

July 21, 1953

A. B. CRICHTON, JR., ET AL

2,646,144

DRILL APPARATUS WITH SAFETY CONTROL

Filed Feb. 4, 1948

2 Sheets-Sheet 1

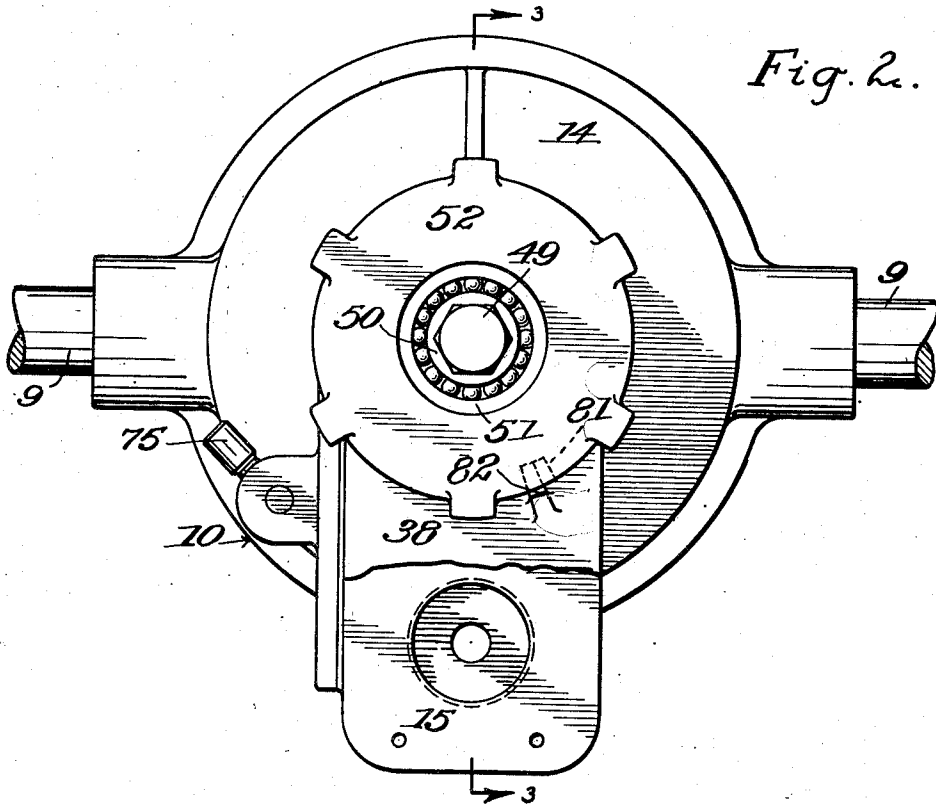


Fig. 2.

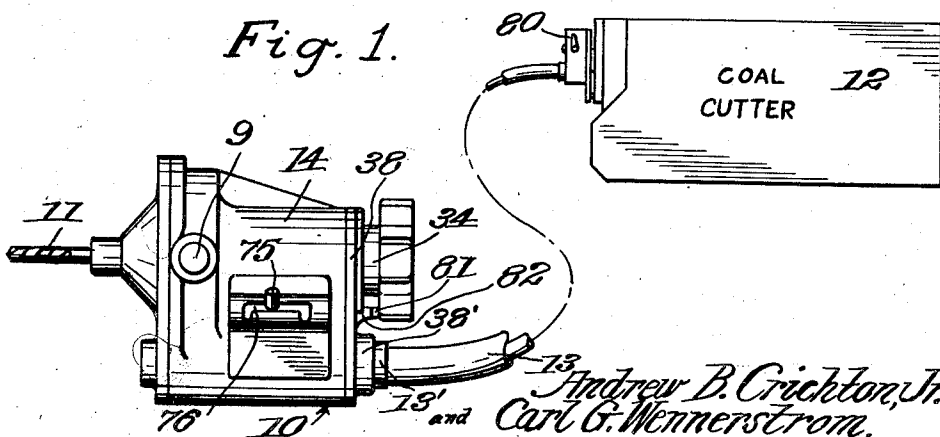


Fig. 1.

Andrew B. Crichton, Jr.,
and Carl G. Wennerstrom,
INVENTORS,

BY *McGraw*,
attorney.

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2 Sheets-Sheet 2

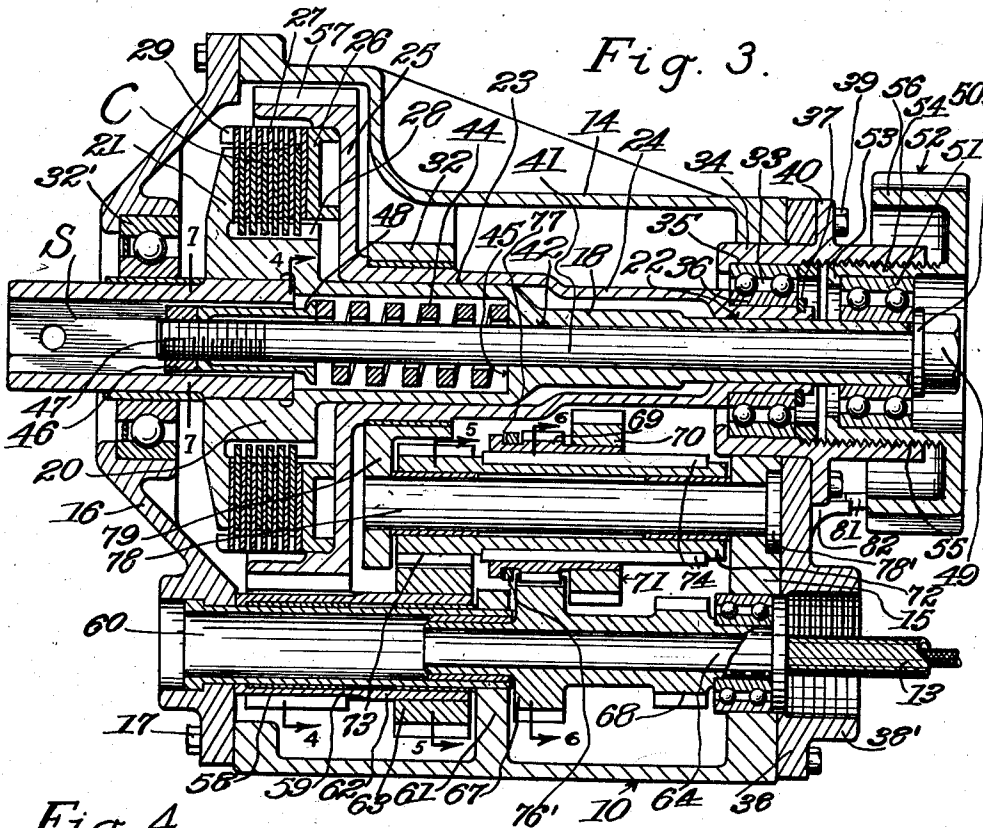


Fig. 4.

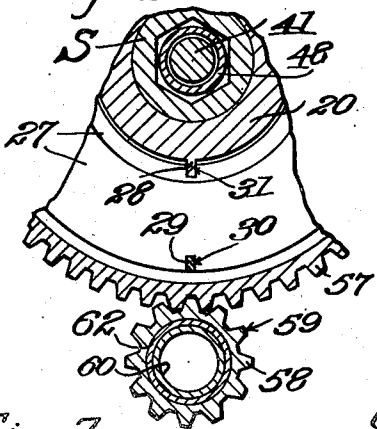


Fig. 5.

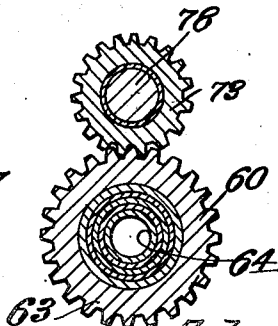


Fig. 6.

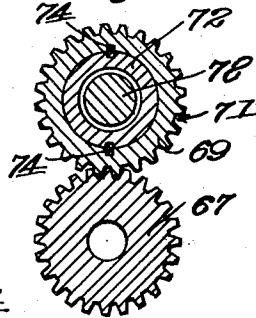


Fig. 7.



Andrew B. Crichton, Jr.,
and Carl G. Hennestrom,
INVENTORS,

BY *W. J. [Signature]*
attorney.

UNITED STATES PATENT OFFICE

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DRILL APPARATUS WITH SAFETY CONTROL

Andrew B. Crichton, Jr., Johnstown, Pa., and Carl G. Wennerstrom, Chicago, Ill.; said Wennerstrom assignor to The Crichton Company, Johnstown, Pa., a corporation of Delaware

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17 Claims: (Cl. 192—3.5)

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This invention concerns mining, especially coal mining, and a drill head capable of use therefor as well as in other relations.

It is particularly aimed to provide a practical means utilizing electricity as the source of power, for mining coal or other material, free of the electrocution hazard.

Another object is to provide a novel drill head of relatively light weight capable of operation from a flexible or other shaft rotated by any preferred power source, even electrical such as a short wall machine which advances with the face, in coal mining, to the end that the drill may at all times be safely manually held and operated.

Still another aim is to provide a coal drill head wherein the parts are advantageously operatively coupled by a friction clutch, to start and stop turning of the drill member and for safety purposes, one part of which clutch may rotate even when the drill is idle, thus avoiding a clutch which gums up, sticks or otherwise becomes dangerous through inactivity.

Further, it is an object to provide coal drill novel parts so that the tension of the spring means of the clutch is variable or adjustable.

Again, an object is to provide an apparatus of the character stated having a novel, rotatable and axially slidable operating shaft for the auger, which shaft carries interfitted therewith novel means to variably or adjustably tension the clutch spring.

Various additional objects and advantages will in part be pointed out or become apparent from a consideration of the description following taken in connection with the accompanying drawings illustrating one operative embodiment by way of example. In said drawings:

Fig. 1 is a view in side elevation illustrating my improved drill head in connection with a coal cutter utilized as a source of operating power,

Fig. 2 is a rear elevation of the improved drill head; the handles thereof being broken away;

Fig. 3 is a central vertical longitudinal sectional view taken approximately on the line 3—3 of Fig. 2, looking in the direction of the arrows;

Fig. 4 is a fragmentary sectional view taken on the plane of line 4—4 of Fig. 3;

Fig. 5 is a fragmentary sectional view taken on the plane of line 5—5 of Fig. 3;

Fig. 6 is a fragmentary sectional view taken on the plane of line 6—6 of Fig. 3; and

Fig. 7 is a fragmentary sectional view taken on the line 7—7 of Fig. 3.

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Referring specifically to the drawings wherein like reference characters designate like or similar parts throughout the different views, 10 designates a drill head designated to operate a coal cutting auger 11. Said drill head 10 is relatively light in weight enabling it to be manually handled, held and controlled during mining operations as by means of diametrically opposite handles 9. A coal cutter 12 is one example of a source of power to operate said drill head, as by means of a suitable flexible cable 13.

Reverting to drill head 10, it has a main casing section 14, which may be a casting having a right-hand end wall 15 and an open left hand end. The latter end is closed by a wall or plate 16 removably bolted or otherwise secured in place at 17.

A hollow rotatable and slightly axially slidable shaft 18 is adapted to operate the cutting tool or auger 11, and may have a socket portion S integral therewith or fastened thereto, provided with a socket or bore 19 hexagonal or otherwise than round in cross-section so as to operatively and removably mount said auger 11 for rotation with shaft 18.

Intermediate its ends, said shaft 18 is annularly enlarged at 20 into a clutch section from which an annular head 21 outwardly extends.

Said shaft 18 throughout most of its length is enclosed by and at two locations 22 and 23 journaled and slidable in a hollow shaft 24 which at one end is enlarged into or has a relatively large gear wheel 25 which is hollow and open at the left hand end.

A suitable or conventional clutch structure which may be mechanical, hydraulic, pneumatic or otherwise, is accommodated mainly within gear wheel 25 and between clutch head 21 and a clutch head 26 secured within and to the main wall of gear-wheel 25. As shown, clutch C is of the friction type having a multiplicity of loosely mounted rings or disks 27 disposed between spiders 28 and 29, of heads 21 and 26, alternate disks 27 being interfitted therewith and guided thereon by means of notches 30 and 31, respectively. As will later appear, shafts 18 and 24 will not rotate together unless clutch C is applied.

The shaft 24 is journaled in an inwardly extending bearing 32 integral with casing section 14 being applied from the left while plate 16 is removed. In addition socket portion S thereof is journaled in a conventional ball bearing structure 32' mounted in an adjacent opening of end wall 16. Further, shaft 24 at the right hand end 55 is journaled by means of a conventional ball-

bearing structure 33 carried by a tubular mounting member 34. It will be noted that the inner race member 35 of ball bearing structure 33 abuts a shoulder 36 on shaft 24 and is held from displacement therefrom by a split ring and groove connection 37 or equivalent whereby shaft 24 is held against movement axially of casing section 14 and hence of the drill head.

The mounting member 34 fits into openings in end wall 15 and a supplemental end wall 38 secured against the same as by means of bolts 39. Certain of the latter bolts pass through an outwardly extending flange 40 to secure mounting member 34 in place.

A clutch control rod 41 is slidably and rotatably mounted in a bore 42 of the hollow shaft 18. Said rod 41 in an enlargement 43 of said bore is surrounded by an expansive coil spring 44 which abuts a shoulder 45 on shaft 18, the tension of which spring is variable through adjustment of a nut 46 along the screw-threads 47 of said rod 41, a spacer 48 preferably being interposed on the rod between the spring 44 and nut 46.

At the right-hand end, rod 41 has a hexagonal or other head 49 facilitating engagement by a wrench to turn the rod relatively to nut 46 which conforms to the shape of the hexagonal bore of socket S to avoid relative rotation although slidable. Head 49 includes a flange 50 which overlaps a ball-bearing structure 51 in which the right-hand end of shaft 18 is journaled and slightly slidable. Such bearing structure 51 is carried by and movable with a knob 52 as it abuts an inward flange 53 of a ring portion 54 thereof through the action of spring 44 and associated parts. Ring portion 54 is adjustably mounted in mounting 34 by means of left-hand screw threads 55. Knob 52 includes an inwardly extending peripheral gripping wall 56.

The teeth of gear 25 are shown at 57 and are enmeshed with the teeth 58 of a gear wheel 59, journaled on a hollow fixed shaft or spindle 60 secured in and bridging aforesaid wall 16 and a wall 61 on the interior of the lower portion of casing section 14. Said gear wheel 59 has a laterally extending tubular hub 62 to which a gear wheel 63 is fixed.

The flexible shaft 13 is suitably and preferably detachably coupled to a hollow drive shaft 64 and between the latter and gear wheel 59 a suitable two or more speed variable transmission is interposed. More specifically, driveshaft 64 at one end 65 is telescoped and journaled in the fixed shaft 60, and at the other end is journaled in a ball-bearing structure 66 mounted in end wall 15. This drive shaft 64 is equipped with different sized gear wheels 67 and 68 adapted to selectively mesh with gear-wheels 69 and 70 coupled together as a change speed unit 71 slidable along an extended tubular hub 72 of a gear-wheel 73 enmeshed with gear-wheel 63 aforesaid.

Said change speed unit 71 as well as slidable along gear hub 72 is rotatable therewith through interengagement with splines 74 of hub 72. Said unit 71 may be moved by any suitable means as by through the manual sliding of a conventional shifter 75 in a slot 76 in the wall of casing section 14 from the exterior of the latter, and which shifter has a fork 76' engaged in an annular groove 77 of unit 71. Reverting to gear 73, it is journaled on a fixed shaft or spindle 78 mounted in openings in end wall 15 and an extension 79 of the bearing 32. Supplemental end wall 38 and a flange 78' on shaft 78 prevent axial displacement of said shaft. Also a hollow boss 38' on end wall

38 accommodates stuffing means 13' about the adjacent end of shaft 13.

Attention is directed to the fact that although two different speeds of operation are shown, the parts may be modified to enable any desired number of different or selective speeds to be attained.

The coal cutter 12 is shown as but one source of power to drive flexible shaft 13 being for instance a Short Wall Machine, electrically or otherwise driven, which advances with the face in coal mining. At the power take-off of coal cutter 12, it may include a clutch with or without speed increasing gearing at 80.

The extent of rotation of knob 52 is limited by the engagement of lugs 81 and 82 on the knob and wall 38 or other part of the casing, respectively.

It will be realized that the casing of the drill head is closed so that lubricant for the operating parts may be sealed therein.

With the parts as in Fig. 3, presuming the clutch C to be in released position, spring 44 is usually neutral or uncompressed, whereby flange 50 is maintained in contact with the inner race member of ball-bearing 51, and this action is augmented through an urge to slide rod 41 to the left, if such spring is under compression. In this position, the spring being neutral does not bind the plate 21 against the clutch plates 27. However, when knob 52 is turned, the left-hand screw-threads at 55 cause the knob to slide slightly to the right, as well as turn, carrying ball-bearing structure 51 with it, and accordingly through its contact with flange 50, moving the rod 41 to the right and compressing the spring 44 which slides shaft 13 to the right and causes plate 21 of the clutch to apply the plates 27 and thus couple or clutch the shaft 13 with the shaft 24 in order to rotate the auger 11. Attention is called to the fact that spring 44 may be placed under any desired operative compression through the turning of rod 41 upon application of a wrench or other tool to the head 49, since such rod is threaded to the nut 46 and the latter cannot turn relatively thereto but slides only in the bore of socket S. Through the medium of this spring, the clutch pressure is variable and regulable.

In the use of the apparatus disclosed, the power is supplied by the coal cutter 12 or any other source, which source may even be electrical, since the parts constituting the instant invention as operated therefrom, are mechanical and thus entirely overcome the electrical hazard, notwithstanding the fact that the instant invention is of such a weight that it is manually held at the handles 9 during operation. Power is supplied through the rotation of flexible shaft 13, which may be of any preferred length, and which shaft operates the power shaft 64. From the latter shaft, gear-wheel 73 is driven at different selected speeds dependent upon the enmeshing of gear-wheels 67 and 69 or gear-wheels 68 and 70, effected through the adjustment of the shifting member 75. Said gear-wheel 73 through the gear-wheel 63 drives gear-wheel 59, and the latter is enmeshed with the gear-wheel 57 so that the shaft 24 is rotated. Shaft 18 and the drill 11 carried thereby will remain idle unless the clutch C is applied, in the manner hereinbefore specifically set forth through the operation of knob 52 and associated parts.

During usual operation, spring 44 will not be compressed so that when pushing the tool against the work, socket S and shaft 13 will have a unitary sliding movement axially relatively to the remainder of the device and cause engage-

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ment of the plates of clutch C so that the socket S and shaft 18 will be rotated from shaft 13 through the gearing and clutch. Should it be desired, rod 41 may be rotated to compress spring 44 so that the plates of clutch C will be engaged through such compression, this being done primarily in an emergency should the operator wish to rotate the drill while extracting it.

It is to be especially emphasized that clutch C affords a maximum safety feature inasmuch as certain of the clutch disks 27, even when the clutch is released, will positively rotate with the shaft 24. This overcomes the employment of a clutch wherein parts are not moved, even though the drive for the apparatus is operating, thus avoiding inefficiency and danger of sticking or breakage through non-use. The present clutch is therefore always in condition for effective and safe operation of the apparatus to the miner. Further, clutch C is set or adjusted to automatically slip or yield at its plates or disks upon the auger in drilling encountering resistance above a predetermined degree, which greatly enhances safety because the drill head cannot be turned or twisted by the power and correspondingly swing or tilt the body of the operator holding the same or swing against his face or other part of his body.

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 having a casing including a wall at one end and a closure member at the other end, a rotatable shaft extending through the casing and journaled and slidable in said wall and closure member, said shaft at the end adjacent said closure member forming a socket for an auger or the like, a shaft non-axially movable relatively to and journaled in said casing concentric with and rotatable independently of the first shaft, means to drive the second shaft controlled through movement of the first-mentioned shaft relatively to the second-mentioned shaft, clutch means between said shafts, and means extending within the first shaft operable to control said clutch means.

2. Apparatus of the class described having a casing including a wall at one end and a closure member at the other end, a rotatable shaft extending through the casing and journaled in said wall and closure member, said shaft at the end adjacent said closure member forming a socket for an auger or the like, a shaft journaled in said casing concentric with and rotatable independently of the first shaft, means to drive the second shaft, clutch means between said shafts, said first shaft being slidable, a rod extending longitudinally of the first shaft in limited relatively slidable relation therewith, a spring abutting the first shaft and a part on said rod preventing application of the clutch means, and means operable to slide said rod against said spring to cause the latter to slide the first shaft to apply said clutch means.

3. Apparatus of the class described having a casing including a wall at one end and a closure member at the other end, a rotatable shaft extending through the casing and journaled in said wall and closure member, said shaft at the end adjacent said closure member forming a socket for an auger or the like, a shaft journaled in said casing concentric with and rotatable independently of the first shaft, means to drive the second shaft, clutch means between said shafts, said

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first shaft being slidable, a rod extending longitudinally of the first shaft in limited rotatable and slidable relation therewith, a nut slidable in the said socket and held therein against rotation, said nut being threaded to said rod, spring means abutting the first shaft and abutted by said nut so that turning of the nut will compress the spring means, and means operable to slide said rod against said spring to cause the latter to slide the first shaft to apply said clutch means.

4. Apparatus of the class described having a casing including a wall at one end and a closure member at the other end, a rotatable shaft extending through the casing and journaled in said wall and closure member, said shaft at the end adjacent said closure member forming a socket for an auger or the like, a shaft journaled in said casing concentric with and rotatable independently of the first shaft, means to drive the second shaft, clutch means between said shafts, said first shaft being slidable, a rod extending longitudinally of the first shaft in limited rotatable and slidable relation therewith, a nut slidable in the said socket and held therein against rotation, said nut being threaded to said rod, spring means abutting the first shaft and abutted by said nut so that turning of the nut will compress the spring means, a bearing in the casing in which the first shaft is journaled abutted by a part on said rod, and rotatable and axially movable means carrying said bearing.

5. Apparatus of the class described having a casing including a wall at one end and a closure member at the other end, a rotatable shaft extending through the casing and journaled in said wall and closure member, said shaft at the end adjacent said closure member forming a socket for an auger or the like, a shaft journaled in said casing concentric with and rotatable independently of the first shaft, means to drive the second shaft, clutch means between said shafts, said first shaft being slidable, a rod extending longitudinally of the first shaft in limited rotatable and slidable relation therewith, a nut slidable in the said socket and held therein against rotation, said nut being threaded to said rod, spring means abutting the first shaft and abutted by said nut so that turning of the nut will compress the spring means, a bearing in the casing in which the first shaft is journaled abutted by a part on said rod, the second shaft journaling the first shaft adjacent said bearing, a bearing for the first shaft, a mounting on the casing for the latter bearing, and an operating element carrying the first bearing and screw threaded to said mounting.

6. 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 hollow shaft within the casing concentric with the first shaft having a relatively large gear-wheel thereon, clutch means between said plate and gear-wheel, means to drive said second shaft, said first shaft having a limited axial movement, a rod disposed within the first shaft in relatively slidable relation with respect thereto, spring means within the first shaft engageable at opposite ends with such shaft and the rod, and means operable from the exterior of the casing to slide said rod to compress said spring whereby the latter will slide the second-mentioned shaft and apply the clutch.

7. 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 hollow shaft within the casing concentric with the first shaft having a relatively large gear-wheel thereon, clutch means between said plate and gear wheel, means to drive said second shaft, said first shaft having a limited axial movement, a rod disposed within the first shaft in relatively slidable relation with respect thereto, spring means within the first shaft engageable at opposite ends with such 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 second-mentioned shaft and apply the clutch, said means to drive said second shaft including gearing intermeshed with said gear-wheel, a hollow shaft mounting said last-mentioned gear-wheel, a drive-shaft inter-fitted with the last-mentioned hollow shaft, and a variable speed connection operable from the exterior of the casing and located between the last-mentioned shaft and last-mentioned gear-wheel.

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 hollow shaft within the casing concentric with the first shaft having a relatively large gear-wheel thereon, clutch means between said plate and gear-wheel, means to drive said second shaft, said first shaft having a limited axial movement, a rod disposed within the first shaft in relatively slidable relation with respect thereto, spring means within the first shaft engageable at opposite ends with such 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 second-mentioned shaft and apply the clutch, said means to drive said second shaft including gearing intermeshed with said gear-wheel, a hollow shaft mounting said last-mentioned gear-wheel, a drive-shaft inter-fitted with the last-mentioned hollow shaft, a variable speed connection operable from the exterior of the casing and located between the last-mentioned shaft and last-mentioned gear-wheel, including a fixed shaft on which a part of the variable speed connection is mounted, and a bearing within the case for the second-mentioned shaft having an extension in which the last-mentioned fixed shaft is supported.

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 hollow shaft within the casing concentric with the first shaft having a relatively large gear-wheel thereon, clutch means between said plate and gear-wheel, means to drive said second shaft, said first shaft having a limited axial movement, a rod disposed within the first shaft in relatively slidable relation with respect thereto, spring means within the first shaft engageable at opposite ends with such 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 second-mentioned shaft and apply the clutch, a mounting member on the casing, the last-mentioned means comprising an element screw-threaded to said mounting member, a bearing structure carried by the last-mentioned means against which the rod abuts, and a bearing member for the second shaft carried by the mounting member.

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 hollow shaft within the casing concentric with the first shaft having a relatively large gear-wheel thereon, clutch means between said plate and gear-wheel, means to drive said second shaft, said first shaft having a limited axial movement, a rod disposed within the first shaft in relatively slidable relation with respect thereto, spring means within the first shaft engageable at opposite ends with such shaft and the rod, and means operable from the exterior of the casing to slide said rod to compress said spring whereby the latter will slide the second-mentioned shaft and apply the clutch, a mounting member on the casing, the last-mentioned means comprising an element screw-threaded to said mounting member, a bearing structure carried by the last-mentioned means against which the rod abuts, a bearing member for the second shaft carried by the mounting member, said casing having an end wall, a supplemental wall disposed against the same, said walls having openings into which the supporting member extends, a flange on the mounting member secured to the supplemental wall, and said supplemental wall crossing the last-mentioned fixed shaft.

11. Apparatus of the class described having a casing, a rotatable shaft spanning the casing and at opposite ends being journaled and slidably mounted in walls of the casing, said shaft at one end having means for attachment thereto of an auger or the like, a shaft non-axially movable relatively to and journaled in said casing concentric with and rotatable independently of the first shaft, means to drive the second shaft, clutch means between the shafts controlled by movement of the first-mentioned shaft relative to the second-mentioned shaft, and means extending within the first shaft operable to control said clutch means.

12. Apparatus of the class described having a casing, a shaft member extending therethrough having its opposite ends journaled and slidably mounted in opposite walls of said casing, said shaft member within said casing having an enlarged part forming a clutch plate, a shaft journaled on said member for rotation independently thereof, said shaft having an enlargement providing a plate opposite said clutch plate and an outer annular rim provided with gear teeth, friction clutch means between said clutch plate and second-mentioned plate controlled through the sliding of said shaft member, a bearing mounted in the casing, means securing said shaft to said bearing against sliding movement, and drive means including gearing enmeshed with said teeth.

13. Apparatus of the class described having a casing, relatively close aligned outer and inner bearings mounted in one wall of said casing, a shaft member rotatably and slidably mounted by said outer bearing and by the opposite wall of said casing, a shaft journaled on said member and by said inner bearing, means securing said shaft to the inner bearing against sliding movement, clutch plates extending out from said shaft member and shaft within said casing, friction clutch means between said plates controlled through the sliding movement of said shaft member.

14. Apparatus of the class described having a casing, relatively close aligned outer and inner

bearings mounted in one wall of said casing, a shaft member rotatably and slidably mounted by said outer bearing and by the opposite wall of said casing, a shaft journaled on said member and by said inner bearing, a bearing extending inwardly from a wall of the casing in spaced relation to the first-mentioned walls and outer and inner bearings through which said shaft passes, means securing said shaft to the inner bearing against sliding movement, clutch plates extending out from said shaft member and shaft within said casing, and friction clutch means between said plates controlled through the sliding movement of said shaft member.

15. Apparatus of the class described having a casing, relatively close aligned outer and inner bearings mounted in one wall of said casing, a shaft member rotatably and slidably mounted by said outer bearing and by the opposite wall of said casing, a shaft journaled on said member and by said inner bearing, means securing said shaft to the inner bearing against sliding movement, clutch plates extending out from said shaft member and shaft within said casing, friction clutch means between said plates controlled through the sliding movement of said shaft member, means having screw connection with said casing carrying said outer bearing, and resilient clutch-control means passing through the shaft member and having a sliding movement with said outer bearing.

16. Apparatus of the class described having a casing, a rotatable shaft member, a tool-mounting and driving member aligned with and extending from one end of the shaft member, a shaft in said casing mounted against axial movement longitudinally thereof and being journaled on and concentric with and rotatable independently of said shaft member, means to drive the shaft, clutch means in the casing carried by and between the shaft and shaft member, said shaft member and tool-mounting and driving

member being slidable as a unit in one direction relative to the casing and shaft to apply the said clutch means, and means coacting with said shaft and shaft member operable to apply available force on said clutch means.

17. Apparatus of the class described having a rotary and slidable member provided with means at one end to mount and operate an auger or the like, a shaft member rotatable independently of said slidable member, means to rotate said shaft member, means intermediate the ends of said members and carried by the members and operable to clutch said slidable member and shaft member together to operate said slidable member through the application of operating pressure to the slidable member, a spring carried by one of said members, and means operable to compress said spring against one of said members to engage said clutch means.

ANDREW B. CRICHTON, JR.
CARL G. WENNERSTROM.

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