Jan. 31, 1933. H. R. SMITH 1,895,901

KELLY BAR

Filed April 9, 1932 2 Sheets-Sheet 1

FIG.1.

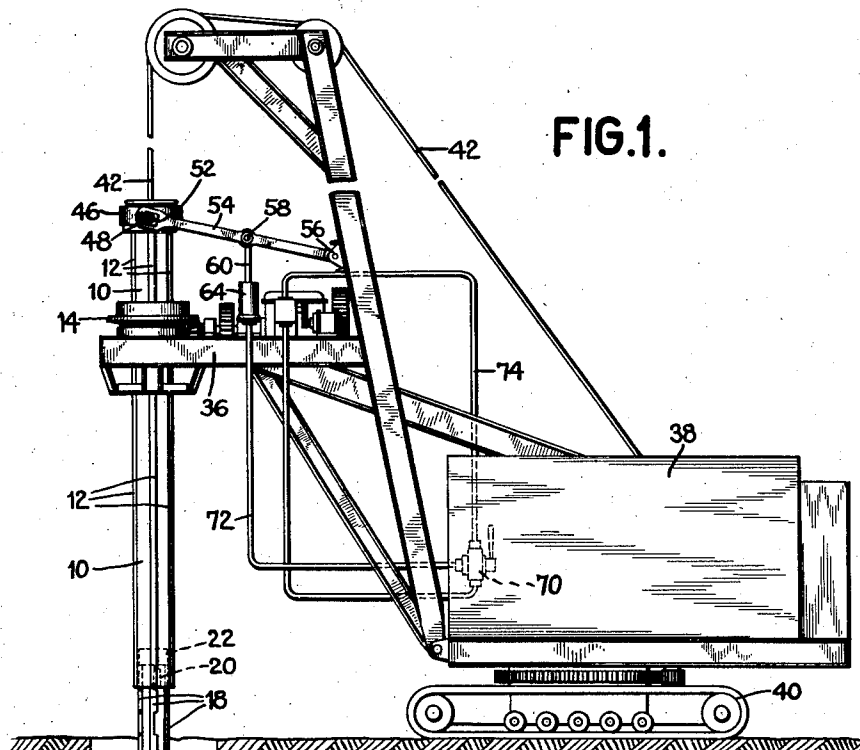


FIG.2.

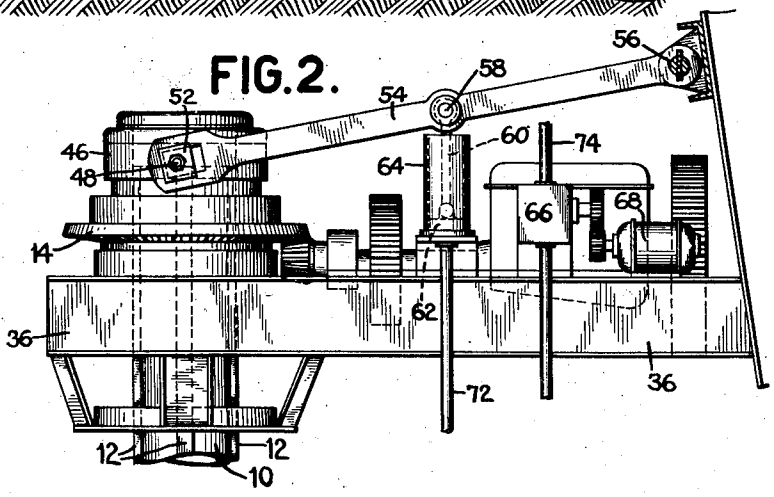
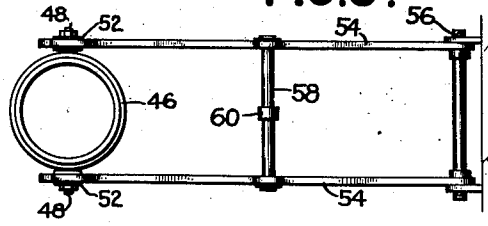


FIG.3.



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Filed April 9, 1932 2 Sheets-Sheet 2

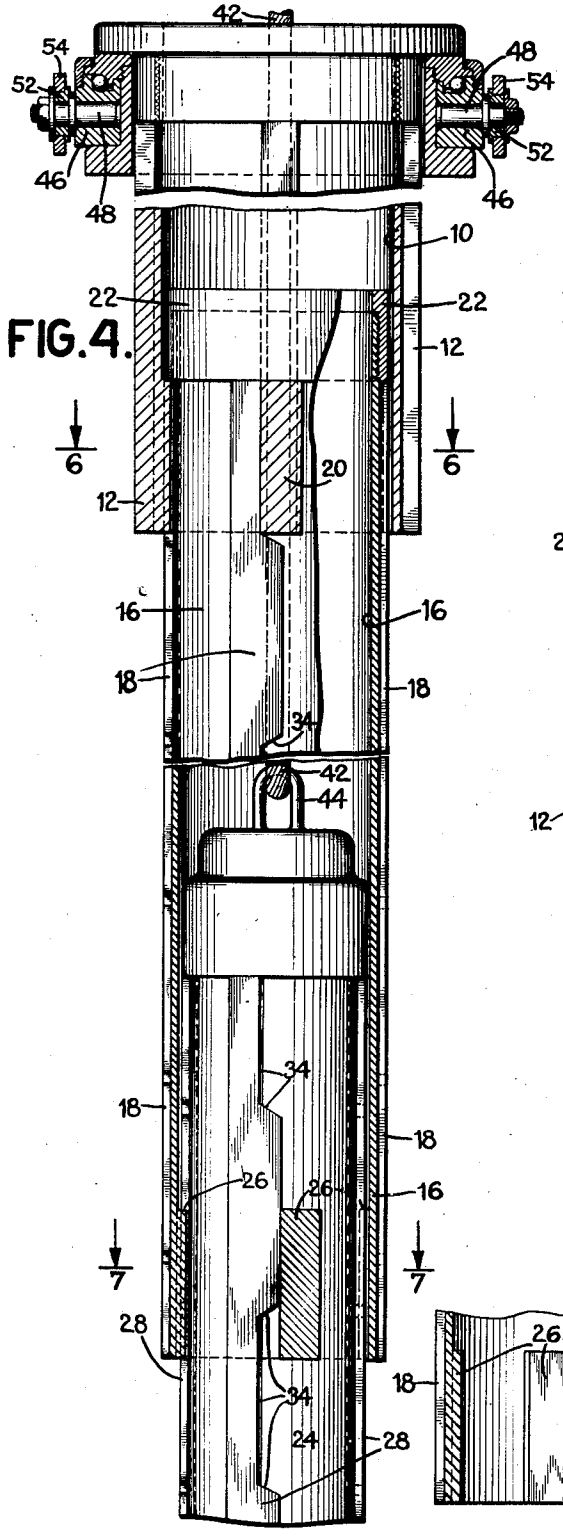


FIG.4.

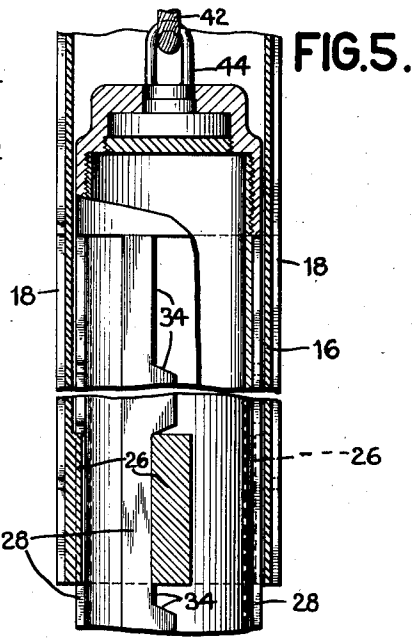


FIG.5.

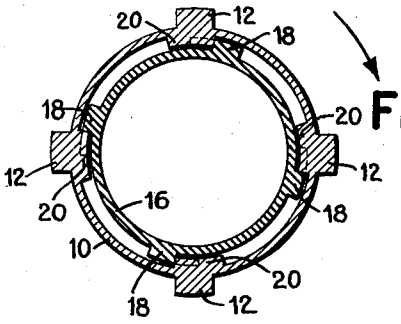


FIG.6.

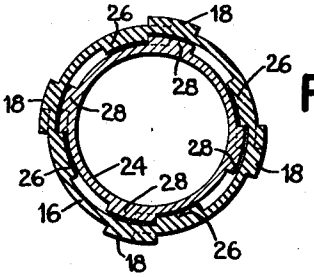


FIG.7.

FIG.8.

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KELLY BAR

Application filed April 9, 1932. Serial No. 604,284.

Rotary earth boring buckets are often driven by telescopic shafts called kellys. The sections of the kelly are in the form of tubes, each smaller in diameter than the one above it. In one form of kelly each section transmits torque to the section below it by means of short internal keys at its lower end engaging external splines extending substantially the full length of the section below. As the bucket digs into the earth the sections slide through each other, thus permitting the kelly to automatically adjust its length to the depth of the bucket.

That part of the weight of the kelly resting upon the bucket is available to force the bucket downwardly for digging except insofar as the effective weight is reduced by friction between kelly and driving gear. While the bucket is near the surface of the ground, all or most of the kelly sections may rest on the bucket, but as the digging proceeds and the kelly lengthens, each fully extended section hangs from the section above it and is therefore no longer able to apply its weight to the bucket. As a result of this condition, the speed of digging usually decreases as the depth of the hole increases.

An object of the present invention is to overcome the above difficulty by providing ways and means for applying the entire weight of the kelly to the bucket regardless of the depth of the hole.

Further and other objects and advantages will be apparent from the specification and claims, and from the accompanying drawings which illustrate what is now considered the preferred embodiment of the invention.

Fig. 1 shows the apparatus in operation, the kelly being in three sections, the upper two sections being fully extended and the lower section only partly extended.

Fig. 2 is an enlarged view of a portion of Fig. 1.

Fig. 3 is a detail plan view of the kelly-hoisting frame.

Fig. 4 is a vertical cross-section of the kelly.

Fig. 5 is a vertical cross-sectional detail view of a portion of the kelly.

Fig. 6 is a cross-section on line 6—6 of Fig. 4.

Fig. 7 is a cross-section on line 7—7 of Fig. 4.

Fig. 8 is a vertical detail cross-section of the lower end of a kelly section.

Referring to the drawings, the upper kelly section 10 has external splines 12 which engage keys in the hub of drive gear 14 through which section 10 is slidable vertically. Slidable vertically through section 10 is the second kelly section 16, having vertical splines 18 suitable for engagement by keys 20 within the lower end of section 10. A collar 22 at the top of section 16 rests on top of keys 20 when section 16 has reached the limit of its downward movement relatively to section 10.

In like manner section 16 drives section 24 below it by means of keys 26 within the lower end of section 16 engaging splines 28 on the outside of section 24. The lower end of section 24 is attached to digging bucket 30 by means of bails 32.

In former practice, splines 18 and 28 would have had straight sides, and it would have been a matter of indifference as to where drive keys 20 and 26 contacted with the splines. In the present invention, however, the splines, on their driven sides, are provided with notches or recesses such as 34 (Fig. 4), each notch being of sufficient length to easily accommodate a drive key such as 20, 26. It will be appreciated that whenever the drive keys of any kelly section are in recesses of the splines of the adjoining kelly section, those particular kelly sections are locked together so far as longitudinal movement relatively to each other is concerned. This is especially true while driving torque is being applied. This ability to temporarily lock the kelly sections together is made use of by the operator to apply the entire weight of the kelly to the bucket, as will appear.

Gear 14 and mechanism for driving it is supported on platform 36, which in turn is supported, as will be apparent from the drawings, on crane 38 mounted on tractor 40. Hoisting cable 42 passes down through the kelly for attachment to swivel 44 at the upper end of the lowest kelly section.

The upper end of kelly section 10 is provided with a ball bearing ring 46 having diametrically opposed studs 48 which are fitted with bearing blocks 52 slidable in slots in the ends of bars 54 of a frame pivotally mounted at 56 on the crane.

Near the middle of the pivoted frame is a cross bar 58 interconnecting side bars 54. Connected to cross bar 58 is the upper end of piston rod 60 of plunger 62 in hydraulic cylinder 64 mounted upright on platform 36. Also mounted on platform 36 is a reservoir 66 containing a pump and a motor 68 to drive the pump. With the pump in operation, valve 70 in the cab enables the operator to pump oil through pipe 72 into the bottom of cylinder 64, causing plunger 62 to raise the pivoted frame 54 and the top of the kelly from the positions of Fig. 2 to the position of Fig. 1. With valve 70 in a different position, the oil may return, through pipe 72, valve 70 and pipe 74, back to reservoir 66. At still another position of valve 70 the liquid may be locked in cylinder 64 and pipe 72.

When the drilling of a hole is to be undertaken, cable 42 telescopes the kelly sections upwardly into the top kelly section and even draws the top section up through and out of engagement with collar 46 so that the bucket may be located over the spot to be drilled. Then when drilling is begun, the entire weight of the kelly may be placed on the bucket, and may remain thereon until the hole is deep enough to permit upper kelly section 10 to rest on collar 46, whereupon the only weight on the bucket is the other kelly sections. As the digging proceeds (were the present invention not used), the weight of each kelly section is transferred from the bucket to the kelly section above it until only the lowest section rests on the bucket. The rate of progress of the bucket decreases as the superimposed weight decreases. Use of the present invention overcomes that condition as follows: Assuming that the bucket has been raised by cable 42 to dump a load, liquid is admitted to cylinder 64 to raise collar 46 to its position in Fig. 1. Then when the bucket is lowered again into the hole (Fig. 1), the upper kelly section is supported on collar 46, the middle section is supported by its collar 22 resting on top of keys 20 of the upper section with keys 20 of the upper section in the uppermost notches 34 of the middle section, while drive keys 26 at the bottom of the middle section are probably not in registry with any notches 34 in the splines of the lowest kelly section as in the lower part of Fig. 4. To overcome the lack of registry, liquid is released from below plunger 62, thus lowering the two interlocked upper sections of the kelly until the desired registry is obtained, as in the lower part of Fig. 5. During this lowering operation enough driving pressure is maintained on the kelly so that when registery is obtained, keys 26 snap into the notches of the lower section, thus interlocking all the kelly sections and preventing their longitudinal movement relatively to each other so long as driving pressure is maintained.

As soon as the above described interlocking is obtained, the liquid is released from cylinder 64, thus permitting the entire weight of the kelly to rest on the bucket, thus accomplishing the purpose of the invention.

Notches 34 have slightly sloping ends, so that when driving pressure is removed and tension is applied to cable 42 to telescope the kelly sections and withdraw the bucket from the hole, the drive keys usually slide out of the notches, thus automatically unlocking the sections from each other to permit telescoping. If, for any reason the sections do not unlock automatically, the kelly may be slightly rotated in reverse direction to bring about positive unlocking.

It is to be understood that the invention is not limited to the specific embodiment herein illustrated and described, but may be used in other ways without departure from its spirit as defined by the following claims.

1. In apparatus of the class described, in combination, a rotatable bucket for digging a hole in the ground, a vertical telescopic drive kelly for rotating said bucket, and interconnecting means for the sections of said kelly whereby while said bucket is digging, the weight of all of said sections may rest upon said bucket at any stage of the digging operation.

2. In apparatus of the class described, in combination, a kelly having a plurality of telescopic sections, and interlocking means operable at the will of the operator for preventing longitudinal movement of said sections relatively to each other.

3. In apparatus of the class described, in combination, a kelly having a plurality of telescopic sections, and interlocking means operable at the will of the operator for preventing longitudinal movement of said sections relatively to each other, said interlocking means being effective while said sections are in any telescopic relationship relatively to each other.

4. In apparatus of the class described, in combination, a kelly having a plurality of telescopic tubular sections, each driven by the section above it through the instrumentality of keys in the driving section, and notched splines on the driven section, each of said keys being adapted to enter a notch in a spline to prevent longitudinal relative movement of said driving and driven sections relatively to each other.

5. The invention set forth in claim 4 in which driving pressure applied to said kelly tends to hold said keys in said notches.

6. The invention set forth in claim 4 in

which said notches have inclined ends whereby longitudinal pressure tending to move said sections relatively to each other also tends to move said keys out of engagement with said notches.

7. In apparatus of the class described, in combination, a kelly having a plurality of telescopic sections, and means for interlocking said sections in a plurality of predetermined telescopic positions relatively to each other, for the purpose set forth.

8. In apparatus of the class described, in combination, a kelly having a plurality of telescopic sections, means for interlocking said sections in a plurality of predetermined telescopic positions relatively to each other, and means for moving said sections relatively to each other to place said sections in the desired telescopic positions.

9. The invention set forth in claim 8 in which said moving means comprises a hydraulic plunger.

10. The invention set forth in claim 1 in which said interlocking means is effective while said kelly is rotating in one direction and ineffective while said kelly is rotating in the other directon.

11. The invention set forth in claim 7 in which said interlocking means is effective while said kelly is rotating in one direction and ineffective while said kelly is rotating in the other direction.

In testimony whereof I hereto affix my signature.

HERMAN R. SMITH.