Sept. 13, 1955 A. B. CRICHTON, JR 2,717,674

COAL MINING DRILL APPARATUS

Filed April 4, 1952 4 Sheets-Sheet 1

FIG. 1

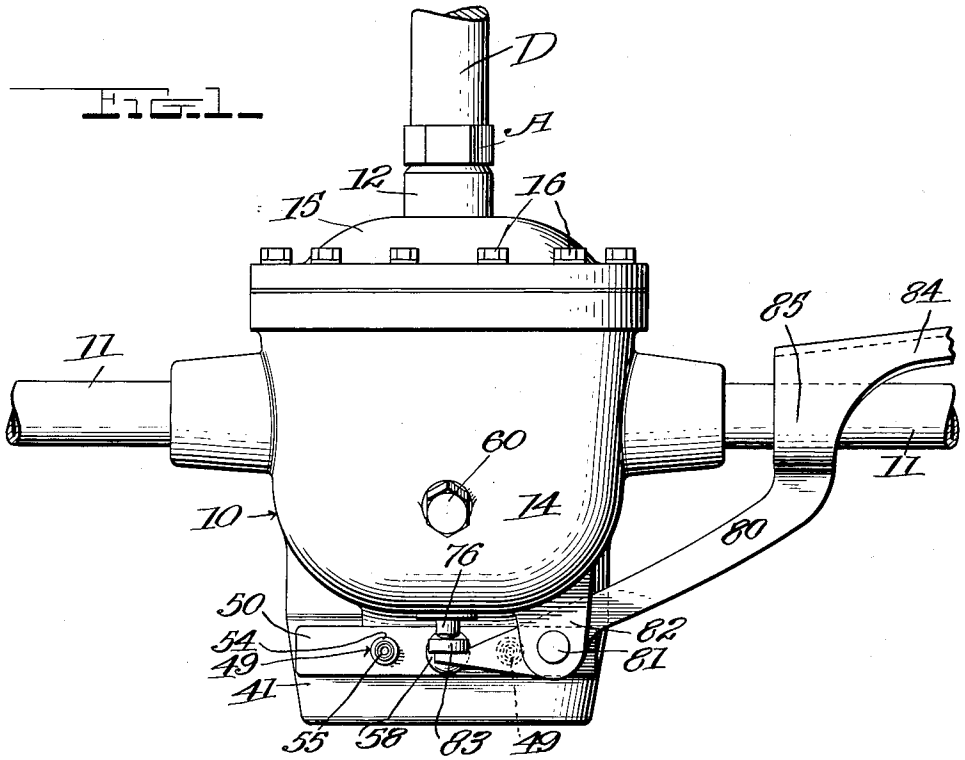
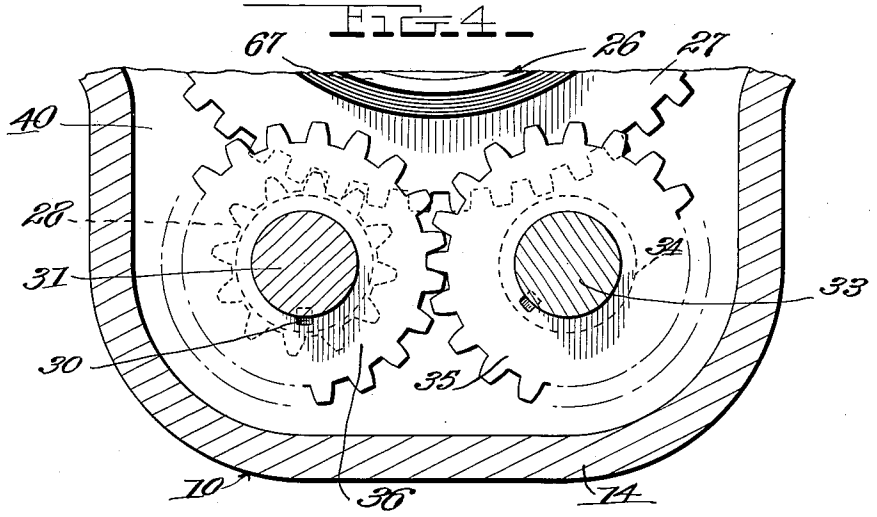


FIG. 4

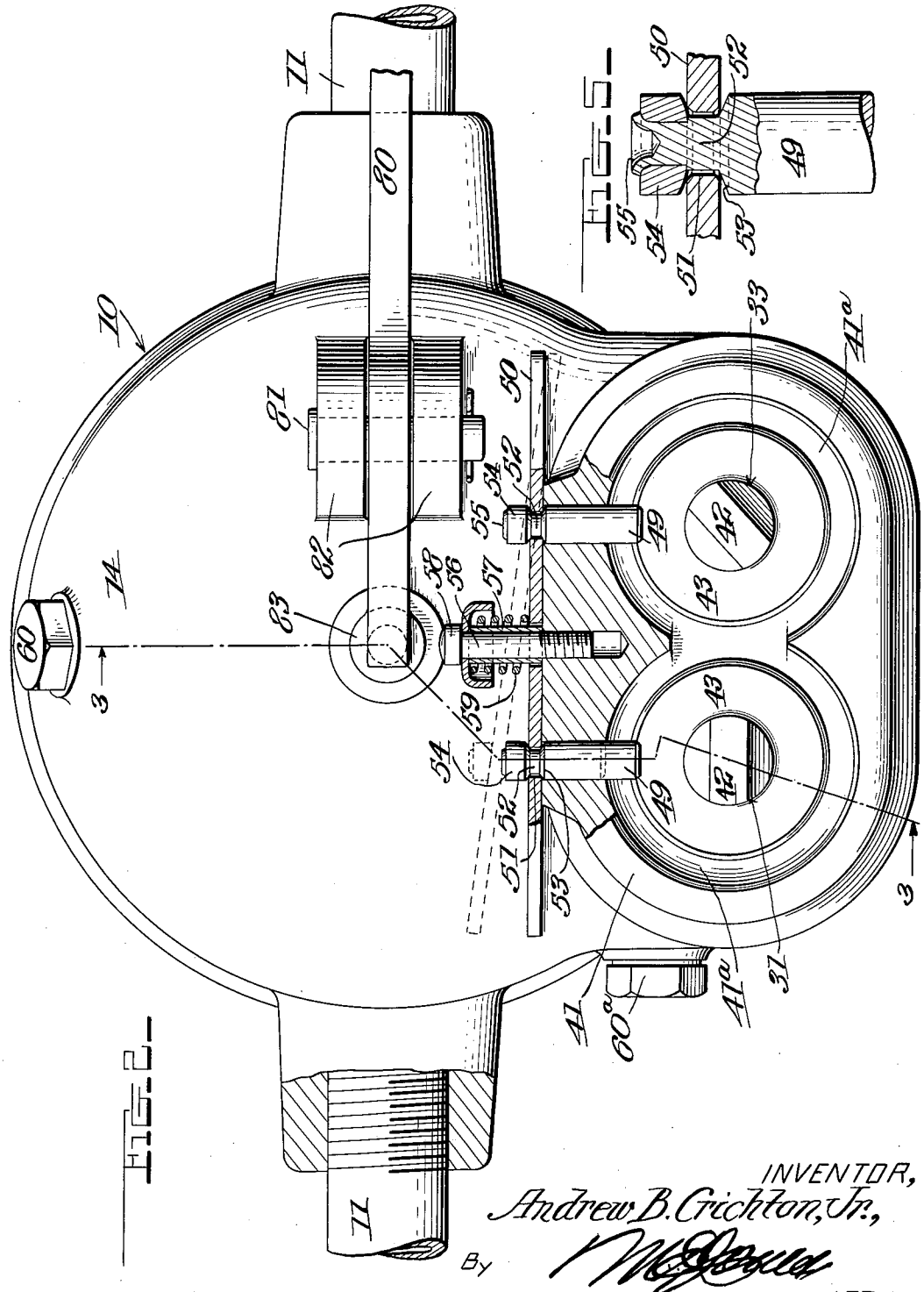


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COAL MINING DRILL APPARATUS

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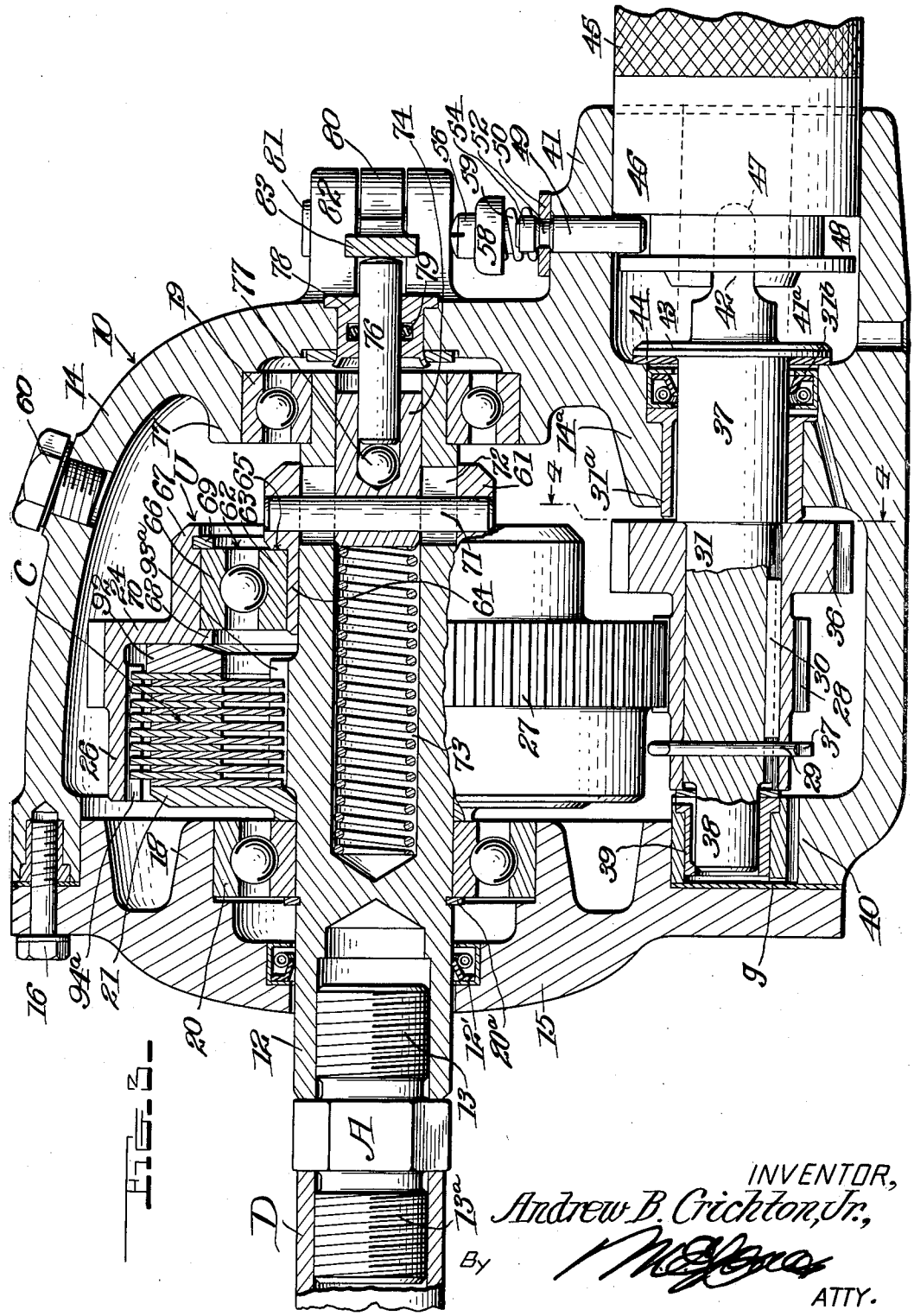


FIG. 5

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COAL MINING DRILL APPARATUS

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FIG. 6

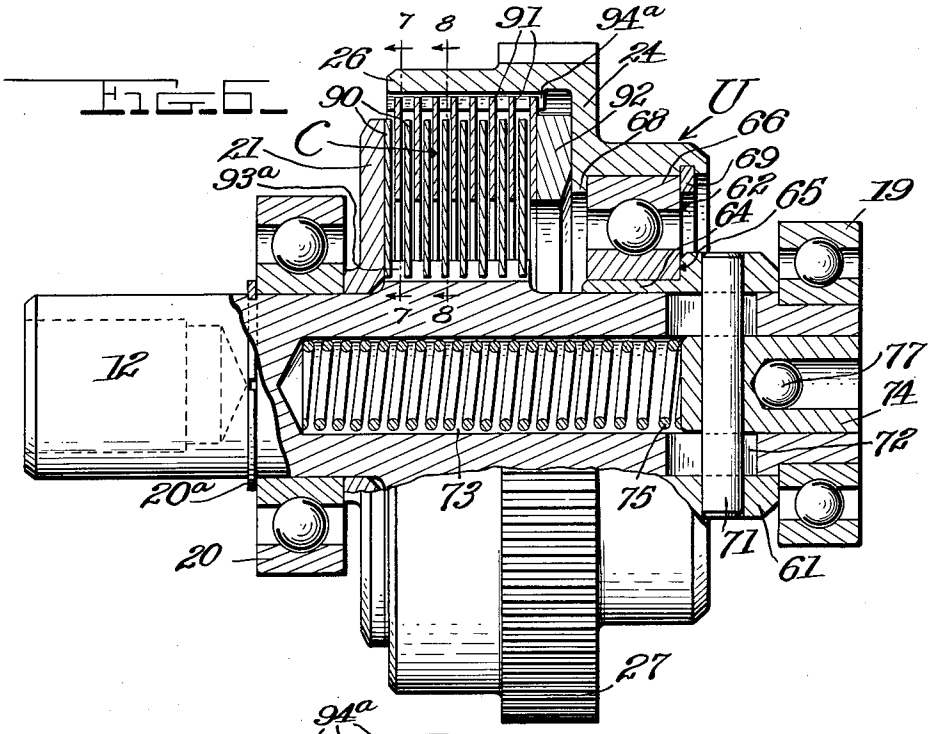


FIG. 7

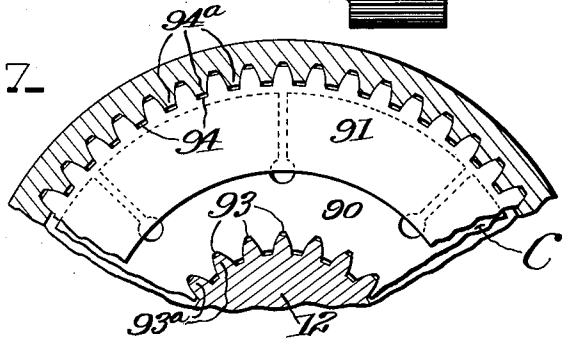
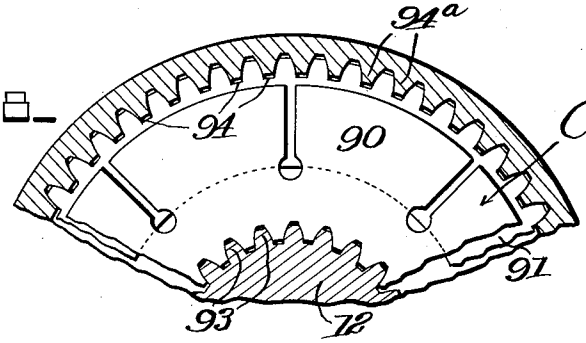


FIG. 8



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United States Patent Office 2,717,674
Patented Sept. 13, 1955

2,717,674

COAL MINING DRILL APPARATUS

Andrew B. Crichton, Jr., Johnstown, Pa.

Application April 4, 1952, Serial No. 280,619

9 Claims. (Cl. 192—20)

This invention relates to a drill apparatus especially useful in coal mining and other relations of the general character disclosed for instance in the pending application of Andrew B. Crichton, Jr. et al., Serial No. 6236, filed February 4, 1948, for Clutch Mechanism for Coal Mining Drill Apparatus, now Patent No. 2,646,144, dated July 21, 1953.

It is aimed to provide a structure possessing all of the advantages of the invention of said pending application and particularly one that is structurally different to the end that it is more substantial and sturdier, with its various novel walls or parts in a given relative size of overall structure or head may be made thicker and the gearing heavier.

A prime object also is to provide for novel and improved control of the clutch employed particularly without sacrifice of strength of the tool drive shaft and with assurance of maximum strength, coaction, mounting, and operation in association therewith.

A further object is to provide novel means and selective forward or reverse driving of the apparatus or head from a shaft, preferably flexible, driven for example from a coal cutter, and novel means to readily detachably couple or latch the latter shaft in its selected positions of operation.

Still further, it is an object to provide a construction wherein the housing or casing is sectional and the tool drive shaft and clutch and the internal operating mechanism may be assembled as a unit and as such applied to and removed from the housing or casing.

Another object is to provide an improved construction of means operating through the tool drive shaft to control a clutch in surrounding relation thereto.

Generally it is sought to produce a simplified and improved construction, especially with regard to strength, safety of operation and facility of assembly.

Various additional objects and advantages will in part be pointed out and otherwise become apparent from a consideration of the description following taken in connection with the accompanying drawings illustrating one operative embodiment, and in which drawings,

Fig. 1 is a plan view of the improved drill apparatus;

Fig. 2 is a rear view thereof on an enlarged scale, certain parts being broken away and shown in section to emphasize details;

Fig. 3 is a vertical longitudinal sectional view taken approximately along the line 3—3 of Fig. 2;

Fig. 4 is a detail vertical sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a detail sectional view of one of the latches and its connection to the actuator, the section for instance being taken along aforesaid line 3—3 of Fig. 2;

Fig. 6 is a view showing the unitary interior assembly employed;

Fig. 7 is a vertical detail section taken on line 7—7 of Fig. 6; and

Fig. 8 is a vertical detail section taken on the line 8—8 of Fig. 6.

Referring specifically to the drawings, wherein like reference characters designate like or corresponding parts throughout the different views, **10** designates a lightweight casing for example of aluminum adapted to be manually held in operation by means of diametrically opposite handles **11**, to apply a coal drilling auger or other tool fragmentarily shown at D in Fig. 3, driven by a tool drive shaft **12** and detachably coupled thereto by suitable means such as an adapter A respectively screw-threaded therein at **13** and **13a** for example.

Said casing **10** may comprise two or more separable sections such as a main section **14** and a comparatively flat cover or closure section **15** secured together against lubricant leakage as by screws **16** and an interposed gasket *g*. Aligned hubs **17** and **18** strengthen and extend integrally and inwardly from the said sections and rotatably but non-slidably detachably mount the aforesaid tool drive shaft **12** in ball-bearing devices **19** and **20** detachably disposed in the said hubs **17** and **18**, respectively located on opposite sides of a clutch generally designated C, and which includes an initially separate clutch ring or head **21** made rigid with the shaft **12** through shrinking, welding or otherwise. Clutch C also includes a head or plate **24** which is part of a preferably one-piece large hollow ring gear body **26** whose gear-teeth **27** are external. It will be noted that said shaft **12** extends to the exterior of the casing through an opening of section **15** and an oil seal **12'** mounted therein.

Said ring-gear **26** under control of said clutch C drives shaft **12** to operate the coal cutting auger D.

As shown in Fig. 6, the tool drive shaft **12** together with ball bearings **19** and **20** and the parts mounted internally and externally by said shaft **12** constitute a unitary assembly which may be designated U and which is positioned as a unit in the condition of Fig. 6, in casing section **14** when the casing sections are detached, following which section **15** is applied onto shaft **12** and bolted to section **14** by the said bolts **16**. In the said assembly bearing **20** is held in place on shaft **12** against head **21** by a snap ring **20a** engaging a groove in the shaft.

Enmeshed with teeth **27** are the teeth of a "slow speed" gear wheel or pinion **28** formed integral with a stub shaft sleeve **29** detachably keyed at **30** on a driving stub shaft **31** and on which it is held against detachment by a cotter key **37**. Adjacent and parallel to stub shaft **31** is a reversing stub shaft **33** which has a stub shaft sleeve **34** detachably keyed thereon in the same manner as stub shaft sleeve **29** is detachably keyed on stub shaft **31**. Integral with said sleeve **34** is a reversing gear wheel or pinion **35** whose teeth are enmeshed with the teeth of a preferably similar sized high speed gear wheel or pinion **36** formed integrally as part of stub shaft sleeve **29**. Said stub shafts **31** and **33** are detachably mounted in casing section **14** each being slidably insertable from the rear of the casing inwardly through bushings **31a** and oil seals **31b** disposed in openings in section **14**. Said stub shafts **31** and **33** each has an enlarged rear portion **37** and a reduced front end **38**, the former being journalled in said bushings **31a** and the latter extending removably into and being journalled in bushings **39** mounted in a low oil-reservoir-forming front wall **40** of casing section **14**. It will be realized that such stub shafts **31** and **33** are attached to casing section **14** before the assembly of unit U therein and casing section **15** is bolted in place. Stub shaft sleeves **29** are of a length corresponding to the distance between bearings **31** and **39** and are initially positioned so that stub-shafts **31** and **33** are passed therethrough as they are assembled in section **14**. Thereafter cotters **37** are applied whereby the stub shafts and sleeves **29** are operatively coupled together and to casing section **14** against accidental displacement.

The wall of casing section 14 in which the bushing 31a is mounted is thickened as at 14a, and integral with such casing section and externally thereof is an exteriorly open flange 41 forming a head or double socket formed by two arcuate sections 41a. The rear ends of both shafts 31 and 33 extend into said double socket 41 and terminate in reduced extensions having relatively flat tongues 42. Integral with said shafts 31 and 33 and disposed in the socket 41 are plates 43 adapted to overlap the wall of casing 14 about the openings through which said shafts 31 and 33 extend. Washers 44 are preferably interposed between said plates or flanges 42 and the casing section 14 as shown.

The apparatus is adapted to be power-operated from any suitable source, and for instance by means of a flexible shaft 45 driven by a short wall coal cutter. Said flexible shaft 45 is equipped with a metallic terminal 46 adapted to be inserted into the socket 41 and engage at a slot 47 provided in such terminal selectively in the arcuate sections 41a of said socket and with the tongues 42 in order to drive shaft 31 as a forward drive or shaft 33 as a reverse drive. It will be noted that terminal 46 has an annular groove 48 which may be adapted to be occupied by either of the latch pins 49. Said latch pins are vertically slidable in the top wall of the socket 41 one at each section 41a and are manipulated by means of an actuator in the form of a bar 50, adapted to be raised at either end according to which pin 49 is to be elevated for connection or disconnection in groove 48. Actuator 50 has openings 51 enlarged with respect to necks 52 of the pin 49. The pins at opposite sides of the bar have shoulders 53 and shoulders afforded by means of disks 54 which are fastened to the pins as by upsetting the outer ends thereof as at 55. It will be clear that the shoulders 51 and the disk 54 are spaced a greater distance than the thickness of actuator 50 in order that a loose connection will be afforded to enable the actuator 50 to be elevated at either end. One of the lifting positions of said actuator is suggested by dotted lines in Fig. 2.

A bolt 56 passes through an enlarged opening in the actuator 50 and is screwed in place to the top wall of the socket 41. Surrounding such bolt 56 is a sleeve 57 passing through the adjacent enlarged opening of the actuator 50. On sleeve 57 rests a cap or abutment 58 positioned on the bolt 56 while an expansive coil spring 59 surrounds said sleeve 57 and at opposite ends engages actuator 50 and abutment 58 to bias the actuator 50 to the horizontal or full line position of the drawings.

Attention is called to the fact that the various bearings and bushings are grooved, open or otherwise shown in such manner that lubricant may freely pass to and through the same and also that the casing is adapted to contain lubricant for the effective operation of the parts with minimum friction and which lubricant may be applied through a suitable opening in the casing such as that covered by a detachable plug 60.

In order to longitudinally slide the ring gear body 26 to control the clutch C, a collar 61 is adapted to slide therewith, and to this end ring gear body 26 and collar 61 are connected by means of a ball bearing device 62 which also slides with said ring gear body and collar, although bearing 62 need not be connected to said collar. However, the inner race member 63 is mounted on a reduced terminal 64 of said collar 61 and is abutted by a shoulder 65 in said collar in order to slide the bearing 62 in applying the clutch. The outer race member 66 is disposed in a hub of flange 67 of the ring gear body, being positioned between an inwardly extending flange integral therewith and a detachable snap ring 69 disposed in a groove 70 in said hub 67. A pin or connector 71 is removably carried diametrically by collar 61 and it passes through a diametric slot 72 in the tool drive shaft 12. The latter

shaft has a hollow 73 in which a plug 74 is slidable and through which said pin 71 also passes. Said coil spring 75 is disposed in the hollow 73, abutting the plug 74 and accordingly biasing the clutch C to release position.

Said plug 74 is hollow and into one end thereof a pin 76 extends, preferably freely and engaging a friction reducing ball 77 trapped in the hollow. Pin 76 is rotatable and slidable in a bushing 78 suitably mounted in an opening of casing section 14. Bushing 78 preferably carries a sealing washer 79 surrounding said pin 76 as shown. Any suitable means may be employed to slide the pin 76 to the left to apply the clutch C against the action of spring 75 which normally biases such clutch to open position. This means may be a lever 80 pivoted as at 81 to lugs 82 integral with section 14. Said lever 80 has a head 83 which directly engages the outer end of the pin 76 exteriorly of the casing. The free end of lever 80 terminates in an operating handle 84 which is adapted to be engaged simultaneously with the adjacent handle rod 11 and pressed toward that handle rod to apply the clutch, it being clear that at portion 85 the handle 80 is hollow so that adjacent handle rod 11 will pass freely therethrough.

Attention is called to the fact that the clutch C is of the friction type and that the spring 75 is adapted to yield at a predetermined degree of tension as a safety measure so that the drill head and drill cannot twist the arms and body of the operator when using the same, the apparatus thus being automatically relieved of pressure should the operator for any reason let go of the handles 11 while drilling, and the clutch being automatically released in all events to avoid injury to the workmen or mechanism. Said friction clutch C may, for example, comprise a series of alternate clutch disks or plates 90 and 91 together with a spacing ring 92. Said disks 90 and 91 and spacing disk 92 are freely mounted about shaft 12 for limited sliding movement relative to such shaft and to each other, and the disks 90 about the shaft 12 are notched at 93 and have interfitting sliding engagement with ribs 93a integral with shaft 12 while the disks 91 are in the shape of rings and are peripherally notched at 94 and have sliding positioning engagement with ribs 94a on the interior of the ring gear body.

In the operation of the device it will be clear that it is driven by the flexible shaft 45 in forward direction when that shaft is coupled to stub-shaft 31, and in reverse direction when flexible shaft 45 is selectively coupled to the shaft 33, it being clear that to effect the coupling and uncoupling of said flexible shaft, that actuator bar 50 may be raised or tilted from either end against the tension of the spring 59 in order to move the appropriate pin 49 into or out of the groove 48. Gear 36 through gear 28 directly or reversely, from gear 35, drives the gear teeth 27, and thus the ring gear body 26 and through the clutch C, when lever 80 is applied, slides ring gear body 26 to a limited extent to the left, and with it the bearing 62, sleeve 61, pin 71, plug 74 and pin 76 thereby to clutch the tool drive shaft 12 with the source of power, and accordingly operate the coal drill auger or other tool D.

Various changes may be resorted to provide they fall within the spirit and scope of the invention.

I claim:

1. Apparatus of the class described having a casing, an operating shaft journalled therein, a clutch plate within the casing on said shaft, a clutch plate member within said casing slidable on said shaft and having an annular wall, friction clutch means between said plate and member surrounded by said wall, gear teeth on the exterior of said wall, a rib on the inner surface of said wall, a rib on said shaft, said friction clutch means being interengaged with said ribs, means operable to slide said member including a plug slidably disposed in said shaft, said

shaft having a longitudinally enlarged slot, a pin extending through said slot connecting said member to said plug, means engaging said gear teeth to rotate said member, an operating member on the exterior of the casing, a bushing in the wall of said casing, and a slidable pin mounted in said bushing engageable at opposite ends with said plug and operating member.

2. Apparatus of the class described having a casing, an operating shaft journalled therein, a clutch plate within the casing on said shaft, a body within the casing including a clutch plate, friction clutch means between the clutch plates, an annular gear wall on said body enclosing said friction clutch means, a hub on said body, a bearing device having inner and outer races, said outer race being mounted in said hub, a slidable collar on said shaft fixed to said inner race, means operable to slide said collar extending into the shaft, a connection through said shaft from said collar to said means, and means to rotate said gear wall.

3. Apparatus of the class described having a casing, an operating shaft journalled therein, a clutch plate within the casing on said shaft, a body within the casing including a clutch plate, friction clutch means between the clutch plates, an annular gear wall on said body enclosing said friction clutch means, a hub on said body, a bearing device having inner and outer races, said outer race being mounted in said hub, a slidable collar on said shaft fixed to said inner race, means operable to slide said collar extending into the shaft, a connection through said shaft from said collar to said means, means to rotate said gear wall, said casing having a main wall, an operating member on the exterior of said main wall, and a slidable pin mounted in said main wall engageable at opposite ends with said plug and operating member.

4. Apparatus of the class described having a casing consisting of a main section and a closure section, each of said sections having inner annular flanges, bearings in said flanges, an operating shaft journalled in said bearings, a clutch plate within the casing on said shaft, a body within the casing including a clutch plate, friction clutch means between the clutch plates, an annular gear wall on said body enclosing said friction clutch means, a hub on said body, a bearing device having inner and outer races, said outer race being mounted in said hub, a slidable collar on said shaft fixed to said inner race, means operable to slide said collar extending into the shaft, a connection through said shaft from said collar to said means, and means to rotate said gear wall.

5. Apparatus of the class described having a sectional casing, an operating shaft journaled in the sections of said casing, a clutch plate within the casing on said shaft, a clutch plate member within said casing slidable on said shaft, friction clutch means between said plate and member, said shaft and parts mounted thereon constituting a unit, one of the casing sections having an open side through which said unit is inserted, said unit carrying bearings at opposite ends, each section having a seat for its said associated bearing, and driving mean positioned in the main casing section and movable with said unit through application of the latter into the main casing section.

6. Apparatus of the class described having a sectional casing; said casing having spaced walls providing bearings, a driving shaft applicable from the exterior of the casing through one of said bearings into the other, a sleeve disposed between said walls through which the driving shaft passes, means to secure said driving shaft and sleeve in said position against accidental displacement, an operating shaft mounted in said casing, a loosely mounted shaft about said operating shaft, clutch means between said shafts, and gear means whereby the second shaft enmeshes with said sleeve to be driven therefrom.

7. Apparatus of the class described having a casing, an operating shaft journaled in said casing, a clutch plate within the casing on said shaft, a body within the casing including a clutch plate, friction clutch means between the clutch plates, an annular gear wall on said body enclosing said friction clutch means, a hub on said body, a collar slidable on and rotatable with said shaft, means at said hub mounting said body to slide with and rotate on said collar, and mechanism coacting with said collar accessible for operation from the exterior of the casing.

8. Apparatus of the class described having a casing, an operating shaft journaled in said casing, a clutch plate within the casing on said shaft, a body within the casing including a clutch plate, friction clutch means between the clutch plates, an annular gear wall on said body enclosing said friction clutch means, a hub on said body, a collar slidable on and rotatable with said shaft, means at said hub mounting said body to slide with and rotate on said collar, and mechanism coacting with said collar accessible for operation from the exterior of the casing extending through the wall of the casing, the interior of said operating shaft and to said collar.

9. Apparatus of the class described having a casing, an operating shaft journaled in said casing, a clutch plate within the casing on said shaft, a body within the casing including a clutch plate, friction clutch elements loosely disposed between said plates, a rib on the interior of said wall slidably interengaged with said clutch elements, friction clutch elements coacting with the first friction clutch elements, a rib on the operating shaft slidably interengaged with said second-mentioned clutch elements, a hub on said body, a collar slidable on and rotatable with said operating shaft, bearing means mounting said body at said hub to slide with and rotate on said collar, and mechanism coacting with said collar accessible for operation from the exterior of the casing.

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