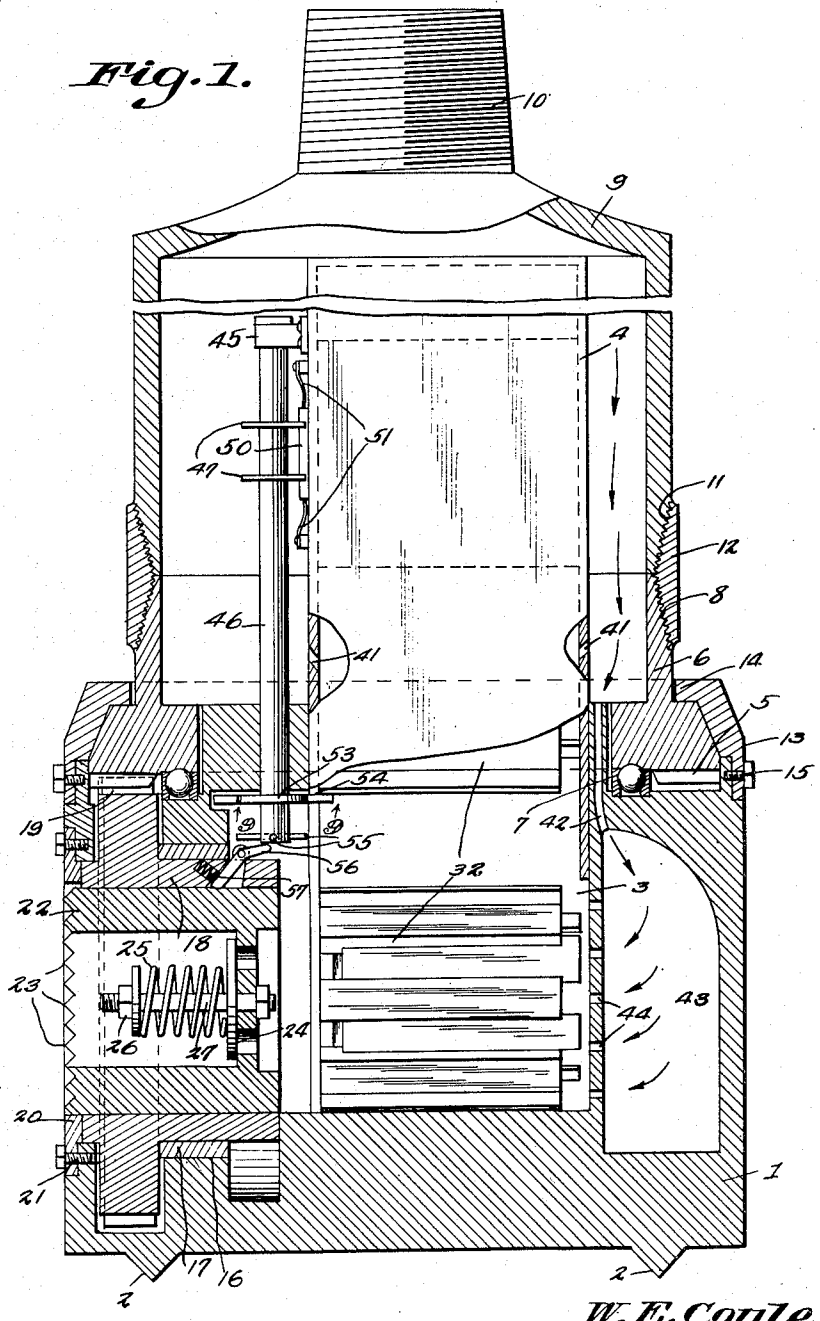
April 24, 1951 W. E. COYLE 2,550,330

DROP COLLAR RIGHT ANGLE DRILL FOR WELLS

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Fig. 1.



W. E. Coyle
INVENTOR

BY C. A. Snow & Co.
ATTORNEYS.

April 24, 1951 W. E. COYLE 2,550,330

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Fig. 2.

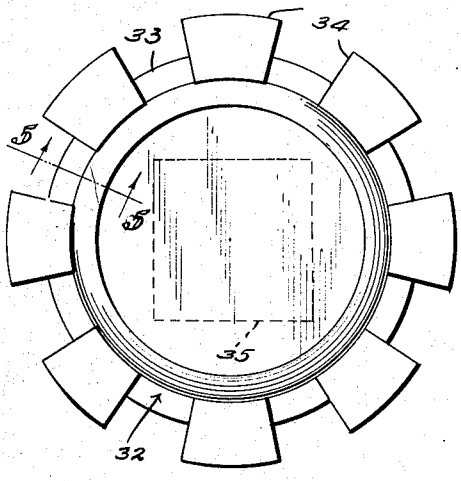


Fig. 3.

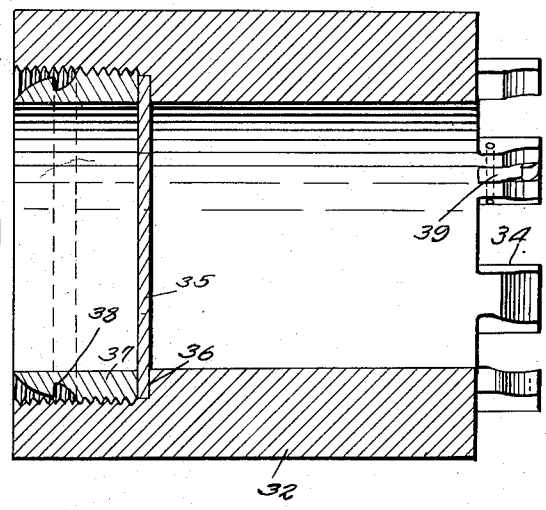


Fig. 4.

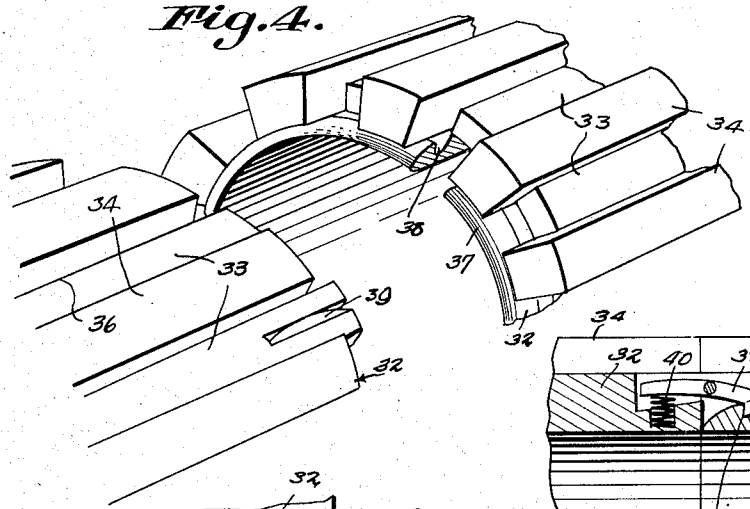


Fig. 5.

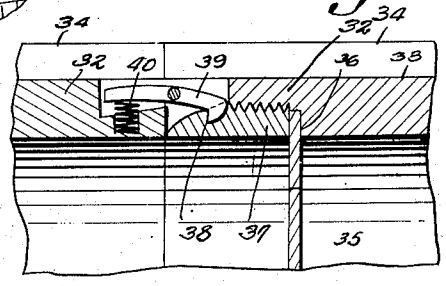
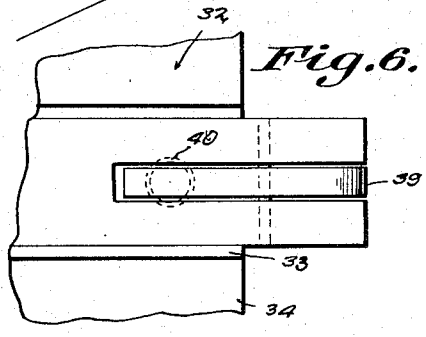


Fig. 6.



W. E. Coyle
INVENTOR

BY C. A. Snow & Co.
ATTORNEYS.

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Fig. 7.

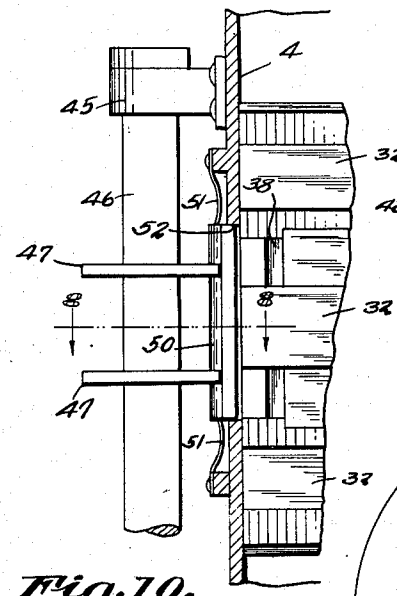


Fig. 8.

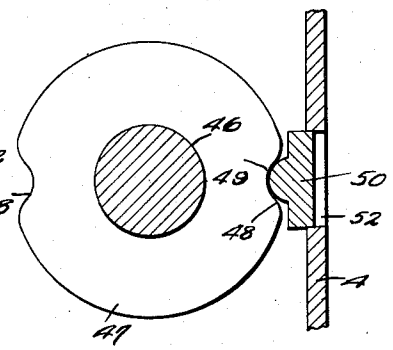


Fig. 9.

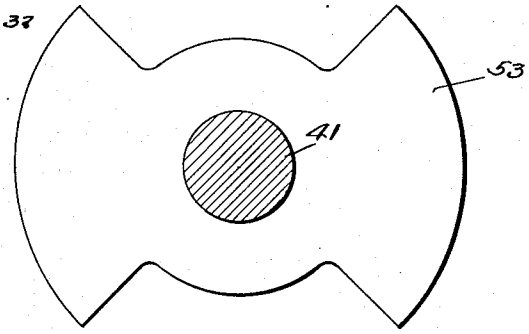


Fig. 10.

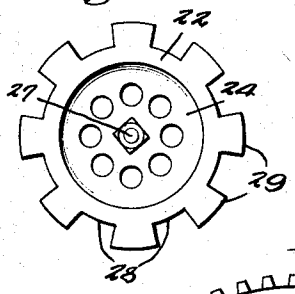


Fig. 11.

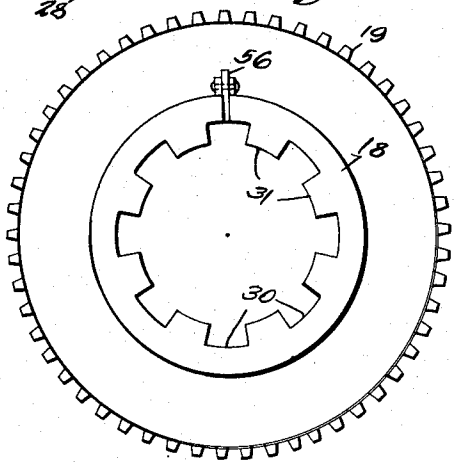
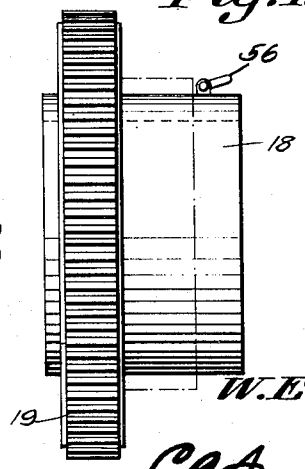


Fig. 12.



W. E. Coyle
INVENTOR

BY C. A. Snow & Co.
ATTORNEYS.

Patented Apr. 24, 1951

2,550,330

UNITED STATES PATENT OFFICE

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DROP COLLAR RIGHT ANGLE DRILL FOR WELLS

William E. Coyle, Cotton Valley, La.

Application June 14, 1948, Serial No. 32,815

3 Claims. (Cl. 255—1.6)

1

This invention relates to improvements in drop collar right angle drills for wells.

An object of the invention is to provide an improved construction of drop collar right angle drill for wells.

Another object of the invention is to provide an improved drop collar right angle drill for wells which will intermittently drop and connect collars between the laterally cutting drill bit and rotatable ring gear barrel.

A further object of the invention is to provide an improved multiple drop collar right angle drill for wells which will be highly efficient in operation and relatively inexpensive to manufacture and produce.

Other objects will appear as the description proceeds.

In the accompanying drawings which form a part of this application:

Figure 1 is a vertical sectional view through the improved drop collar right angle drill for wells.

Fig. 2 is an end view of one of the drop collars used with the right angle drill.

Fig. 3 is a longitudinal sectional view through one of the drop collars showing the blow-out plug disk in place therein.

Fig. 4 is a perspective view of portions of two drop collars showing a pivoted locking pawl for securing the adjacent ends of said drop collar together.

Fig. 5 is an enlarged detail sectional view taken on the line 5—5 of Fig. 2.

Fig. 6 is an enlarged detail plan view of the pivoted locking pawl supported on the inner end of each drop collar.

Fig. 7 is a partial vertical sectional view through the stationary stack for supporting the drop collars, and showing the automatic retaining and feed means for said drop collars.

Fig. 8 is an enlarged sectional view taken on the line 8—8 of Fig. 7.

Fig. 9 is an enlarged sectional view taken on the line 9—9 of Fig. 1.

Fig. 10 is an inner end view of the rotatable laterally cutting drill bit.

Fig. 11 is an inner end view of the rotatable cutting drill bit supporting hub or barrel with driving spur gear formed thereon.

Fig. 12 is a side elevation of the cutting drill bit supporting hub or barrel and driving spur gear.

Like characters of reference are used throughout the following specification and the accompanying drawings to designate corresponding parts.

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In carrying out the invention, there is shown and provided an improved form and construction of drop collar right angle drill for wells comprising a cylindrical base casting generally denoted by the reference numeral 1 formed with a plurality of depending anchoring teeth 2 on its bottom surface for engaging the bottom of the vertical bore of the well into which the apparatus is lowered when a lateral or right angle bore is to be drilled.

The base casting 1 is formed with a centrally disposed vertical chamber 3 which is substantially square in cross section, into the upper end of which an upwardly extending square collar stack 4 is supported in fixed position together with the fixed base casting 1.

A transversely disposed ring gear 5 having an upwardly extending sleeve 6 is rotatably mounted upon the ball bearing race 7 supported upon the upper surface of the base casting 1, said sleeve 6 being formed with the upwardly and inwardly extending threads 8.

A barrel 9 having a threaded coupling collar 10 on its upper end is adapted to be threaded upon the lower end of the drill pipe (not shown). The lower end of the barrel 9 is of a similar diameter as the sleeve 6, and is also formed with the downwardly and inwardly extending threads 11 on its lower end for cooperating with internally threaded coupling ring 12 used to rigidly connect the barrel 9 and sleeve 6 together for the rotating of the ring gear 5.

A locking ring 13 formed with an inwardly extending locking flange 14 overlying the ring gear 5 is detachably secured to the upper peripheral edge of the base casting 1 by means of the plurality of bolts 15, thus holding the ring gear 5 firmly upon the ball bearing race 7.

The horizontal cylindrical bore 16 is formed between the vertical bore 3 in the base casting 1 and the outer peripheral surface of said base casting 1, and supports a bearing collar 17, in which the drill bit supporting hub or barrel 18 with its integral vertical spur gear 19 is rotatably supported, said spur gear 19 meshing with and being driven by the ring gear 5 when the barrel 9 is rotated. The drill bit supporting hub or barrel 18 is held within the bore 16 by means of the retaining ring 20 and bolts 21 which are threaded into the base casting 1.

A cylindrical drill bit 22 is disposed within the hub or barrel 18 and is formed with the cutting teeth 23 on its outer end, and with the check valve 24 in its inner end, the operation of said check valve 24 being selectively and adjustably

controlled by the coil tensioning spring 25 and adjusting nut 26 threaded upon the valve supporting stud bolt 27. A plurality of longitudinally extending spaced locking grooves 28 and splines 29 are formed about the outer periphery of the drill bit 22 for being telescopically received in the longitudinally extending grooves 30 and splines 31 formed in the inner surface of the hub or barrel 18, said splines being received in the grooves.

A plurality of drop collars 32 are supported one upon another in the collar stack 4, each collar 32 being formed with a plurality of longitudinally extending grooves 33 and spaced splines 34 along their outer peripheries, which will match up with the grooves 30 and splines 31 in the hub or barrel 18 as the drop collars 32 are released from their supporting stack and are moved laterally to be connected together with the drill bit supporting hub or barrel 18.

Frangible blow-out discs 35 are seated upon internal annular shoulders 36 in the outer ends of the drop collars 32 and are held in position by the threaded rings 37 in the outer ends of which annular locking grooves 38 are formed. Oppositely disposed pivoted locking pawls 39 are supported in the inner ends of the drop collars 32, and are tensioned by the coil springs 40 to cause the automatic and positive joining together of the drop collars 32 as fed into position from the stack 4 and forced laterally by means of the pressure of mud and water fed down through the barrel 9 to and through the annular ports 41 formed through the stack 4 and through the vertical port 42 extending from above the ring gear 5 into pressure chamber 43 in the base casting 1, and from thence through the series of ports 44 in the casting 1 directly behind the inner end of the collar 32 most recently dropped from the stack 4. The pressure of the mud against the blow-out disc 35 will move the collars 32 outwardly to slide into the guide grooves 30 in the hub or barrel 18 and to couple with the preceding collar 32.

A bearing bracket 45 is attached to the upper end of the stack 4 and rotatably supports the vertical actuating shaft 46 upon which the upper holding cams 47 are secured. The cams 47 are formed with the opposed notches 48 and ride upon the ridge 49 of the collar holding bar 50 supported by the springs 51. The bar 50 extends through a slot 52 in the stack 4 and clamps the collar 32 in fixed position therein until one of the notches 48 receives the ridge 49 of the bar 50, at which time a collar 32 is released for dropping downward upon the checking cam 53 mounted upon the lower end of the shaft 46 which is arranged to pass through a slot 54 in the lower end of the stack 4 until the continued rotation of the shaft 46 causes the holding cams 47 to again clamp the holding bar 50 against the collars 32. Further rotation of the shaft 46 removes the checking cam 53 from the stack 4 and permits the dropping of the collar 32 into operative position for coupling to the preceding collar.

Radially extending pins 55 are supported by the lower end of the shaft 46 and are engaged by the pivoted pawl 56 supported by the hub or barrel 18 as it is rotated, thus releasing the collar 32 when necessary. A coil spring 57 tensions the operation of the pawl 56.

The mode of operation of the improved drop collar right angle drill will now be described. Assuming that the device is connected to the lowermost drill pipe section (not shown) and is anchored in the bottom of the well bore, the rotation of the drill pipe and barrel 9 will rotate the ring gear 5 and vertical spur gear 19 meshed therewith to rotate the drill bit 22. As water and mud are fed down the well pipe, it will pass through the ports 41 and 42 into the chamber 43, and force through the ports 44 against the blow-out plug 35 to force the collar 32 and coupled drill bit 22 laterally and outwardly as it performs the drilling operation. As other collars 32 are needed, due to the lateral movement of the drill bit 22, the pawl 56 will drop into one of the notches, or grooves in the collar 32, causing the upper end of the pawl 56 to raise and contact one of the pins 55 on the shaft 46 as the hub or barrel 18 rotates, thus actuating the cams 50 and 53 to drop another collar 32 from the stack 4 into position to be automatically coupled to the preceding collar 32 as hereinbefore described. The pawl 56 will be actuated a second time as the collar 32 passes a certain point in the hub or barrel 18.

While the preferred embodiment of the instant invention has been illustrated and described, it will be understood that it is not intended to limit the scope of the invention thereto, as many minor changes in detail of construction may be resorted to without departure from the spirit of the invention.

Further reference to the coupling of each dropped collar to the collar immediately preceding, from the standpoint of alignment of the collars for mating thereof, is believed appropriate. In this connection each collar when dropped is of course not rotating while being slowly forced to the left in Fig. 1 by mud and water pressure. The geared hub 18 is of course rotating, as is the collar 32 immediately preceding the dropped collar, said hub 18 and immediately preceding collar rotating together by reason of said preceding collar being fitted into the correspondingly shaped bore of the hub 18.

Considering now the dropped collar, the splines 34 of the dropped collar will be the forwardmost or leading part thereof, as may be readily noted from Fig. 4 in which the dropped collar is the right hand collar, the splines 34 thereof projecting to the left beyond the ring 37 and grooved portions 33.

The end faces of the splines 34 will ultimately press against the end face of the rotating hub 18, which end face of the hub 18 is formed with grooves 30 adapted to receive the splines 34 of the advancing dropped collar. If the dropped collar continues to press against the end face of the rotating hub 18, the splines 34 will enter the grooves 30 of the hub as soon as they align with said grooves 30. Said splines 34 will align with the grooves 30 by reason of the fact that the hub 18 is rotating while the advancing collar is not rotating, and the engagement of the advancing collar with the hub will be not unlike a conventional clutch engagement.

As soon as this hub and collar engagement takes place, continued mud and water pressure will shift the collar lengthwise of the rotating hub, with which hub it is now rotating. Now the collar newly received in the hub will of course be aligned with the collar immediately preceding, since both collars will be engaged in the same splines and grooves of the hub. It is accordingly necessary only that the newly received collar be forced against the adjacent or trailing end of the preceding collar, with the result that the pawl 39

of the leading collar will engage in the ring 37 of the newly received or trailing collar.

The question might arise as to how the bit 22 would be withdrawn from the formation and how the collars would be uncoupled from each other when it is desired to do this. In this connection, such uncoupling of the collars and withdrawal of the bit would not be a factor to be reckoned with in the invention, because the collars and bit are expendable material, this being common practice in many oil drilling operations.

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States is:

1. A drop collar right angle drill for wells comprising a base; a barrel rotatably mounted therein and having an approximately horizontal splined bore; means for rotating the barrel; a drill bit formed for splined engagement with said bore; a disc on the bit; means for exerting pressure against said disc to shift the bit axially within the bore while being rotated by the barrel; a hollow stack mounted in said base; a plurality of splined collars supported within said stack; means on the bit and on each collar for coupling said bit and collars in succession; a cam shaft rotatably mounted against said stack in engagement with supported collars for dropping a single collar on partial rotation of the shaft, said dropped collar being dropped into position for coupling to the preceding collar; and a pawl on the barrel and engageable periodically with said shaft for partial rotation of the shaft.

2. A drop collar right angle drill for wells comprising a stationary base adapted to be seated at the bottom of a vertically drilled well bore; a barrel mounted for rotation in a substantially vertical plane in one wall of the base and having a substantially horizontal bore open at opposite ends; a splined drill bit receivable in the bore and adapted to be shifted axially of the bore during rotation by the barrel to drill a right angled extension of said well bore; a disc formed on said drill bit; means for directing fluid pressure against said disc to shift the drill bit axially of the bore; a hollow stack immovably mounted within the base; a plurality of splined collars supported one upon the other within said stack and adapted to be successively dropped into axial alignment with said bore to be fed through said bore; means on the bit and on each collar for coupling of the bit and collars during axial movement through the bore for progressively increasing the length of the right angle drill; a frangible disc on each collar in the path of said fluid pressure for shifting of each dropped collar into engagement with the preceding bit and collars; a cam shaft mounted for rotation against the stack and including a series of cams engageable with the supported collars and adapted for the release of the lowermost collar on partial rotation of the shaft to drop said lowermost collar into alignment with the barrel; and a pawl on the barrel engageable with the shaft to partially rotate said shaft.

3. A drop collar right angle drill for wells comprising a stationary base adapted to be seated immovably at the bottom of a vertically drilled well bore; a barrel mounted for rotation in a vertical plane in one wall of a base and having an approximately horizontal bore open at opposite ends and formed with splined grooves; gear teeth formed on the exterior surface of said barrel; a ring gear mounted for rotation within the base and in mesh with said gear teeth for driving the barrel; a drill bit formed with splined ribs engageable with said grooves for rotation of the bit on rotation of the barrel and for axial movement of the bit within the barrel; a disc formed on the bit and adapted to receive fluid pressure exerted against the bit to feed the bit axially within said barrel; a check valve on the disc, said disc having a plurality of perforations normally closed by the check valve for passage of fluid in one direction through the disc and prevention of back pressure exerted by said fluid; a hollow upstanding stack stationarily mounted within the base; a plurality of sleeve-like collars supported one upon the other within said stack; spline ribs on the respective collars adapted for engagement in the bore of the barrel; means on the bit and on each barrel for coupling of the bit and collars in axial alignment to form a right angle drill extending horizontally from the base and progressively increasing in length on exertion of fluid pressure against the bit and as the bit and succeeding collars are coupled; a frangible disc within each collar against which said fluid pressure is exerted to feed the collar against the collar immediately preceding; a cam shaft mounted rotatably against the stack and including a series of cams adapted to normally support the collars within the stack and drop the lowermost collar on partial rotation of said cam shaft; and a pawl on the barrel and engageable with said cam shaft to partially rotate the same for successive dropping of said collars.

WILLIAM E. COYLE.

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