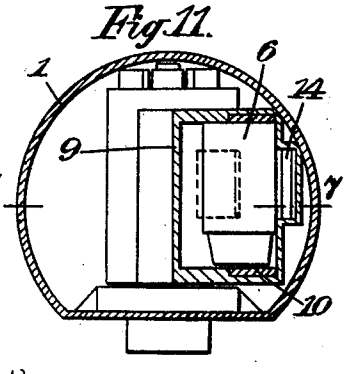


Fig. 11.



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APPARATUS FOR BORING

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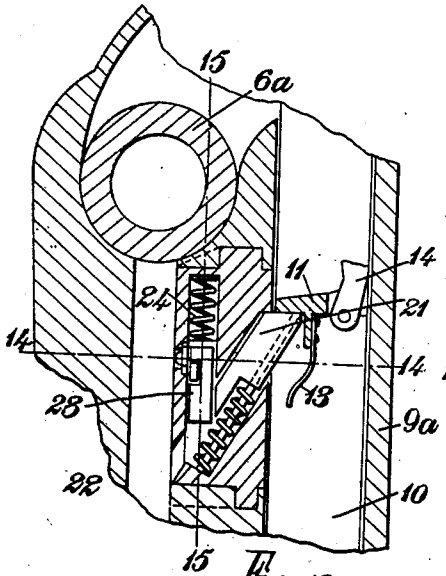


Fig.13.

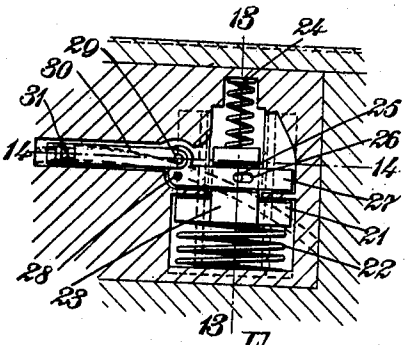


Fig.15.

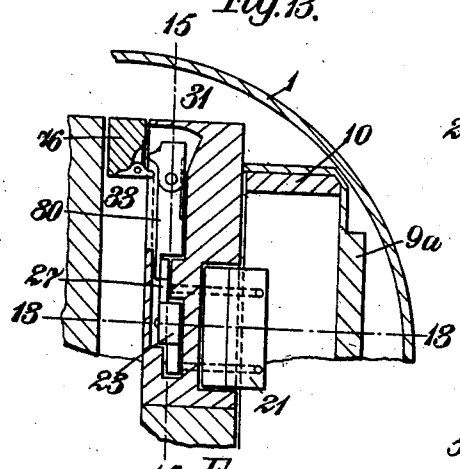


Fig.14.

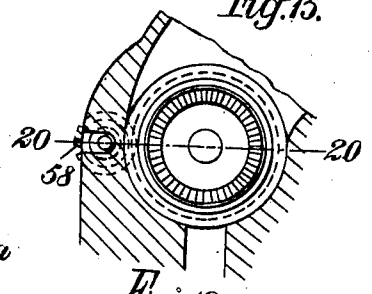


Fig.19.

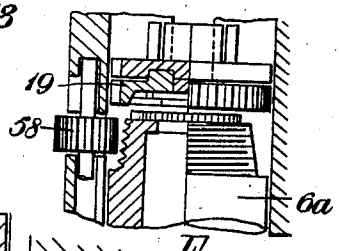


Fig.20.

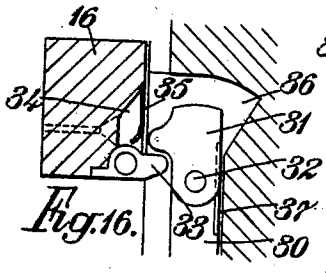


Fig.16.

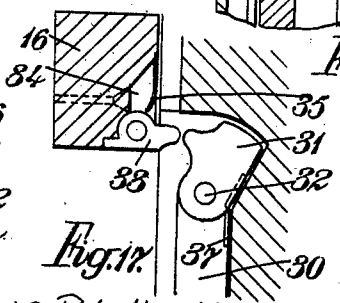


Fig.17.

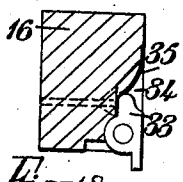


Fig.18.

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APPARATUS FOR BORING

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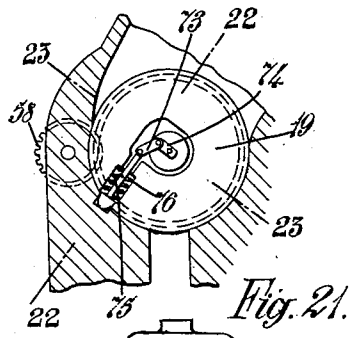


Fig. 21.

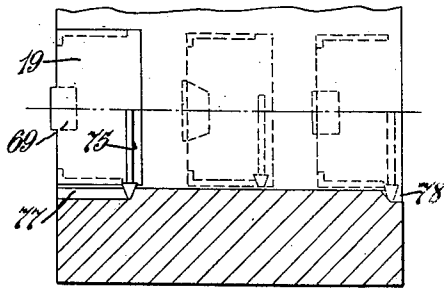


Fig. 22.

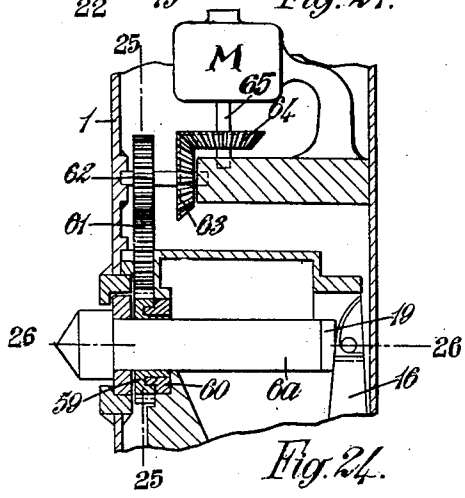


Fig. 24.

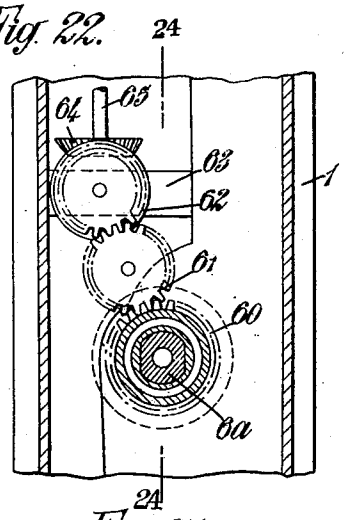


Fig 25.

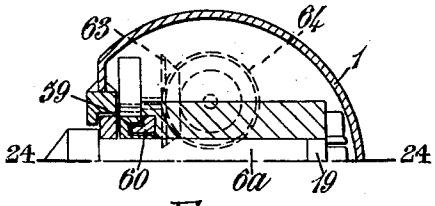


Fig. 26.

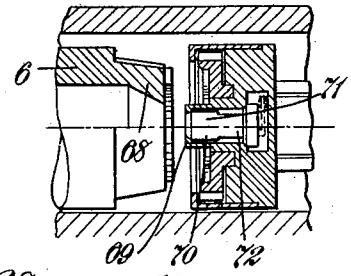


Fig. 23.

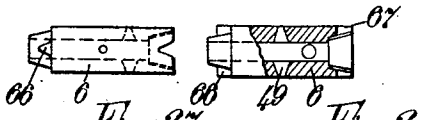


Fig. 27. Fig. 28.

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Patented Feb. 14, 1939

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UNITED STATES PATENT OFFICE

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APPARATUS FOR BORING

Victor Pérébaskine, Beziers, and Pierre Gravirowsky and Serge Nikitine, Strasbourg, France

Application September 15, 1936 Serial No. 100,938
In France September 28, 1935

17 Claims. (Cl. 255—4)

Up to the present time the exploration of a petroleum or supposedly petroleum region has been effected by means of successive vertical borings. Some of these borings at present attain a depth as much as 4,000 metres and it is known that each of these is a source of very considerable cost. Now it frequently happens that one bored shaft passes very close to a petroleum strata without traversing it.

The method of boring which is the object of the present invention permits a considerable reduction in the number of these vertical borings when the level of the petroleum layer is approximately known as is generally the case. According to the invention a method of boring with a rigid boring rod consists in arranging at any point in a vertical or substantially vertical shaft, one or more side bore holes. These bore holes may be horizontal or oblique.

Further when an existing shaft is producing petroleum it is known that its delivery progressively decreases although the layer may be far from exhausted while a new shaft arranged near the first is giving a high delivery. This phenomenon is due to a kind of autocementation of the walls of the shaft, by solid particles driven by the petroleum and the method which is the object of the present invention avoids the necessity of boring an adjacent vertical shaft and permits the existing shaft to deliver at least a part of its maximum capacity by merely piercing its walls.

Finally a productive vertical shaft provided with horizontal or oblique branches of only a few dozen metres in length permits the exploitation of a much greater region than a simple vertical shaft and is in consequence equivalent to several vertical shafts.

The process according to the present invention can of course be also applied to the boring of water wells. Another possible application is the consolidation of mellow or broken-up soil by injecting cement under pressure as in modern public works of technique.

The practical application of this process presents a certain number of difficulties which have been overcome by means of the apparatus which is also the object of the invention.

This apparatus is constituted essentially by a hollow cylindrical body which is caused to descend into the vertical shaft to the desired depth and in which are enclosed a number of sections of tubes sufficient to form end to end the desired horizontal or oblique tubing. These sections are preferably superposed on a vertical rigid loading device, hinged or flexible similar to the belt of a machine gun and an extractor mechanism effects their successive ejection through a lateral orifice in the cylindrical body.

The resistance presented by the earth to the advance of the horizontal or inclined tubing is overcome by means of a rotating or percussion tool arranged in the head of the first tube section. The driving force necessary in order to actuate the said tool and the ejection mechanism may be in a horizontal direction, or other means may be used such as pneumatic or electrical. It is led to the apparatus through the tube or tubes which support it at the ground.

The different tube sections may be assembled together in any suitable manner, for example by a conical friction joint, by screwing or by a bayonet joint, etc. The continuous tubing thus formed can subsequently be removed from the shaft and automatically withdrawn into the cylindrical body. It can also remain in the horizontal or oblique boring. In this case the tube sections preferably present perforations which are closed during the boring operation and which are subsequently opened by mechanical means or by a solvent, a mordant, etc.

The description which follows with respect to the accompanying drawings given by way of example will enable the present invention to be better understood.

Figure 1 shows an elevation of the apparatus seen from the side of the ejection orifice for the horizontal or inclined boring tubes.

Figure 2 shows the same apparatus, part in profile and part in section along the line 2—2 of Figure 1 before the operation of horizontal or inclined boring.

Figure 3 is a profile view showing the horizontal tubing after its ejection from the apparatus and showing as modifications two oblique directions for the tubing in broken lines.

Figure 4 is a plan view corresponding to Figure 3.

Figure 5 shows the details of assembly of the tube sections.

Figure 6 shows a method of securing the last tube section to the head of the push piece.

Figure 7 is a partial section on a larger scale of the ejector or extractor mechanism for the tube sections through the line 7—7 of Figures 2 and 8.

Figure 8 is a cross section through the line 8—8 of Figures 7 and 9.

Figure 9 is a vertical section through the line 9—9 of Figures 7, 8 and 10.

Figures 10 and 11 are cross sections through

the lines 10—10 and 11—11 of Figures 7 and 9 respectively.

Figure 12 shows in perspective a detail of the device for deadening the fall of the frame supporting the tube sections inside the apparatus.

Figures 12 and 12b show respectively transverse and longitudinal sections on a large scale of the device for declutching the rotation mechanism from the head of the driving device.

Figure 13 is a partial section on a larger scale corresponding to Figure 7 and in the plan of section along the line 13—13 of Figures 14 and 15; it shows details of the mechanism for permitting movement of the frame carrying the tube sections.

Figure 14 is a partial cross section along the line 14—14 of Figures 13 and 15.

Figure 15 is a partial longitudinal section along the line 15—15 of Figures 13 and 14.

Figures 16–18 show in section on a larger scale different positions of one of the members for controlling movement of the frame.

Figure 19 shows in vertical section a form of embodiment of the head of the push piece.

Figure 20 is a section through the line 20—20 of Figure 19.

Figure 21 is a vertical section of a second form of embodiment of the head of the push piece.

Figure 22 is an oblique section through the line 22—22 of Figure 21.

Figure 23 is an oblique section perpendicular to that of Figure 22 through the line 23—23 of Figure 21.

Figure 24 shows in vertical section through the line 24—24 of Figures 25 and 26 the device for driving the tubing when it is arranged so as to rotate.

Figure 25 is a vertical section through the line 25—25 of Figure 24.

Figure 26 is a cross section through the line 26—26 of Figure 24.

Figure 27 is a plan view of a section of tubing.

Figure 28 is a view corresponding to Figure 27 part in elevation and part in section.

As shown in Figures 1–4 the apparatus is constituted externally by a casing 1 of general cylindrical form the lower end 2 of which is preferably pointed. The said casing 1 of steel or brass for example is riveted into a cap 3 to which are secured the supporting tubes 4 which traverse it and terminate inside the casing 1.

The casing 1 comprises a lateral orifice 5 through which are successively ejected the different sections of horizontal tubing 6. As shown at 6a and 6b in Figure 3 tubing may also be oblique towards the upper or lower part according to any desired angle.

Before the operation the magazine contained in the casing 1 is supplied with tubes and the first tube section 7 which carries the boring tool 8 is introduced into the orifice 5, the tool 8 alone projecting outside (Figure 2). The apparatus which is suspended by a column of tubes 4 is caused to descend in the main vertical (or inclined) shaft to the depth at which it is desired to effect the lateral boring. The motor for driving the tool 8 and the ejector mechanism of the tubes is then started.

The tool 8 is actuated by means of any type of hydraulic motor placed in the head tube section 7 a speed reduction device being interposed. This motor may be for example of the known type with two eccentric rotors. The casing 1 and the tubing 6 being fluid-tight (or nearly so) the fluid under pressure is led from the surface of the earth through the tubes 4 and upon issuing from the motor it expands at the head of the shaft thereby facilitating the work of the tool 8.

In the simplest form of embodiment the successive sections of tubing 7 are assembled by a conical joint as shown in Figure 5. Their extraction or ejection is effected by means of mechanism described hereunder with reference to Figures 7 to 18.

Inside the cylinder 1 is lodged a fixed magazine 9 in which a frame 10 can slide parallel to the axis of the casing 1 (Figure 7). This frame has the form of a kind of ladder on each rung 11 of which rests one of the tube sections 6a. The part of the magazine 9 which is above the level 10—10 of the orifice 5 has a width which is just sufficient to allow the frame 10 with the tube 6 to slide without friction. This part comprises a lateral branch 12 through which the tubes can pass one by one to face the ejection orifice 5 in the position 6a. Below this level the magazine 9 is extended towards the base by a narrow part 9a in which the lower part of the frame 10 which is freed from the tubes 6 is progressively removed.

Each tube 6 is held against the corresponding round 11 by a spring 13 secured to the round immediately above. Further at each round 11 is pivoted a bent lever 14 of which the free arm bears on the tube 6. During the descent of the frame 10 the back of this lever meets the shoulder 15 of the magazine; the lever rocks and pushes the tube 6 into the lateral cavity 12. The spring 13 then becomes placed vertically in such a way as not to oppose the descent of the frame in the passage 9a. This descent takes place in jerks following the same rhythm as the ejection of the tubes 6 either by hand or automatically by means of an ejector mechanism which is hereinunder described.

The ejector mechanism (shown particularly in Figure 9) comprises an oscillating lever or push piece 16 which is pivoted around a horizontal shaft 81 and the free end of which carries freely pivoted at 82 a cylindrical head 19. This head applies itself against one end of the tube 6a and the movement of the push piece 16 effects a partial expulsion of this tube (position shown by broken lines in Figure 9). The space thus left free is then occupied by the following section of tubing which is ejected in its turn and which by pushing the preceding section of tubing becomes connected to it and completely ejects it from the apparatus.

The alternating motion of the push piece 16 is produced by means of a small hydraulic motor with pistons 17 (Figure 8) of which the rods 18 operate on a spindle 19a engaged in a slot 20 of the lever 16. This movement is also transmitted to the device for moving the frame 10 in the following manner (Figures 13–18).

In the metal frame which contains the motor 17, 18 and which forms at the same time the magazine 9, can slide obliquely a tongue 21 (Figs. 13–15); a spring 22 tends to push it towards the passage 9a to the position in which its tip supports the frame 10 by one of the rounds 11. Nevertheless the force of the spring 22 is slightly less than the weight of the frame 10 so that the latter pushes back the tongue when it is not locked under the action of the spring 24 by a bolt 23.

At each return movement of the push piece 16 the latter causes the bolt 23 to be lifted clear of the tongue 21 which yields under the weight of the frame 10 which falls by the distance which separates two successive rounds 11. For this pur-

pose the bolt 23 carries a pin 25 engaging in a slot 26 of the bent lever 27 which pivots around a horizontal fixed shaft 28. The other arm of this lever is pivoted at 29 to one end of a horizontal slide block 30 the other end of which is pivoted at 32 to a rocking tip 31 (see particularly Figures 16 and 17). The said tip 31 co-operates with a pivoting tip 33 carried by the push piece 16, the said tip 33 being effective only during the return movement of the push piece 16 (Figures 16 and 17) which during the advance movement it yields into a lodgement 34 against the action of a blade spring 35 (Figure 18). At the end of the path the tip 31 can also yield into a lodgement 36 against the action of a blade spring 37 (Figure 17). Under these conditions the two tips 31 and 33 co-operate effectively only during a period which is just sufficient to cause the bent lever 27 to pivot and thus disengage the tongue 21; when the push piece 16 has passed the recess 36 in its return path the tip 33 pivots to pass tip 31 which then again takes up its position as in Figure 16 under the action of the spring 37. Due to the action of the spring 24 the bolt 23 again takes up its locking position and brings forward the slide block 30 by means of the lever 27, the spring 22 having returned the tongue 21.

The frame 10 is prevented from falling abruptly by an oil damper shown in the lower part of Figure 7. This damper is constituted by a slide block 38 arranged obliquely in the same frame as the hydraulic motor and below it. At its upper end this slide block supports one of the rounds 11 which rests on rollers 39 (Figure 12) carried by the tip of the slide block; the latter has a recess 40 connected to permit the passage of the springs 13. At its lower curved end 41 the slide block 38 engages with the spring 42 which constantly tends to lift it, but the strength of which is less than the weight of the frame 10, and also engages with the end of the rod 42*a* of the piston which moves in the oil cylinder 42*b* of the damper.

When the tongue 21 releases the frame 10, the weight of the frame produces a progressive inclined movement of the slide block 38; at the instant when through this movement the frame becomes free from the block 38 and would begin to descend and fall freely, it is stopped by the engagement of the next higher bar 11 on the tongue 21. The slide block 38 then engages with another bar.

When the tubing 6 is completely buried in the ground, it can either be cut off flush with the cylindrical casing 1 in order to disengage the latter and allow it to be brought back to the surface, or it can be driven completely outside the casing in order, for example, to prevent the horizontal or oblique bore hole from collapsing if the tubing were withdrawn.

The first of these operations may also be necessary in case of any accident during the boring in which case the sections of tubing already engaged in the ground can be abandoned and the operation can be repeated near by or in another direction. The separation of the tubing is effected by means of a guillotine device (Figures 1–4).

The cap 3 is arranged so as to be able to slide on the upper part of the casing 1 but it is normally prevented from doing so by rivets 43 which join it to the said casing with a certain amount of vertical play. The cap 3 comprises towards the lower part an extension 44 forming a guillotine or drop door which can slide against a flat part 45 of the cylinder 1 in the same way as a distribution slide valve on its slide face. The lower end of the guillotine 44 terminates in a cutting edge 46 similar to that of a cold chisel.

When it is desired to cut off the tubing 6 an alternating force is exerted from ground level on the column of tubes 4 thereby producing shearing of the rivets 43 (formed for example of soft metal such as copper) due to the fact that the cylinder 1 is held stationary, and is integral with the tubing 6.

After fracture of the rivets the column of tubes 4 is operated on as a rammer causing the guillotine 44 to fall several times on the tubing which is finally cut.

In order to drive the tubing completely outside the cylinder the head 19 of the push piece 16 can be provided with claws 47 (Figure 6) and a supplementary section 6*b* is placed in the magazine above the sections 6 intended to form the tubing. This section 6*b* is provided at its rear part with an annular groove 48 in which the claws 47 can grip. During the driving in of the tubes 6, the said claws 47 have no action on their smooth surface. On the other hand, when the additional tube 6*b* has been driven in the head 19 of the push piece remains connected to the tube 6*b* and brings it back inside the cylinder 1 during its return path. The tubing 6 is thus separated from the cylindrical body 1.

The tubing 6 which remains in the ground is preferably pierced by holes 49 in order to give access for petroleum, water or any other natural liquid to the inside of the tube, or on the other hand to permit the tube to be supplied with cement or any other substance to be injected. During the boring, however, the tubing 6 must be fluid tight; for this purpose the holes 49 can be temporarily closed by a suitable substance which after boring is finished can be removed by a solvent, or the holes can be closed by any other means, for example by a valve.

The embodiment of the apparatus hereinabove described is obviously possible with numerous modifications without departing beyond the scope of the invention.

For example, the drive can be pneumatic or electrical instead of being hydraulic and any desired type of motor may be used; the tube sections can be assembled by screwing or by bayonet joints; the movement of the magazine or the operation of the ejector mechanism and the forward movement of the boring rod may be produced by a screw or gear transmission, the motor actuating these devices being placed either at the ground surface or at any other place; finally the advance of the tubing through the ground can be effected not by a special motor lodged in the head section 7 and actuating the tool 8 but by the rotation of the tube assembly.

In Figures 7, 8 and 10, additional mechanism is shown for producing the rotation of the tubes 6 necessary for assembling the tubes by screwing or by bayonet joints. A dovetail rack 50 which moves integrally with the piston rod 18 of the motor engages with a toothed pinion 51 keyed on a vertical shaft 52; on this shaft is also keyed a conical pinion 53 engaging with a second pinion 54. The rotation of the horizontal shaft 55 which carries the said pinion 54 is transmitted to a toothed wheel 56 through a coupling 57 (Figure 10). This coupling is constituted by two small concentric cylinders 57 and 57*a*, one of which is integral with the shaft 55 and the other with the wheel 56, and which normally engage with one another by radial fingers 57*b* resiliently

mounted; when the resisting force exceeds a certain limit, these fingers yield and the movement is declutched (Figures 12*a* and 12*b*).

By means of a pinion **58** the motion of the wheel **56** is transmitted to the head **19** of the push piece which is therefore toothed and adapted to rotate (Figures 19 and 20). When the head **19** passes into the plane of the pinion **58** the latter imparts the rotational movement necessary in order to effect the screwing of the section **6***a* into the tube section previously driven into the ground. For this purpose the rotating head **19** is provided with projections which engage in a corresponding groove at the rear end of the tube **6***a*. When the screwing in is completed the resistance opposed to the rotation of the head becomes considerable thereby causing the declutching of the coupling **57**.

According to another modification the sections can be screwed without rotation by the head **19** by means of simple pressure on the tube **6***a* which is provided with a screw thread with very inclined threads.

If it is desired to effect the boring by rotating the assembly of the tubing **6** a mechanism similar to that hereinabove described can be used or the mechanism shown in Figures 24–28.

In this case the tubes **6** are provided either with grooves or with flat surfaces or with an oval section (Figures 25, 26, 27, 28).

The rotation of the tube assembly or of other members may, if desired, be effected by means of electric motors placed inside the hollow body.

As shown in Figures 24–26 the tube **6***a* engages in the central opening of the toothed wheel **59** which rotates in a bearing **60**; this opening is of exactly the same section as the tube **6***a*. The rotation of the wheel **59** is produced by means of gearing **61**, **62**, **63**, **64**, through a vertical shaft **65** which either may be actuated by a motor arranged in the casing I as indicated at M in Fig. 24 or may be extended up to the surface of the ground and actuated by an external motor.

In order to prevent any rotation of the tube sections with respect to one another their assembly comprises in this case a locking device **66**, **67** (Figures 27, 28). The head **19** of the push piece **16** is preferably mounted so as to be able to turn idly on a support in order to follow the rotation of the tubing.

Finally the tubes **6** can be automatically connected to or disconnected from the head **19** according to the position of the push piece **16** (Figures 21–23) in the following manner. Each tube section **6** is terminated at its rear part by an internally conical part **68**. Into this conical cavity penetrates a split sleeve **69** integral with the head **19** of the push piece; this sleeve can be dilated by the frustro-conical mandrel **70** when the latter is advanced; this translatory movement is caused by the transformation by means of a screw thread **71** of the rotational movement imparted to the shaft **72** of the mandrel **70** through a small lever rod mechanism **73**, **74** lodged in the head **19**. This mechanism receives a rectilinear movement of a rod **75** which a spring **76** constantly tends to cause to emerge from the head **19** (Figure 21).

An interrupted groove **77**, **78** arranged in the guide wall of the head **19** permits the rod **75** to emerge at the two ends of the path of the push piece liberating the tube **6** (Figure 22) while this tube is connected to the head **19** during the median part of the path due to the dilatation of the sleeve **69**.

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

1. Apparatus for constructing side bore holes in a main vertical shaft comprising a hollow body adapted to be lowered down said vertical shaft, said hollow body containing a magazine in which are arranged rigid tube sections and an ejector mechanism for the successive ejection of said tube sections through a lateral orifice, in said hollow body.

2. Apparatus for constructing side bore holes in a main vertical shaft comprising a hollow body, said hollow body containing firstly a magazine in which rigid tube sections are superposed on a loading device and secondly an ejector mechanism for the successive ejection of said tube sections through a lateral orifice in said hollow body, the first tube section carrying at its head a boring tool and being provided with a motor actuating said tool.

3. Apparatus for constructing side bore holes in a main vertical shaft comprising a hollow body containing a magazine in which rigid tube sections are superposed on a loading device, an ejector mechanism for the successive ejection of said tubes through a lateral orifice in said hollow body and means for assembling said tube sections, the first tube section carrying a boring tool at its head and being provided with a motor actuating said tool.

4. Apparatus for constructing side bore holes in a main vertical shaft comprising a hollow body containing a magazine in which rigid tube sections are superposed on a loading device, a motor-operated ejector mechanism for the successive ejection of said tubes through a lateral orifice in said hollow body and means for assembling said tube sections, the first tube section carrying a boring tool at its head and being provided with a motor actuating said tool, which motor and the motor driving the ejector mechanism are operated by compressed fluid led from the ground surface through at least one tube which also supports the apparatus.

5. Apparatus for constructing side bore holes in a main vertical shaft comprising a hollow body containing a magazine in which rigid tube sections are superposed on a loading device and a motor-operated reciprocating ejector mechanism for the successive ejection of said tubes through a lateral orifice in said hollow body, the first tube section carrying a boring tool at its head and being provided with a motor actuating said tool, which motor and the motor driving the ejector mechanism are operated by compressed fluid led from the ground surface through at least one tube which also supports the apparatus, said hollow body also containing means for assembling said tube sections and a vertical movable frame which holds the different tube sections in the mechanism and which is adapted to be displaced in jerks with the same rhythm as the reciprocating movement of the ejector mechanism.

6. Apparatus according to claim 5 wherein the motion of the movable frame is stopped by a slide block resiliently mounted and locked at a suitable instant by a mechanism operated by the ejector mechanism.

7. Apparatus as claimed in claim 1 wherein the ejector mechanism is constituted by an oscillating push-piece.

8. Apparatus as claimed in claim 1 wherein the

ejector mechanism is constituted by an advancing screw.

9. Apparatus for constructing side bore holes in a vertical shaft comprising a hollow body containing a magazine in which rigid tube sections are superposed on a loading device and a motor-operated oscillating push-piece for the successive ejection of said tubes through a lateral orifice in said hollow body, the first tube section being provided with a boring tool and a motor actuating said tool, which motor and the motor driving the push-piece are operated by compressed fluid led from the ground surface through at least one tube which also supports the apparatus, said hollow body also containing means for assembling said tube sections, a movable frame supporting the tube sections and adapted to move intermittently in step with the push-piece, means for rendering said push-piece integral with a tube section during rotation and transmission means for transmitting rotating movement to said push-piece.

10. Apparatus according to claim 9 comprising a cutting device for disengaging the hollow body from the tubing which has been ejected outside said hollow body.

11. Apparatus according to claim 9 comprising a cutting device constituted by a guillotine movable vertically along and outside the hollow body and actuated at ground level for disengaging the hollow body from the tubing which has been ejected outside said hollow body.

12. Apparatus according to claim 9 wherein a supplementary tube section is arranged in the magazine in order to drive the tubing completely outside the hollow body, said section comprising a device for connecting it to the push-piece head to enable the push-piece to be brought back inside the hollow body.

13. Apparatus according to claim 9 wherein a supplementary tube section is arranged in the magazine in order to drive the tubing completely outside the hollow body, said section being provided with an annular groove in which can engage claws carried by the push-piece head to enable the push-piece to be brought back inside the hollow body.

14. Apparatus according to claim 9, wherein a supplementary tube section is arranged in the magazine in order to drive the tubing completely outside the hollow body, said supplementary section comprising a split sleeve adapted to expand and penetrate into a conical-shaped rear end of an inner recess in said tube section for connecting to the push-piece head to enable the push-piece to be brought back inside the hollow body.

15. Apparatus for constructing side bore holes in a vertical shaft comprising a hollow body containing a magazine in which rigid tube sections are superposed on a loading device, an ejector mechanism for the successive ejection of said tubes through a lateral orifice in said hollow body, means for effecting the advance of the tubing in the ground by the rotation of said tubing and locking means for locking the tube assembly formed by the tube sections.

16. Apparatus for constructing side bore holes in a vertical shaft comprising a hollow body containing a magazine in which rigid tube sections are superposed on a loading device, a reciprocating push-piece for the successive ejection of said tubes through a lateral orifice in said hollow body, means for rotating the head of said push-piece to effect the advance of the tubing in the ground by the rotation of said tubing, and locking means for locking the tube assembly formed by the tube sections.

17. Apparatus for constructing side bore holes in a vertical shaft comprising a hollow body containing a magazine in which rigid non-circular tube sections are superposed on a loading device, an ejector mechanism for the successive ejection of said tubes through a lateral orifice in said hollow body, a toothed wheel having a central non-circular aperture of the same shape as the tube sections through which the tube sections are inserted, said sections being set in rotation and thus advanced in the ground by the rotation of said toothed wheel, and locking means for locking the tube assembly formed by the tube sections.

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