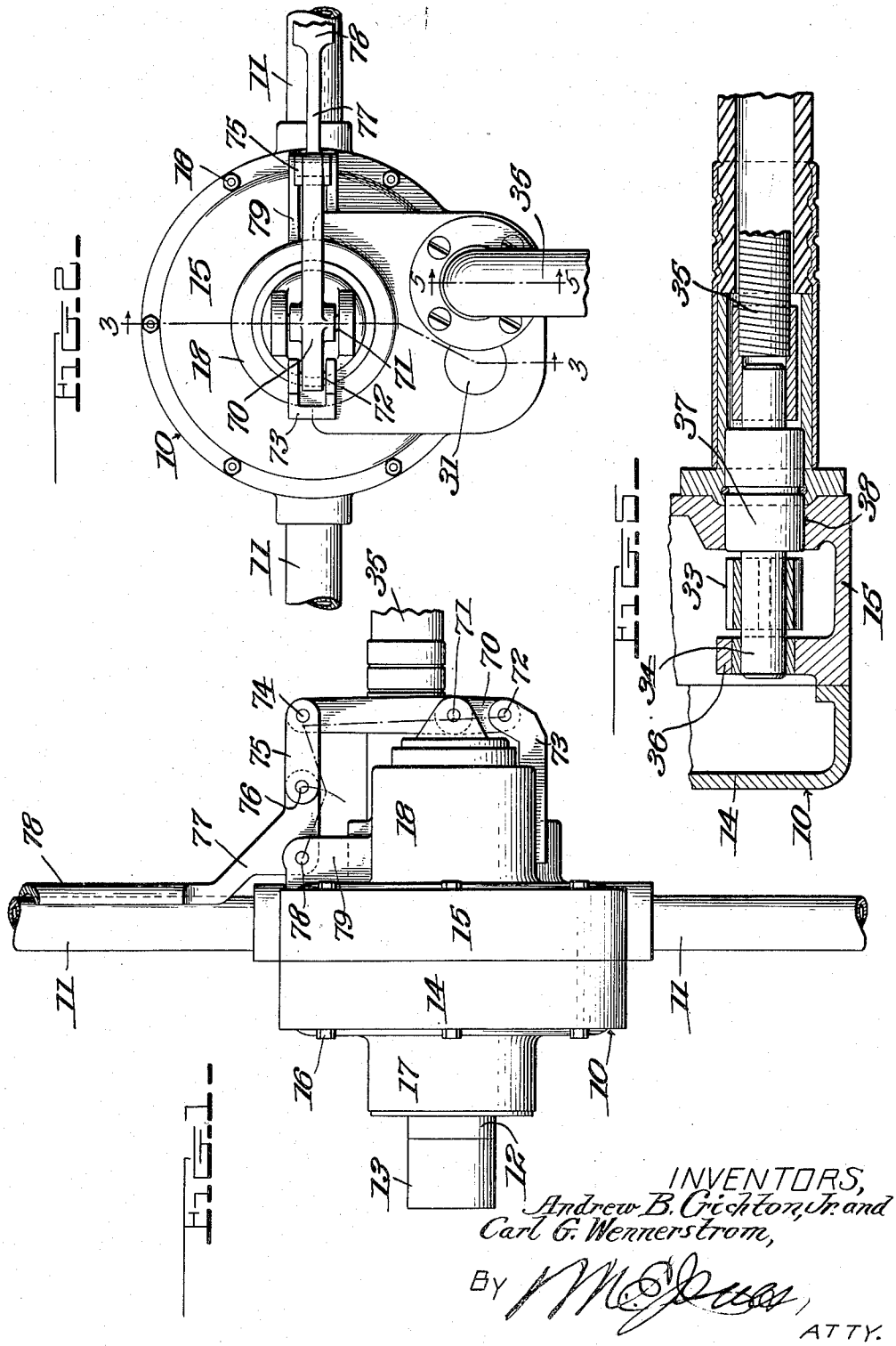
July 21, 1953 A. B. CRICHTON, JR., ET AL 2,646,146

CLUTCH FOR DRILL HEADS

Filed April 19, 1948 3 Sheets-Sheet 1



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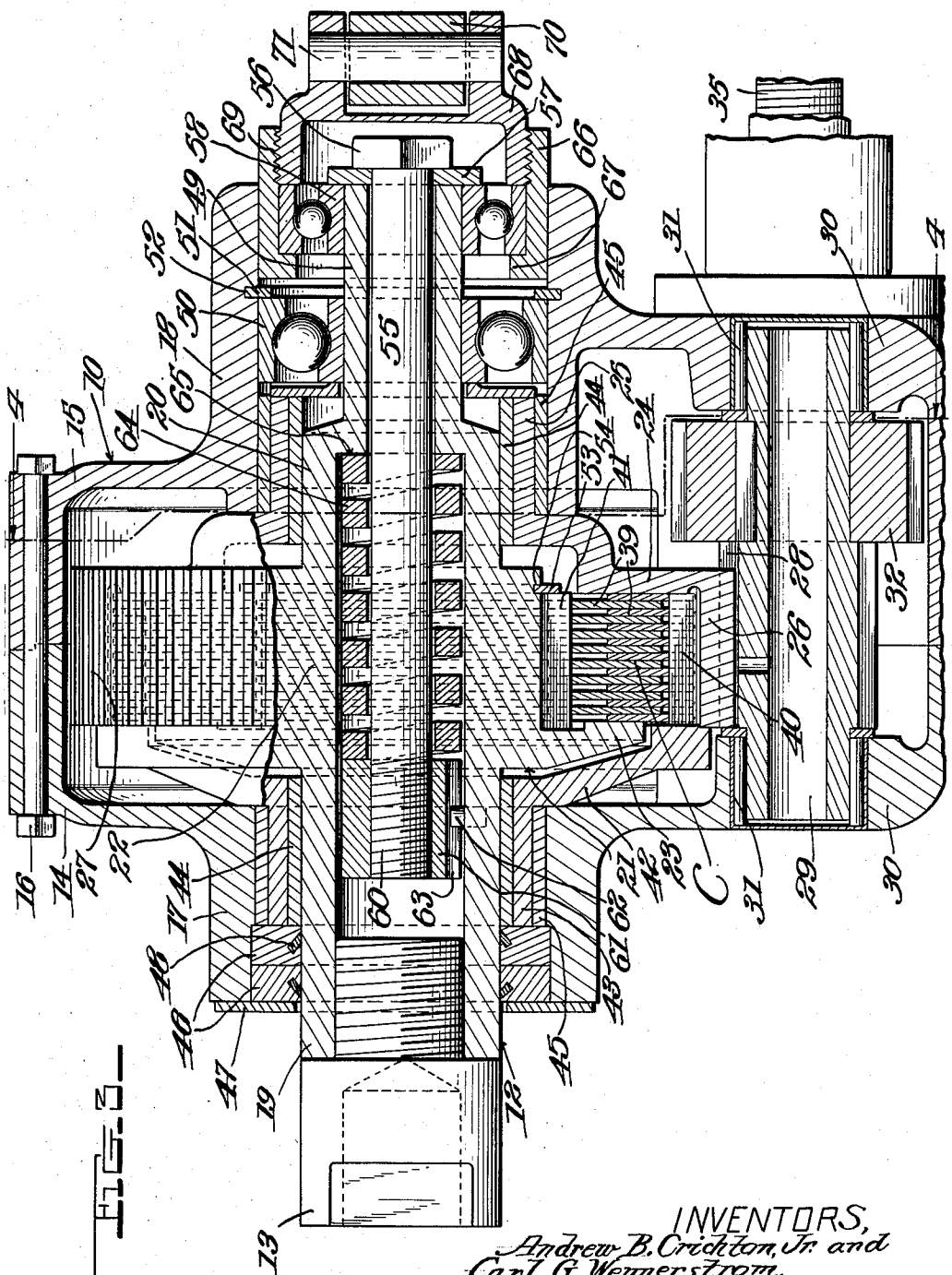

FIG. 3

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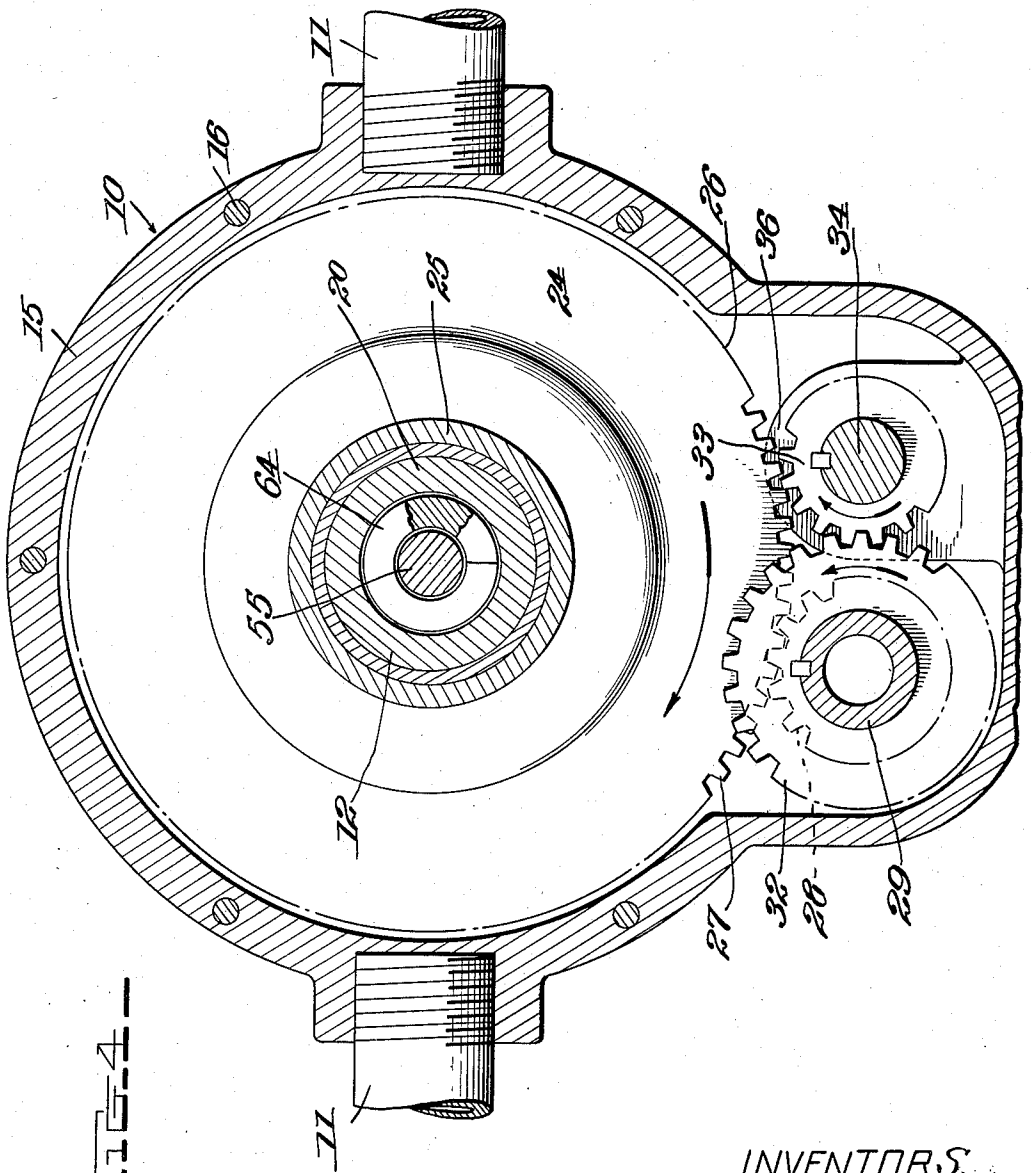

FIG. 4

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CLUTCH FOR DRILL HEADS

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Application April 19, 1948, Serial No. 21,894

18 Claims. (Cl. 192—20)

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This invention relates to a drill head especially applicable in coal mining and other relations of the general character disclosed in our pending application, Serial No. 6,236, filed February 4, 1948, for Coal Mining Apparatus, and our pending application, Serial No. 21,893, filed of even date herewith for a Power Take-Off System and Apparatus.

An important object is to produce, irrespective of any particular source of power, a drill head wherein the torque capacity of the clutch which controls the operation of the auger, in order to enhance safety of operation, will be in direct proportion to the amount of pressure manually exerted in applying the drill head, enabling the miner to feel his way along as he drills and exert just enough pressure to revolve the auger, any sticking or jamming of the drill causing slipping of the clutch.

Again, an object is to provide for optional operation of said drill head without slippage of the clutch, especially when the driller wishes to rotate the drill in extracting it.

While it is generally aimed to provide a construction which will carry out the objects and aims disclosed in the mentioned applications, it is also aimed to provide a novel and preferably lever-controlled mechanism for applying the clutch against slippage; to provide a novel detail construction, to provide a construction wherein the clutch plates are maintained against oil seepage, and a construction wherein the drive or auger operating shaft and associated parts are better balanced and more evenly supported at opposite sides.

Various additional objects and advantages will in particular be pointed out and otherwise become apparent as this description progresses, taken in connection with the accompanying drawings illustrating one operative embodiment by way of example. In said drawings:

Fig. 1 is a plan view of a drill head constructed in accordance with the invention;

Fig. 2 is a rear view of such drill head;

Fig. 3 is a substantially longitudinal sectional view on an enlarged scale taken on the line 3—3 of Fig. 2;

Fig. 4 is a cross-section taken on the line 4—4 of Figure 3; and

Fig. 5 is a fragmentary section taken on the line 5—5 of Fig. 2.

Referring specifically to the drawings, wherein like reference characters designate like or corresponding parts throughout the different views, 10 designates a light-weight casing adapted to be

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manually held in operation by means of diametrically opposite handles 11, to apply a coal drilling auger or other tool (not shown) driven by a hollow drive shaft 12 and attached thereto by means of a socket 13 for example.

Said casing 10 may comprise two or more separate sections 14 and 15 secured together as by bolts 16. Aligned hubs 17 and 18 extend outwardly from the respective said sections and suitably, rotatably and slidably mount the aforesaid tool drive shaft 12 at portions 19 and 20 located on opposite sides of a clutch generally designated C, and which includes a clutch section 21 integral with the shaft 12 provided by an enlarged annular portion 22 and a clutch head 23. Clutch C also includes a large hollow section 24 open at one side and having a hub 25 concentric with shaft portion 20. Hollow section 24 is a large gear wheel since a peripheral flange 26 integral therewith extends in the opposite direction to hub 25 and is provided with gear-teeth 27.

Said integral gear-wheel 26 drives shaft 12 to operate the coal cutting auger under control of the said clutch C. Enmeshed with teeth 27 are the teeth of a gear wheel 28 formed integral with a stub shaft 29 removably journalled in bearings 30 on the sections 17 and 18 and preferably directly in needle or roller bearing structures 31.

Keyed on shaft 29 is a pinion 32 enmeshed with a pinion 33 keyed to a driving shaft 34 in unitary relation with and driven by a flexible shaft 35, such shaft 34 being journalled in a bearing 36 in casing section 15 and in ball or needle-bearing structure 37 partly and removably disposed in a bearing opening 38 in section 15. Said shaft 34 with pinion 33 thereon and said part of structure 37 are applicable and removable through said opening 38.

Said flexible shaft 35 is adapted to be driven from any suitable source of power and especially from a short wall coal-cutter or other means necessarily employed in mining operations, as in our previously identified applications for patents.

Reverting to clutch C, it is preferably of the friction type employing a series of separate rings or disks 39 arranged for frictional engagement with each other and alternately having guided engagement at marginal notches with any number of splines 40 and 41 carried by flange 26 and enlargement 22.

The casing 10 is adapted to be filled with lubricant which is excluded from the clutch C by a closure plate 42 covering the open side of hollow section 24 and bearing against the free edge of flange 26. Closure plate 42 has an integral out-

wardly extending hub 43 extending into hub 17 in which shaft portion 19 is journaled. Hollow section 24 and plate 42 coact in balancing the structure at opposite sides of the clutch and they respectively bear against the inner faces of the hubs 18 and 17. Hubs 25 and 43 on both the inner and outer faces have attached thereto or loosely provided, suitable ring linings or bearings 44 and 45. Closure plate 42 may be loosely journalled or float or be relatively fixed as preferred. The hub 17 is sealed against the escape of lubricant in any suitable manner as by means of one or more ring washers 46 retained in place by a ring plate 47 detachably secured to the outer end of hub 17. Ring washers 46 preferably carry gaskets 48 contacting shaft portion 19.

Said shaft portion 20 terminates in a reduced portion 49 which is journaled and has limited sliding movement in a suitable ball bearing or equivalent structure 50 housed in the bore of hub 18 and retained against outward displacement by a split ring 51 mounted in an annular groove 52 at said bore. A washer is interposed between said bearing structure 50 and the end of hub 25. A split ring 53, detachably mounted in an annular groove 54 in enlargement 22 aids in confining and positioning the clutch rings or disks 39.

A clutch control rod 55 shown as a bolt is disposed slidably in the bore of the tool drive shaft 12, with a head 56 bearing against a plate 57 which in turn abuts the outer end of shaft portion 49 and the adjacent surface of a race of a ball bearing or equivalent structure 58. Control rod 55 at screw-threads 60 is adjustably engaged with the screw-threads of a nut 61 slightly slidable but non-rotatably located in the bore of hollow shaft 12, as by a lug 62 carried by said shaft and extending into a longitudinal groove 63 of said nut 61. A coil spring 64 surrounds rod 55 bearing at one end against said nut and at its other end against a shoulder 65 in the said bore of hollow shaft 12.

It is to be noted that spring 64 may be compressed or variably tensioned according to the adjustment of the rod 55 and co-acting nut 61.

Said rod 55 is adapted to be moved to the right, noting Fig. 3, to correspondingly move the tool drive-shaft 12 to the right, against the tension of the spring 64, and thus apply the clutch section 23 to compact and frictionally bind the clutch rings or disks 39 and thereby apply the clutch. To this end, a tubular mounting member 66 is slidably mounted in the bore of hub 18, preferably projecting slightly outwardly from said bore. The bearing device 58 is in unitary relation and moves with the tubular mounting member 66 bearing at one side against an inwardly extending flange 67 of the latter, and against the other side thereof an interiorly recessed cap 68 abuts, the latter being screw-threaded at 69 to the interior of the tubular bearing member 66. Thus the cap 68 is readily removable to permit access to and adjustment of the rod 55 through the engagement of the head 56.

Any suitable means may be employed to slide the tubular mounting member outwardly or to the right in Figs. 1 and 3 in order that the plate 57 and rod 55 will be correspondingly moved since one race of the bearing structure 58 abuts said plate 57.

As shown, means to accomplish the result stated consists of a lever 70 which is pivoted at 71 exteriorly of and to the cap 68, which lever is also pivoted at 72 to a lug 73 anchored on the hub 18. At the opposite end of lever 70, it is pivoted at 74 to a link 75 in turn pivoted at 76 to a shifting lever 77, which at 78 is pivoted to a lug 79 on said hub 18. Clutch shifting or applying lever 77 terminates in a handle 78 of suitable length arranged relatively close to another one of the handles 11 in order that it may be simultaneously grasped with the latter by one hand of the operator when desired.

Presuming the clutch C to be in released position, spring 64 is usually neutral or uncompressed whereby plate 57 is maintained in contact with the inner race member of ball bearing structure 58, and this action is augmented through an urge to slide clutch control rod 55 to the left, if such spring 64 is under compression. In this position, said spring being neutral does not bind the clutch section 23 against the friction rings or disks 39 or bind them together. However, when lever 77 is pressed at the handle 78 toward the adjacent handle-rod 11 (as in Fig. 1) the system of levers and linkage 70—77 applies the clutch by sliding the tubular mounting member 66 slightly to the right, moving the bearing structure 58 with it, also the plate 57, rod 55, nut 61, compressing or tensioning the spring 64, and slightly moving tool drive shaft 12 to the right and causing clutch section 23 to compact the plates 39 against each other and the hollow section 24.

Attention is called to the fact, however, that this operation is not normally necessary in order to apply the clutch, but is especially useful when an operator desires to extract an auger or tool from the coal. At any rate, such spring 64 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 said clutch plates are of such multiplicity and friction contact with each other and with the clutch section 23 and hollow clutch section 24, that mere pressure of the tool head and auger against the coal by manual effort, will slide the tool drive shaft 12 slightly to the right in Fig. 3, thereby compacting the rings or disks 39 and frictionally binding the same and adjacent faces of clutch sections 23 and 24, it being clear that the clutch C will be released upon relief of the pressure through the expansion of spring 64 and the pushing action of plate 57 toward the left in Fig. 3 in view of its contact with bearing structure 58, since the latter moves with the slidable tubular mounting member 66.

Various changes may be resorted to provided they fall within the spirit and scope of the invention. What is claimed is:

1. Apparatus of the class described comprising separable sections forming a casing, each section having an outwardly extending hub integral therewith, a hollow tool operating shaft having portions journaled and slidable in said sections, a gear concentric with and enlarged with respect to said shaft and enclosed by said sections, means to drive said gear, said gear being hollow and having a hub journaling one of said portions and in turn journaled in one of the first-mentioned hubs, a clutch head on said shaft opposite to the inner lateral wall of said gear, friction clutch means in said gear coacting with said wall and clutch head, a plate overlapping said clutch head and open face of said gear, a hub on said clutch plate disposed between the other shaft portion and the other of the first-mentioned hubs in which the latter shaft portion is journaled, and mechanism connected interiorly of

said shaft operable to slide the shaft to apply the clutch parts.

2. Apparatus according to claim 1 wherein said sections are separable transversely of the shaft and approximately on a plane midway of the sides of said gear, and means separably securing the sections together.

3. Apparatus of the class described comprising separable sections forming a casing, each section having an outwardly extending hub integral therewith, a hollow tool operating shaft having portions journaled and slidable in said sections, a gear concentric with and enlarged with respect to said shaft and enclosed by said sections, means to drive said gear, said gear being hollow and having a hub journaling one of said portions and in turn journaled in one of the first-mentioned hubs, a clutch head on said shaft opposite to the inner lateral wall of said gear, friction clutch means in said gear coacting with said wall and clutch head, a plate overlapping said clutch head and open face of said gear, a hub on said clutch plate disposed between the other shaft portion and the other of the first-mentioned hubs in which the latter shaft portion is journaled, and mechanism connected interiorly of said shaft operable to slide the shaft to apply the clutch parts, including a part slidable in one of said hubs.

4. Apparatus of the class described comprising separable sections forming a casing, each section having an outwardly extending hub integral therewith, a hollow tool operating shaft having portions journaled and slidable in said sections, a gear concentric with and enlarged with respect to said shaft and enclosed by said sections, means to drive said gear, said gear being hollow and having a hub journaling one of said portions and in turn journaled in one of the first-mentioned hubs, a clutch head on said shaft opposite to the inner lateral wall of said gear, friction clutch means in said gear coacting with said wall and clutch head, a plate overlapping said clutch head and open face of said gear, a hub on said clutch plate disposed between the other shaft portion and the other of the first-mentioned hubs in which the latter shaft portion is journaled, mechanism connected interiorly of said shaft operable to slide the shaft to apply the clutch parts, including a part slidable in one of said hubs, and lever mechanism operatively pivoted to said slidable part.

5. Apparatus of the class described comprising separable sections forming a casing, each section having an outwardly extending hub integral therewith, a hollow tool operating shaft having portions journaled and slidable in said sections, a gear concentric with and enlarged with respect to said shaft and enclosed by said sections, means to drive said gear, said gear being hollow and having a hub journaling one of said portions and in turn journaled in one of the first-mentioned hubs, a clutch head on said shaft opposite to the inner lateral wall of said gear, friction clutch means in said gear coacting with said wall and clutch head, a plate overlapping said clutch head and open face of said gear, a hub on said clutch plate disposed between the other shaft portion and the other of the first-mentioned hubs in which the latter shaft portion is journaled, handle means extending from the casing for manually applying the apparatus and including an element relatively close to the handle means for gripping jointly therewith, and mechanism operable by said element to slide the shaft to apply the clutch parts.

6. An apparatus of the class described having a casing, a tool-operating shaft rotatably and slidably mounted in said casing, a gear journaled in said casing, means to drive said gear, clutch means within the casing connecting said shaft with said gear and controlled through the sliding of said shaft, and lever mechanism having a lever mounted on the exterior of the casing, said mechanism extending into one end of the shaft and connected interiorly of the shaft to control the sliding of the shaft and the application of the clutch.

7. Apparatus of the class described including a casing having handle means including an element extending from the casing, a lever on said casing having a portion disposed for gripping simultaneously with said element, a tool-operating shaft journaled in the casing, means to drive said shaft including a clutch located within the casing, said shaft being slidable to control the application of the clutch, and mechanism operable by said lever operatively connected interiorly of said shaft to control the sliding of the latter.

8. Apparatus of the class described comprising a casing, a shaft journaled in said casing adapted to operate an auger or the like, a clutch plate extending from said shaft within the casing, a relatively large gear-wheel in said casing concentric therewith, having a hub in which said shaft is journaled and in turn journaled in the casing, clutch means between said plate and gear-wheel, means to drive said gear-wheel, said shaft having a limited axial movement, a rod disposed within the shaft in relatively slidable relation with respect thereto, spring means within said shaft engageable at opposite ends with said shaft and the rod, means operable from the exterior of the casing to slide said rod to compress said spring whereby the latter will slide the shaft and apply the clutch.

9. Apparatus of the class described comprising a casing, a shaft journaled in said casing adapted to operate an auger or the like, a clutch plate extending from said shaft within the casing, a relatively large gear-wheel in said casing concentric therewith, having a hub in which said shaft is journaled and in turn journaled in the casing, clutch means between said plate and gear-wheel, means to drive said gear-wheel, said shaft having a limited axial movement, a rod disposed within the shaft in relatively slidable relatively slidable relation with respect thereto, spring means within said shaft engageable at opposite ends with said shaft and the rod, means operable from the exterior of the casing to slide said rod to compress said spring whereby the latter will slide the shaft and apply the clutch, including a body slidable in the casing, and means connecting the rod to the body for movement therewith in one direction.

10. Apparatus of the class described comprising a casing, a shaft journaled in said casing adapted to operate an auger or the like, a clutch plate extending from said shaft within the casing, a relatively large gear-wheel in said casing concentric therewith, having a hub in which said shaft is journaled and in turn journaled in the casing, clutch means between said plate and gear-wheel, means to drive said gear-wheel, said shaft having a limited axial movement, a rod disposed within the shaft in relatively slidable relation with respect thereto, spring means within said shaft engageable at opposite ends with said shaft and the rod, means operable from the exterior of the casing to slide said rod to compress said

spring whereby the latter will slide the shaft and apply the clutch, including a body slidable in said casing, a bearing carried by said body in which the shaft is rotatable and slidable, a plate through which the rod extends overlapping the bearing to move with the body in one direction, and means operable to slide said body.

11. Apparatus of the class described comprising a casing, a shaft journaled in said casing adapted to operate an auger or the like, a clutch plate extending from said shaft within the casing, a relatively large gear-wheel in said casing concentric therewith, having a hub in which said shaft is journaled and in turn journaled in the casing, clutch means between said plate and gear-wheel, means to drive said gear-wheel, said shaft having a limited axial movement, a rod disposed within the shaft in relatively slidable relation with respect thereto, spring means within said shaft engageable at opposite ends with said shaft and the rod, means operable from the exterior of the casing to slide said rod to compress said spring whereby the latter will slide the shaft and apply the clutch, including a body slidable in said casing, a bearing carried by said body in which the shaft is rotatable and slidable, a plate through which the rod extends overlapping the bearing to move with the body in one direction, means operable to slide said body, including a cap detachably connected to the body, and lever mechanism pivoted to the cap and to the casing operable to slide the body.

12. Apparatus of the class described including a casing having a hub, a relatively large gear-wheel in the casing having a hub journaled in the first-mentioned hub, gearing to drive said gear-wheel, a bearing, a tool-operating shaft rotatable in the casing including the second-mentioned hub and said bearing, clutch means between the shaft and said gear-wheel, control means for said clutch means including a rod extending slidably into said shaft, a spring surrounding said rod and engaged at opposite ends with said rod and said shaft, a slidable body mounted in said hub carrying said bearing, means associated with the bearing and the rod to cause the latter to slide in one direction with said body, a cap detachably connected to the body and holding said bearing in place therein, and link and lever mechanism pivoted to the casing and said body.

13. Apparatus of the class described including a casing having a hub, a relatively large gear-wheel in the casing having a hub journaled in the first-mentioned hub, gearing to drive said gear-wheel, a bearing, a tool-operating shaft rotatable in the casing including the second-mentioned hub and said bearing, clutch means between the shaft and said gear-wheel, control means for said clutch means including a rod extending slidably into said shaft, a spring surrounding said rod and engaged at opposite ends with said rod and said shaft, a slidable body mounted in said hub carrying said bearing, means associated with the bearing and the rod to cause the latter to slide in one direction with said body, a cap detachably connected to the body and holding said bearing in place therein, link and lever mechanism pivoted to the casing and said body, a handle extending from the casing, and said mechanism including an operating lever having a portion disposed relatively close to the handle for gripping simultaneously therewith.

14. Apparatus of the class described including a casing having a hub, a relatively large gear-

wheel in the casing having a hub journaled in the first-mentioned hub, gearing to drive said gear-wheel, a bearing, a tool-operating shaft rotatable in the casing including the second-mentioned hub and said bearing, clutch means between the shaft and said gear-wheel, control means for said clutch means including a rod extending slidably into said shaft, a spring surrounding said rod and engaged at opposite ends with said rod and said shaft, a slidable body mounted in said hub carrying said bearing, means associated with the bearing and the rod to cause the latter to slide in one direction with said body, a cap detachably connected to the body and holding said bearing in place therein, link and lever mechanism pivoted to the casing and said body, and said clutch means including a plate having a hub mounted by the casing and in which the shaft is journaled, said plate being located on the same side of the gear-wheel as said clutch section and overlapping the latter and adjacent a portion of the gear-wheel.

15. Apparatus of the class described comprising separable sections forming a casing, each section having a hub, a tool operating shaft having portions journaled and slidable in said sections, a gear concentric with and enlarged with respect to said shaft and enclosed by said casing, means to drive said gear, said gear being hollow and having a hub journaling one of said portions and in turn journaled in one of the first-mentioned hubs, a clutch head on said shaft opposite to the inner lateral wall of said gear, friction clutch means in said gear coacting with said wall and clutch head, a plate overlapping said clutch head and open face of said gear, a hub on said clutch plate disposed between the other shaft portion and the other of the first-mentioned hubs in which the latter shaft portion is journaled, and mechanism operable to slide the shaft to apply the clutch parts.

16. Apparatus of the class described comprising a casing, a shaft journaled in said casing adapted to operate an auger or the like, a clutch plate extending from said shaft within the casing, a gear-wheel in said casing concentric therewith, having a hub in which said shaft is journaled and in turn journaled in the casing, clutch means between said plate and gear-wheel, means to drive said gear-wheel, said shaft having a limited axial movement, adjustment means controlled from the exterior of said casing and being movable relative to said shaft, spring means engageable with said shaft and said adjustment means for controlling the torque delivered by said clutch.

17. Apparatus of the class described including a casing, a gear-wheel journaled in the casing, gearing to drive said gear-wheel, a bearing, a tool-operating shaft rotatable in said bearing, clutch means between the shaft and said gear-wheel, control means for said clutch means including a member movable relatively to said shaft, a spring engaged at opposite ends with said member and said shaft, a slidable body carrying said bearing, means associated with the bearing and said member to cause the latter to slide in one direction with said body, and link mechanism pivoted to the casing for sliding said body.

18. An apparatus of the class described having a casing, a tool operating shaft rotatably and slidably mounted in said casing, a gear journaled in said casing subject to thrust imparted by the said shaft, means to drive said gear and bearing

device in said casing to take the thrust imposed on said gear in operation, clutch means within the casing to connect said shaft with said gear, means operable interiorly of the casing and entering the latter adjacent one end of said shaft to apply said clutch means, and means to slidingly urge said shaft away from said one end to clutch-releasing position.

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