Oct. 7, 1930. M. A CAPELIUSCHNICOFF 1,777,961

BORE HOLE APPARATUS

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FIG. 1.

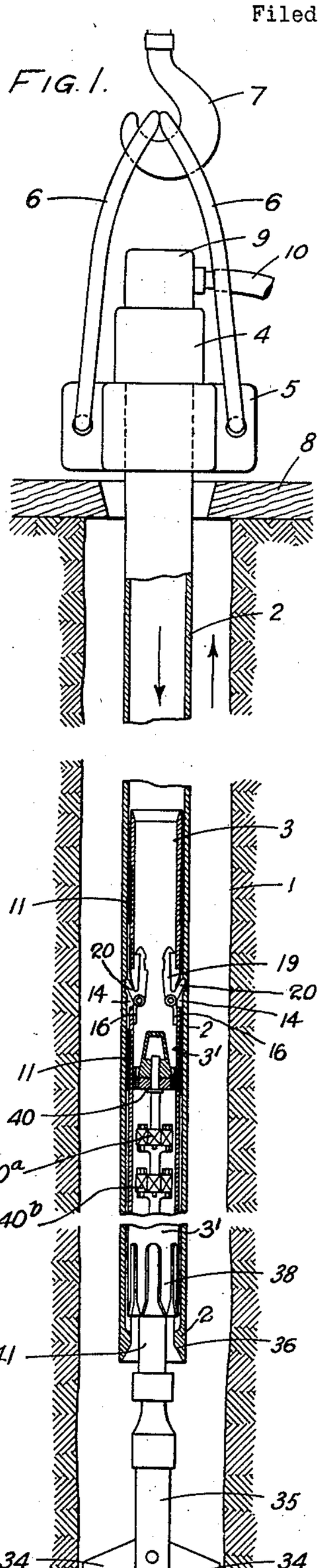

FIG. 2.

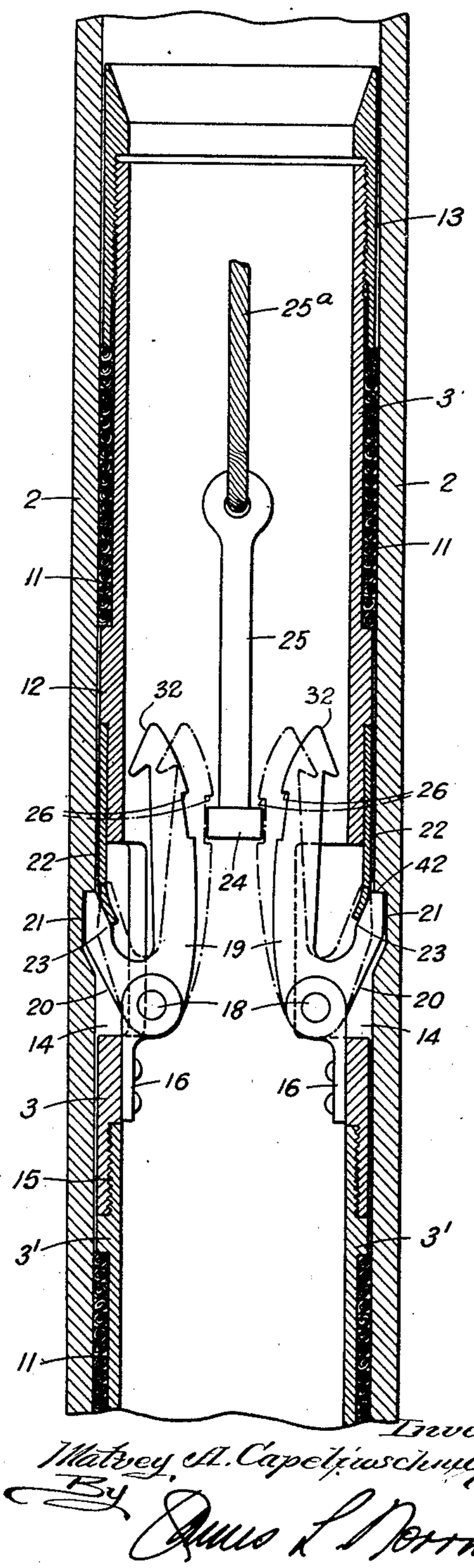

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FIG. 3.

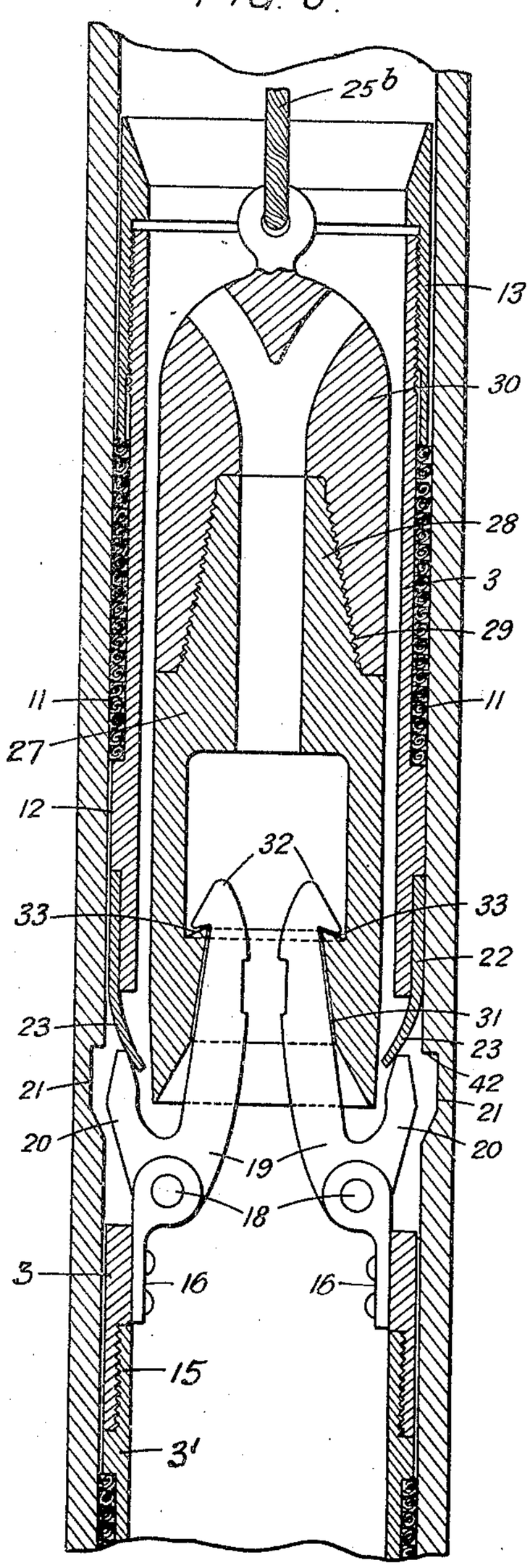


FIG. 4.

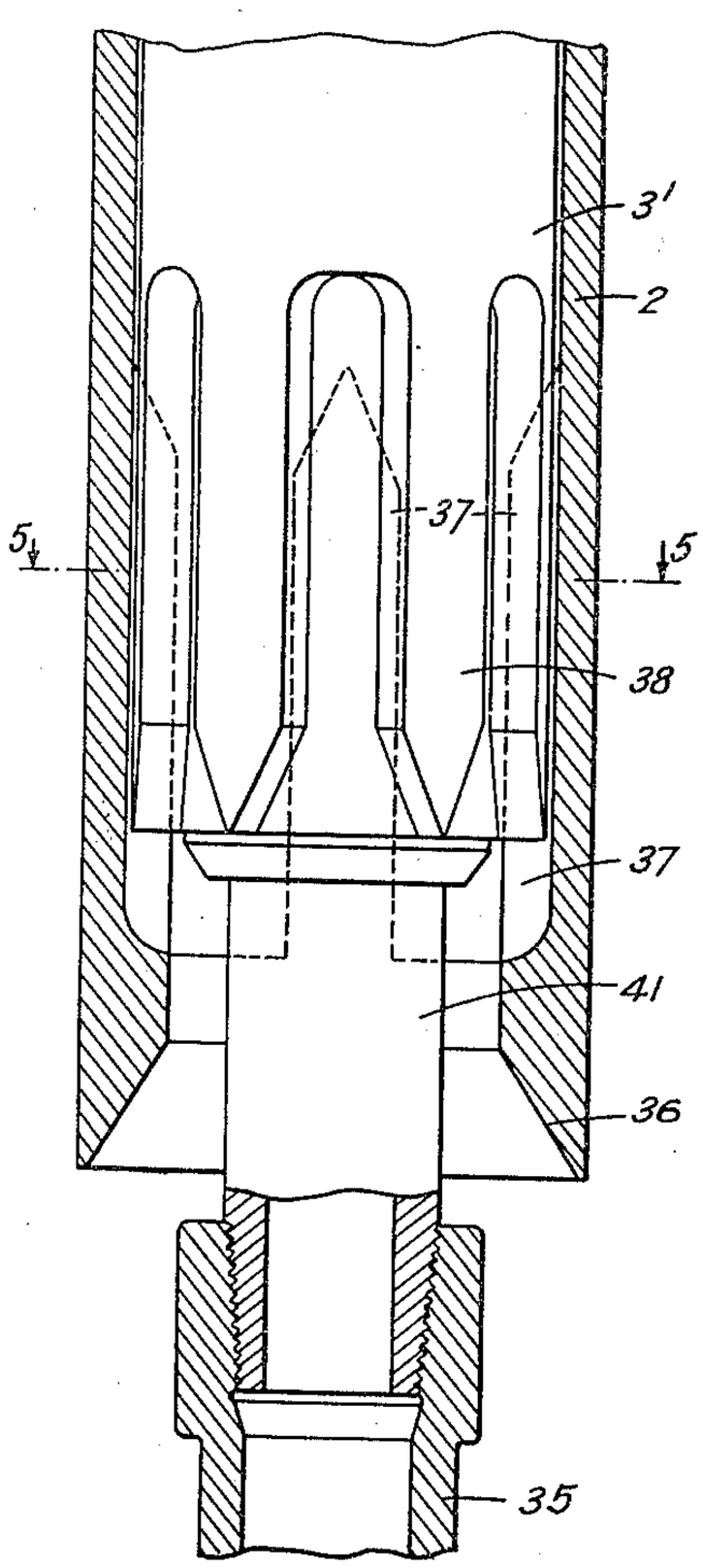
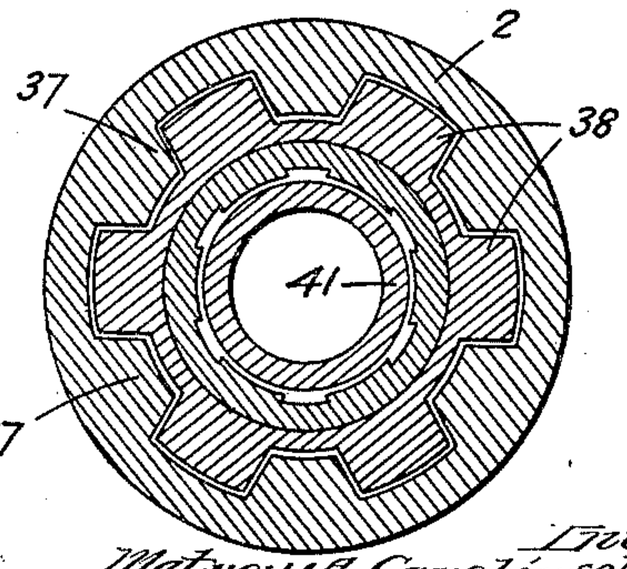


FIG. 5.



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UNITED STATES PATENT OFFICE

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BORE-HOLE APPARATUS

Application filed April 4, 1927. Serial No. 180,988.

The invention relates to apparatus for sinking bore-holes for oil wells and like purposes and is of the type in which the stem of the cutting tool is connected to the shaft of an hydraulic motor enclosed in a special drilling apparatus.

One object of the invention is to provide means by which the drilling apparatus may be lowered by a flexible cable into the non-rotating drill pipes until it is automatically latched thereto in a predetermined position above the bottom of the bore hole, so that it can neither rotate relatively to the drill pipes nor move upwards or downwards, while the cable, by which the drilling apparatus with motor and cutting tool (bit) has been lowered, is automatically released and withdrawn from the bore hole. This arrangement enables the drill pipes to be extended indefinitely without raising the cutting tool.

A further object is to provide means by which the latch may be quickly released when the drilling apparatus is to be raised, and also means by which the said drilling apparatus with the cutting tool and motor may be, at any time, readily raised to the surface independently of the drill pipes.

A still further object is to make it possible to transmit the whole or part of the weight of the drill pipes through the drilling apparatus to the bit and thus to adjust the downward vertical pressure applied to the cutting tool.

Other objects and improvements will be explained by means of the accompanying drawings which illustrate an example of a rotary boring apparatus according to the invention.

Fig. 1 is an elevation, mainly in section, of the general arrangement;

Fig. 2 shows on a larger scale the means for locking the drilling apparatus to the drill pipe in order to impose the weight of the latter upon the former;

Fig. 3 shows the means for releasing the drilling apparatus;

Fig. 4 shows the means for locking the lower end of the drilling apparatus to the drill pipes, and

Fig. 5 is a section on the line 5—5 of Fig. 4.

1 is the bore-hole, 2 the drill pipes, and 3 the upper section of the drilling apparatus.

The drill pipes 2 are provided at their upper end with a collar 4 which rests on an elevator 5 of known construction suspended by links 6 from a hook 7 to which is attached in the usual manner a cable adapted to be raised and lowered by a winding drum.

When sections are to be added to or removed from the drill pipes 2 or when the drilling apparatus is to be raised to the surface, the elevator 5 is lowered on to the platform 8 or raised therefrom in known manner.

The drilling apparatus comprises an upper tubular section 3, a lower tubular section 3′ detachably connected to the upper section 3 as by screw threads 15, and a hydraulic motor 40 in the lower section 3′. The hydraulic motor 40 has a hollow driving shaft 41 extending below the lower end of the lower section 3′, and a rotary bit comprising blades 34 carried by a hollow tool spindle 35 secured to the lower end of the driving shaft 41.

The hydraulic motor 40 is of well-known turbine type operating the hollow driving shaft 41 by means of a double reduction epicyclic gear indicated in Figure 1 at 40^a and 40^b. It may be, for example, of the character disclosed in my U. S. Patent No. 1,681,094 of August 14, 1928, and is actuated by slush water delivered to it through the upper end of the upper tubular section 3 and discharged through its hollow driving shaft 41 and the hollow tool spindle 35 of the rotary bit.

The external diameter of the tubular sections 3 and 3′ of the drilling apparatus is slightly smaller than the internal diameter of the drill pipes 2 in order that said sections may freely slide within said drill pipes; and, to prevent the passage of slush water between the drill pipes 2 and said sections of the drilling apparatus, portions of said sections are of reduced external diameter forming shoulders against which packing 11 interposed between said reduced portions and the drill pipes 2 is compressed, as by means of glands screwed upon the sections 3 and 3′ against

said packing. In Figure 2 one of such glands 13 is shown as screwed upon the upper end of the upper section 3.

Slots 14 are formed in the upper tubular section 3 adjacent the lower end and parallel to the axis of said section and lugs 16 are secured within said section below said slots. The upper ends of the lugs 16 are formed as eyes extending at right angles to the axis of the section 3 and these eyes carry pins 18 on which are pivoted two armed levers 19. The short arms 20 of the levers extend upwardly through said slots 14 and are adapted to engage in an annular recess 21 formed in the pipes 2 under the pressure of spring steel strips 22 secured to the exterior of the upper section 3 of the drilling apparatus 3, the lower ends of said strips extending below the upper ends of the slots 14 and being bent inwards to bear on the upper inclined surfaces 23 of the arms 20. The long arms of the levers 19 extend upwardly within the tubular section 3.

In order to lower the drilling apparatus into the working position, a suitably shaped head 24, connected to the lower end of a short vertical rod 25, is adapted to engage under shoulders 26 formed on the inner sides of the hooked upper ends of the arms 19. The head 24 is secured to a cable 25^a and, during the descent of the drilling apparatus through the stationary drill pipes 2, the parts assume the position shown in dotted lines in Fig. 2, the arms 20 sliding against the interior of the drill pipes 2.

When, in lowering the drilling apparatus into the drill pipes 2, the short arms 20 of the levers 19 come opposite the annular recess 21 of the drill pipes, the ends of said arms are forced by the springs 22 into said recess, thus securing the drilling apparatus against upward movement in the drill pipes and imposing the weight of the drill pipes on the drilling apparatus.

In order to raise the drilling apparatus with its contents, an overshot 27 is lowered through the upper end of the drill pipes into the upper end of the upper section 3 of the drilling apparatus to disengage the lever arms 20 from the recess 21 of the drill pipes. In the example illustrated, the upper end 28 of the overshot has a conical shape and is provided with external screw-threads engaging corresponding threads in a cap 30 which is secured to a cable 25^b. The lower end of the overshot is tapered inwards at 31 to ride over the inclined ends 32 of the longer arms of the levers 19 and has an internal shoulder 33 which is adapted to engage with shoulders 3 formed on the outer sides of the long arms of the levers 19 to rock the lever arms 20 inwards against the resistance of the ends of the springs 22, as shown in Figure 3.

The blades 34 of the rotary bit secured to the tool spindle 35 are pivoted in known manner to the hollow tool spindle 35 and are forced into their working position under pressure of springs (not shown). When the drilling apparatus is to be raised by the cable 25^b for the purpose of re-grinding the blades, the latter engage and are folded inwardly by contact with the inner tapered end 36 of the shoe of the drill pipes (Figs. 1 and 4) and can be readily raised.

The shoe of the drill pipes 2 is provided with inwardly projecting splines 37 which engage with outwardly projecting splines 38 of the lower section 3′ of the drilling apparatus, as shown in Figs. 4 and 5, to prevent relative rotation of said parts. When the drilling apparatus is raised by the overshot 27 and cable 25^b, the splines 38 are withdrawn from between the corresponding splines 37 in which they engage so that the drilling apparatus can be raised or lowered independently of the stationary drill pipes 2. The upper ends of the splines 37 and the lower ends of the splines 38 are pointed to facilitate their interengagement.

The tool spindle 35 is hollow in order to convey the water which has been discharged from the hollow driving shaft 41 of the hydraulic motor 40 to the cutting blades 34.

The upper end of the tool spindle 35 forms a socket into which is screwed the shaft 41 of the motor.

The arrangement just described enables the drilling apparatus to be readily drawn up at any time by the cable 25^a while leaving the drill pipes 2 in their given position.

An internal shoulder 42 at the upper end of the annular recess 21 of the drill pipes 2 bears, in the normal working position, on the upper ends of the lever arms 20, so that any required portion of the weight of the suspended drill pipes 2 can be transmitted through the casing of the drilling apparatus to the bit 34, or, conversely, the bit, under suitable working conditions, can be relieved of this weight and be pressed against the bottom of the bore hole merely by the weight of the drilling apparatus itself.

As soon as the arms 20 slip into the recess 21 in the drill pipes 2 as the drilling apparatus is lowered, the slackness of the cable 25^a supporting the drilling apparatus shows that the latter has reached its working position. The weight transmitted to the cutting tool or bit 34 may be adjusted according to the conditions of the work.

Various modifications may be made in the details shown without departing from the scope of the invention.

I claim:

1. An apparatus for drilling bore-holes, comprising in combination non-rotating drill pipes, a shoe at the end of said drill pipes and provided with a recess, a drilling apparatus comprising an inner casing and an hydraulic motor in said inner casing, lugs secured to

said inner casing, pins carried by said lugs, two-armed levers pivoted on said pins, one arm of each lever being adapted to engage in said recess, and a spring secured to said inner casing for forcing said arms into engagement with said recess.

2. An apparatus for drilling bore-holes, comprising in combination non-rotating drill pipes, a shoe at the end of said drill pipes, and provided with a recess, a drilling apparatus comprising an hydraulic motor in said drill pipes, a two-armed lever pivoted to said drilling apparatus and of which the outer arm is adapted to engage in said recess, a cable and an overshot adapted to be lowered by said cable into the drill pipes and in its descent engaging with the inner arm of said lever to rock said lever to disengage the outer arm of said lever from the recess.

3. An apparatus for drilling bore-holes, comprising in combination non-rotating drill pipes, a shoe at the end of said drill pipes and provided with a recess, a drilling apparatus in said drill pipes, said drilling apparatus comprising a casing and an hydraulic motor in said casing, two-armed levers pivotally secured to said casing, the outer arms of said levers being adapted to engage in said recess, a cable and an overshot lowered by said cable into said casing and in its descent engaging with the inner arms of said levers and rocking said levers to disengage the outer arms of said levers from said recess, said overshot and the inner arms of said levers having interengaging shoulders whereby the drilling apparatus may be raised independently of the drill pipes.

4. An apparatus for drilling bore holes, comprising non-rotating drill pipes including a shoe having an internal recess; a drilling apparatus insertable into and removable from said drill pipes through the upper end of the latter, said drilling apparatus including an inner casing having a plurality of longitudinal slots and a motor mounted within said casing below said slots; two arm levers fulcrumed in said casing, one opposite each of said slots, said levers having their inner ends extending upwardly and their outer ends projecting through said slots; means tending to rock said levers to move their outer ends outwardly and their inner arms away from one another; and a supporting rod, said supporting rod and the inner arms of said levers having complemental interengageable means held in inter-engagement during the descent of the drilling apparatus into said drill pipes by engagement of the wall of the drill pipe with the outer ends of said levers and releasable by the entry of the outer arms of said levers into the recess of the shoe of the drill pipes.

5. An apparatus for drilling bore holes according to claim 4 wherein the interengaging means between the supporting rod and the inner arms of the levers comprises shoulders formed on the inner sides of the latter and a head formed on the supporting rod and insertable between the inner arms of the levers and engageable with the shoulders of the latter.

6. An apparatus for drilling bore holes, comprising non-rotating drill pipes including a shoe having an internal recess provided with a downwardly directed shoulder; a drilling apparatus insertable into and removable from said drill pipes through the upper end of the latter, said drilling apparatus including a tubular casing having a plurality of longitudinal slots; a plurality of bell-crank levers fulcrumed in said casing, each of said levers having one of its arms extending into one of said slots; means tending to rock said levers and project said arms beyond the periphery of said tubular casing into the recess of said shoe below the shoulder of the latter when said drilling apparatus is lowered into said drill pipes and said levers arrive opposite said recess; and a member insertable through the upper end of the drill pipes to engage and rock said levers and move their outer ends out of said recess.

In testimony whereof I have signed my name to this specification.

MATVEY ALCUNOVITCH CAPELIUSCHNICOFF.