Dec. 1, 1936. R. E. CAMPBELL 2,062,805

RATCHET MECHANISM

Filed April 15, 1935

Fig. 1.

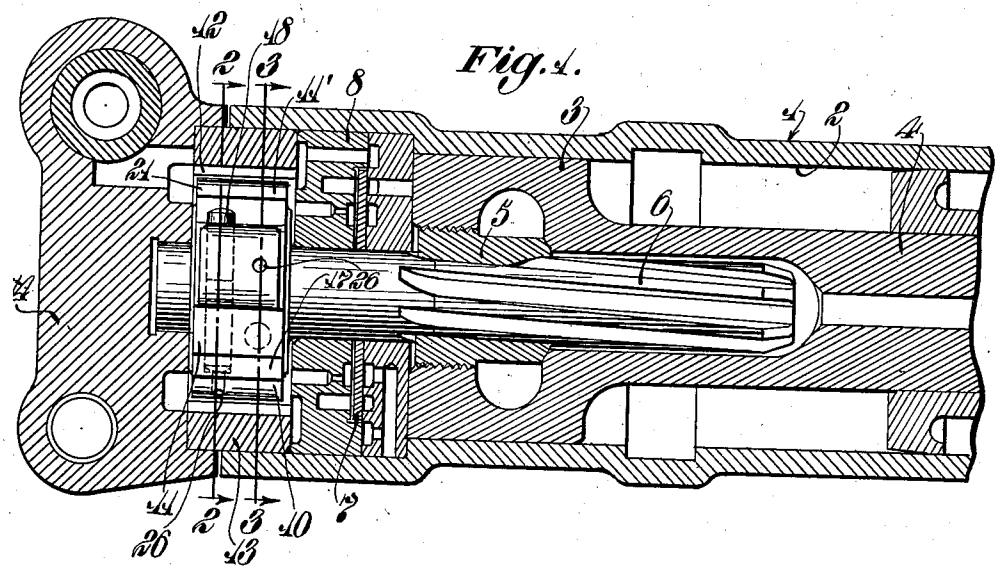


Fig. 2.

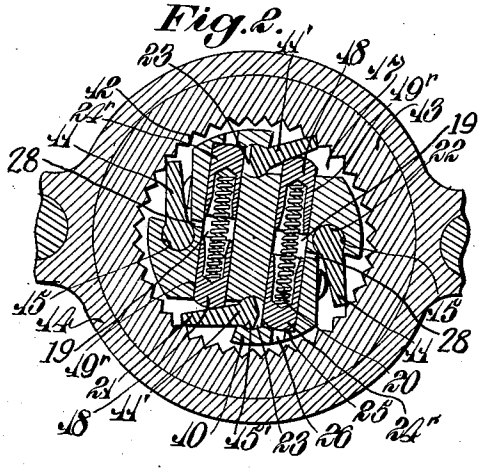


Fig. 3.

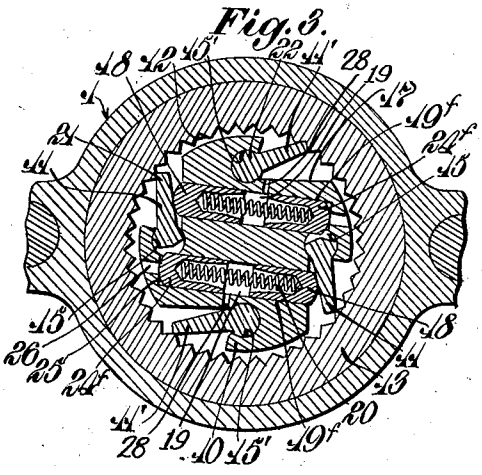


Fig. 4.

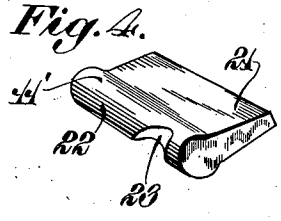
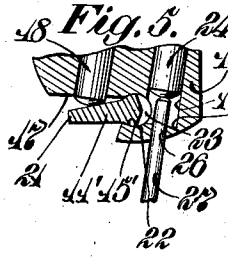


Fig. 5.



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RATCHET MECHANISM

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23 Claims. (Cl. 188—81)

My invention relates to ratchet and pawl mechanisms, and more particularly to ratchet and pawl mechanisms particularly adapted for use in the rotation mechanisms of rock and other drilling devices.

It is customary to effect the rotation of the drill steels which are actuated by pneumatic drilling motors, through the employment of ratchet and pawl controlled mechanism which is adapted to effect a partial rotation of a drill steel during one pass of the motor piston, preferably the rearward pass of the latter, and, through the slipping of the pawls over the ratchet, to permit the other, preferably the working, stroke of the piston to be made without rotation of the steel. Such mechanisms commonly involve the provision of two splined connections between the ratchet and pawl mechanism and the chuck, one of said splined connections being ordinarily helical and the other ordinarily straight. In a generally preferred form of such apparatus, the helical splined connection takes the form of a rifle nut carried by the motor piston and a rifle bar which at its rear end carries pawls which coact with a stationary ratchet ring. In use, the pawls gradually tend to dull at their corner which engages the teeth of the ratchet ring, and the employment of reversible pawls which may be turned over and used with their other edge in engagement with the teeth of the ratchet ring therefore results in a material economy. Such drilling motors as have been described are commonly taken apart and cleaned at frequent intervals, and it is beneficial to preclude the slipping of the pawls out of their seats when this is not desired, upon disassembly of the motor.

From one aspect, my invention comprises an improved pawl carrier providing a pawl mounting and carrying a pawl locking device housed entirely within the carrier but accessible through suitable means from the exterior of the pawl carrier to permit movement of the locking device to effect pawl release.

From another aspect, the invention comprises an improved pawl carrier and pawl combination in which a plurality of pawls are supported by the carrier, and alined means, desirably but not necessarily having common yielding positioning means associated therewith, are arranged for resiliently pressing one pawl into operative position and for locking another pawl against accidental removal. This aspect of the invention may obviously be embodied in an internal or in an external type of pawl carrier structure.

From a further aspect, my invention comprises the feature of providing a pawl carrier supporting a plurality of pawls and having the pawl receiving means therein each provided with a locking device and having the locking devices for different pawl receiving means differently arranged, and providing the pawls with a cooperative type of locking device, so positioned thereon that when a pawl is inserted in one position in a pawl receiving means it may be locked by the locking means of the latter, and when positioned in a different pawl receiving means, in reversed position, it may be locked by the locking means of that pawl receiving means.

From still another aspect, the invention comprises the employment of common resilient means for actuating a locking means for one pawl and a pressing device for another pawl. Other aspects of the invention will hereinafter more fully appear.

It is an object of this invention to provide an improved ratchet and pawl mechanism. It is another object of this invention to provide an improved ratchet and pawl mechanism using reversible pawls and having provision whereby the pawls may be locked against accidental displacement irrespective of their mounting in the pawl carrier. It is a further object of the invention to provide an improved resilient pawl pressing means and pawl locking means, the parts of which are interchangeable so that a locking element may be used as a pawl plunger and vice versa. It is a still further object of my invention to provide an improved ratchet and pawl mechanism especially adapted for use in a rock drilling apparatus of the character mentioned above. It is still another object of my invention to provide an improved ratchet and pawl mechanism in which the pawls are positively locked in position and are not subject to being released by the exertion of a force above a predetermined minimum, but in which, through the use of any suitable thrusting device, even a nail, for example, the pawls may be quickly released when this is desired. Other objects and advantages of the invention will hereinafter more fully appear.

In the accompanying drawing, in which one embodiment of the invention is shown for purposes of illustration,—

Fig. 1 is a central longitudinal section through a drilling motor in which the illustrative form of improved ratchet and pawl mechanism is incorporated.

Fig. 2 is a transverse section on a plane corresponding to the line 2—2 of Fig. 1.

Fig. 3 is a transverse section on a plane corresponding to the section line 3—3 of Fig. 1.

Fig. 4 is a perspective view of a pawl detached from its mounting.

Fig. 5 is a fragmentary view showing the mode of effecting pawl release.

Referring to the drawing, it will be noted that a drilling motor, generally designated 1, has a cylinder bore 2 in which a piston 3 is reciprocable. The piston has a striking bar 4 which is connected, through straight splines and grooves, with a chuck, this structure not being shown, in view of its general familiarity. The piston carries at its rear end a rifle nut 5 with which a rifle bar 6 cooperates, and fluid is distributed to the motor through means, not fully illustrated, as it is not necessary to the disclosure of the invention, but including a distributing valve 7 and a composite valve chest 8. The rear end of the rifle bar 6 is in the form of a pawl carrier 10, which carries two pairs of pawls 11, 11 and 11', 11'. These pawls, which are made symmetrical in end elevation, cooperate with the teeth 12 of a stationary ratchet ring 13, which is suitably clamped between the valve chest 8 and a rear head 14. The pawls 11, 11' are suitably pivotally supported in recesses 15, 15' in the pawl carrying portion of the rifle bar 6, these recesses being generally cylindrical and opening into spaces 17 formed by the cutting away of the periphery of the pawl carrier. Due to the formation of the walls bounding the spaces 17, the pawls have a limited range of oscillation about their pivotal axes, being free to swing outwardly abundantly far for full engagement with the teeth 12, but restrained from excessive outward movement. To maintain the pawls in yielding engagement with the ratchet teeth 12, pawl plungers 18 are provided, these plungers being disposed in bores 19 extending chordally of the pawl carrier and being pressed yieldingly against the inner sides of the pawls by springs 20. Two of the bores, 19^r, 19^r, are arranged to the rear of the median transverse plane of the pawl carrying portion 10; the other two, 19^f, 19^f, forwardly of that plane. Bores 19^r, 19^r are parallel to each other, as are bores 19^f, 19^f, and bores 19^r, 19^r are perpendicular to a line parallel to bores 19^f, 19^f.

Each pawl comprises a blade portion 21 and a pivot portion 22, the latter seated in the sockets 15, 15'. The pivot portion of each pawl is cut away at a point herein shown as positioned between the center and one end of the pawl, as at 23, and it will be noted that the cutting away is substantially symmetrical, extending about equal distances and with corresponding depths at opposite sides of the median longitudinal plane of the pawl.

The bores 19^r and 19^f extend nearly completely across the pawl carrying portion 10; and at their ends in which the plungers 18 do not move, i. e. their inner ends, each intersects the pawl receiving socket of another pawl, each bore herein intersecting the socket of one pawl of a given pair, and carrying a plunger coacting with the other pawl of that pair. For example, the bores 19^f containing the plungers for holding the pawls 11 in yielding engagement with the ratchet teeth, at their other ends intersect the relatively cylindrical recesses or sockets 15 in which the pawls 11 are oscillatably mounted. In like manner, each recess or socket in which one of the pawls 11' is oscillatably mounted is intersected by the bore 19^r in which the plunger cooperating with the other pawl 11' is reciprocable.

Because the offsetting longitudinally from the central transverse plane through the pawl carrier, of the bores 19^f and 19^r, is equal to the distance by which the notch 23 is offset from the longitudinal center of each pawl, it will be observed that when a pawl is inserted in one position in a pawl receiving recess, for example, one recess 15, the notch 23 will come in alinement with a bore 19^f, while upon reverse insertion of the pawl in a recess 15', the notch 23 will come into alinement with a bore 19^r. Accordingly, locking plungers 24^r and 24^f, arranged respectively in the bores 19^r and 19^f, can cooperate with the recesses in the pawls to lock the latter in position. The same springs 20 which are used yieldingly to press the pawls into engagement with the ratchet teeth, also hold the locking plungers in position. The bores 19^r and 19^f are, as noted above, not drilled completely through the pawl carrier, and they have shoulders 25 at their ends which open into the pawl receiving recesses, and these shoulders position the locking plungers in the desired manner. Small openings 26 extend from the ends of the bores 19^r and 19^f through the periphery of the pawl carrier, axially of the bores.

The mode of operation of the device will be readily understood from what has been said. It will be noted that the two pawls 11 are yieldingly pressed into cooperating relation with the ratchet teeth by what, for distinction, may be called pressure plungers, 18, while they are locked by alined locking plungers 24^f. The pawls 11' are yieldingly pressed against the ratchet teeth by other pressure plungers 18, and locked by other locking plungers 24^r. As the parts are assembled, the notches 23 in the pawls 11 are in advance of the transverse median plane of the pawl carrying portion 10 of the rifle bar, and the notches 23 in the pawls 11' are to the rear of that same plane. It will be noted that either pawl 11 might be turned end-for-end and used in the place of a pawl 11', and that either pawl 11' might be turned over and used in the place of either pawl 11. It will be noted, moreover, that any pressure plunger may be used in the place of any locking plunger, and vice versa. The pawls will be noted to be positively locked against removal, but by inserting an instrument, as, for example, a suitable rod 27, through one of the openings 26, a locking plunger may be pressed, against the pressure of a spring 20, inwardly sufficiently to clear the notch 23 into which it had projected, and permit removal of a pawl. Lubrication may be effected through oil holes 28 entering the bores 19 near the centers of the latter.

From the foregoing description it will be observed that I have provided reversible pawls having provision whereby they may be locked against accidental removal irrespective of the manner in which they are assembled in the pawl carrier. It will further be noted that I have provided positive, readily releasable locking means cooperating with the pawls. It will also be noted that I have provided pressure plungers and locking plungers which are interchangeable with each other. Generally, it will be noted that I have provided reversible pawls having locking means, which is, so far as I am advised, a new arrangement in ratchet and pawl mechanisms. It will be noted, moreover, that if desired but two pawls may be used. I use four pawls in order that the minimum angle of advance may be reduced and other pairs of pawls could be added, if needed. The particular arrangement using diametrically

opposite pawls in pairs, as illustrated, is not essential. It will be observed that the structure is simple, requires a minimum number of different parts, is of sturdy construction, and is very well adapted for its intended purpose.

While I have in this application specifically described one form which my invention may assume in practice, it will be understood that this form is shown for purposes of illustration only, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In combination, a ratchet ring, a pawl carrier arranged within said ratchet ring, diametrically opposite pawls carried by said pawl carrier and engageable with said ratchet ring, and alined relatively movable means respectively for locking one pawl on said pawl carrier and yieldingly pressing another into engagement with the ratchet ring.

2. In combination, a ratchet ring, a pawl carrier arranged within said ratchet ring, diametrically opposite pawls carried by said pawl carrier and engageable with said ratchet ring, and alined relatively movable means yieldingly pressed apart respectively for locking one pawl on said pawl carrier and yieldingly pressing another into engagement with the ratchet ring.

3. In combination, a ratchet ring, a pawl carrier disposed therein, pawls oscillatably carried at different positions thereon by said pawl carrier and having locking notches therein, and locking means supported by said pawl carrier and respectively engageable with the notches of said different pawls, said notches and locking means so disposed that reversal of a pawl upon transposition thereof from one position on said pawl carrying means to another will effect cooperative relation between the locking means at said latter position and the notch in said pawl.

4. In an apparatus of the character described, a ratchet ring, a pawl carrier disposed therein and providing a plurality of pawl receiving recesses, pawl locking means including plungers yieldingly maintained in a position in which they project into the bottoms of said recesses, and pawls having pivot portions provided with notches engageable by said locking means.

5. In an apparatus of the character described, a ratchet ring, a pawl carrier disposed therein and providing a plurality of pawl receiving recesses, pawl locking means including plungers yieldingly maintained in a position in which they project into said recesses, and pawls having pivot portions provided with notches engageable by said locking means, the locking means associated with some recesses being differently disposed longitudinally of said recesses than those for other recesses.

6. In an apparatus of the character described, a ratchet ring, a pawl carrier therein supporting at least one pawl, and relatively movable means respectively for pressing said pawl into engagement with said ratchet ring and for locking said pawl against accidental removal from said pawl carrier, including interchangeable relatively movable pressure and locking plungers.

7. In an apparatus of the character described, a ratchet ring, a pawl carrier therein carrying pawls each of which has a blade and a root, and means for pressing said pawls into engagement with said ratchet ring and for locking said pawls against accidental removal, including interchangeable pressure and locking plungers respectively cooperating with the blades and roots of said pawls.

8. In an apparatus of the character described, a ratchet ring, a pawl carrier therein carrying pawls each of which has a blade and a root, and means for pressing said pawls into engagement with said ratchet ring and for locking said pawls against accidental removal, including interchangeable pressure and locking plungers respectively cooperating with the blades and roots of said pawls and yieldingly pressed apart.

9. In combination, a pawl carrier having a pawl receiving recess including a bore for receiving a cylindrical portion of a pawl, a locking plunger wholly housed within said carrier and moving in a path intersecting said bore, a pawl having a notch to receive said locking plunger, and means affording access to said plunger from the exterior of the pawl carrier to enable movement of the latter out of intersecting relation to said recess.

10. In combination, a ratchet ring, a pawl carrier, a reversible pawl associated with said ratchet ring, and means carried by said pawl carrier for locking said reversible pawl against accidental removal from said pawl carrier in reversed positions of said pawl.

11. In combination, a ratchet ring, a pawl carrier, a reversible pawl associated with said ratchet ring, and means for locking said reversible pawl against accidental removal from said pawl carrier in reversed positions of said pawl, said locking means cooperating with said pawl at a point between the ends thereof.

12. In combination, a ratchet ring, a pawl carrier, a reversible pawl associated with said ratchet ring, and means for locking said reversible pawl against accidental removal from said pawl carrier in reversed positions of said pawl, said locking means cooperating with said pawl at a point between the ends thereof but spaced from the center thereof.

13. In combination, a ratchet ring, a pawl carrier arranged within said ratchet ring, pawls carried by said pawl carrier at different points around the periphery thereof and cooperating with said ratchet ring, and alined relatively movable means respectively for locking one of said pawls on said pawl carrier and for yieldingly pressing another into engagement with the ratchet ring.

14. In combination, a pawl carrier having pawls pivotally mounted thereon in spaced positions, means for locking one of said pawls against removal, and alined means for yieldingly pressing another of said pawls into operative position.

15. In combination, a pawl carrier having pawls pivotally mounted thereon in spaced positions, yieldingly positioned means for locking one of said pawls against removal, and alined means for yieldingly pressing another of said pawls into operative position, said locking and pressing means having a common spring for positioning both of them.

16. In an apparatus of the character described, a pawl carrier supporting a pivotally movable pawl, and means carried by said pawl carrier for pressing said pawl into operative position and for locking said pawl against accidental removal, including interchangeable pressure and locking plungers.

17. In an apparatus of the character described, a pawl carrier supporting a pivotally movable pawl, and means carried by said pawl carrier for pressing said pawl into operative position

and for locking said pawl against accidental removal, including interchangeable pressure and locking devices.

18. In combination, a pawl carrier, a reversible pawl, said carrier having a pair of spaced sockets in which said pawl is interchangeably receivable, and locking means associated with each socket, but in different relative positions with respect to the latter, said pawl having cooperating locking means thereon and arranged to coact, upon reversal of the pawl, with the locking means in said different sockets.

19. In combination, a pawl carrier, a reversible pawl associated therewith, and means carried by said carrier for locking said reversible pawl against accidental removal from said pawl carrier in reversed positions of the pawl.

20. As an article of manufacture, a pawl having a generally cylindrical root portion and a blade providing symmetrically disposed opposite edges adapted to cooperate with a ratchet ring, and having a locking portion symmetrical with respect to plane including the axis of the root of the pawl and bisecting the blade thereof.

21. In combination, a ratchet ring, a pawl carrier arranged within said ratchet ring, pawls carried by said pawl carrier and engageable with said ratchet ring, relatively movable plungers mounted on said pawl carrier and respectively engaging one of said pawls for locking the same on said pawl carrier and engaging another pawl for pressing the latter into engagement with the ratchet ring, and means yieldingly acting on said plungers for pressing the same apart.

22. In combination, a ratchet ring, a pawl carrier arranged within said ratchet ring, pawls carried by said pawl carrier and engageable with said ratchet ring, alined relatively movable plungers mounted in said pawl carrier and one engaging one pawl for locking the latter on said pawl carrier and the other engaging another pawl for pressing the latter into engagement with the ratchet ring, and means acting between said plungers for yieldingly pressing the same apart.

23. In an apparatus of the character described, a ratchet ring, a pawl carrier therein supporting at least one pawl, a pair of plungers engaging said pawl, one plunger pressing said pawl into engagement with said ratchet ring and the other plunger locking said pawl against accidental removal from said pawl carrier, and means for yieldingly urging said pressing plunger into engagement with said pawl.

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