

Oct. 24, 1933.

E. J. WARREN

1,932,259

ROCK DRILL

Filed Aug. 25, 1931

2 Sheets-Sheet 1

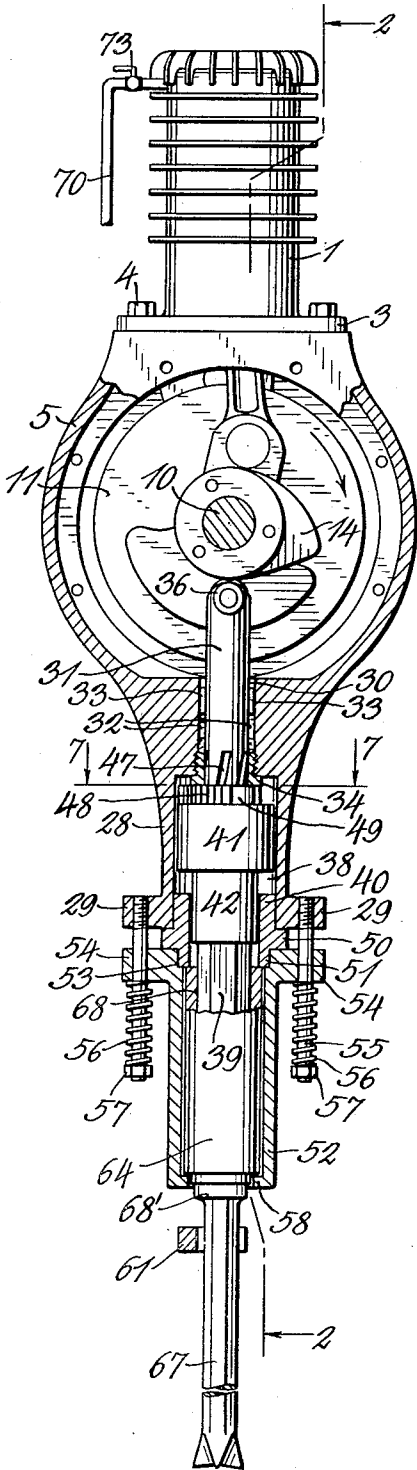


Fig. 1.

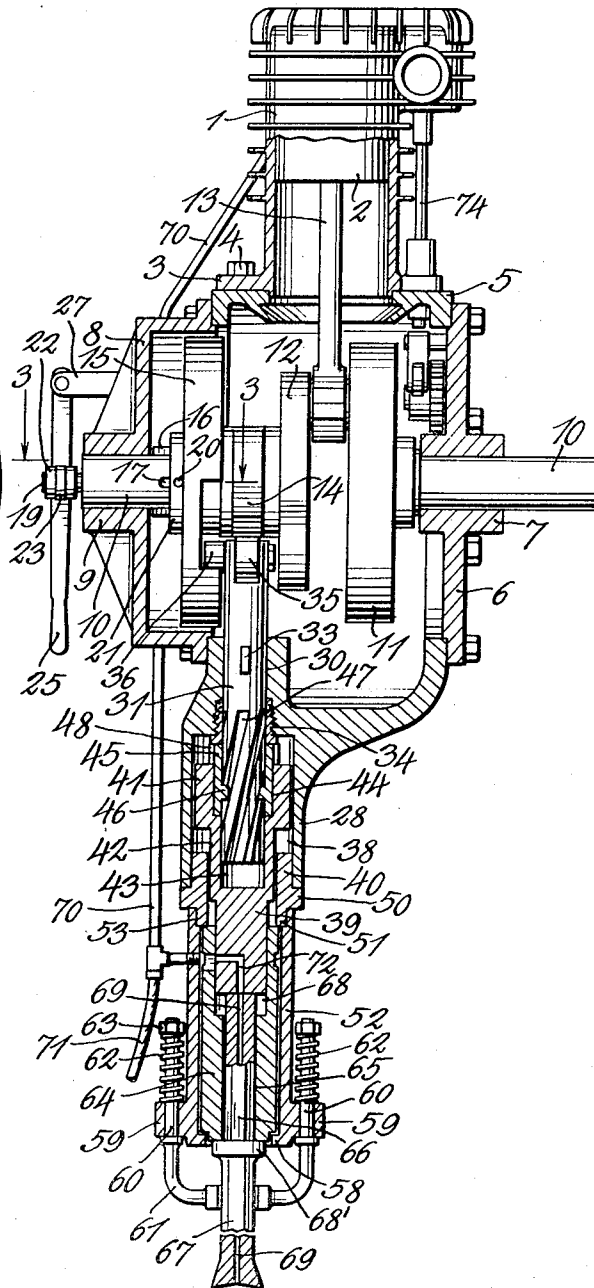


Fig. 2.

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2 Sheets-Sheet 2

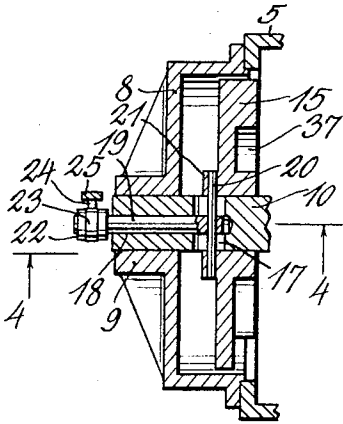


Fig. 3.

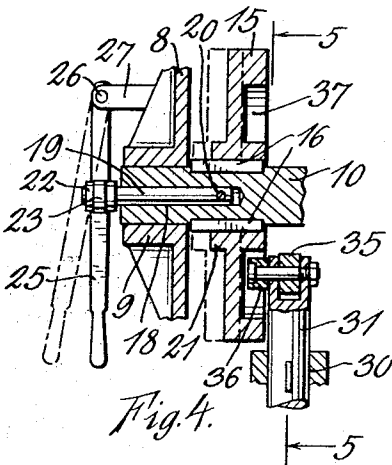


Fig. 4.

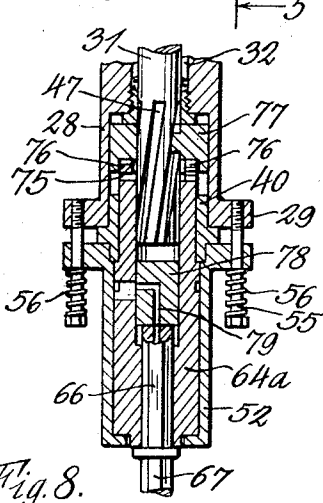


Fig. 8.

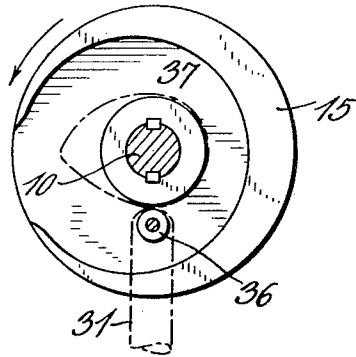


Fig. 5.

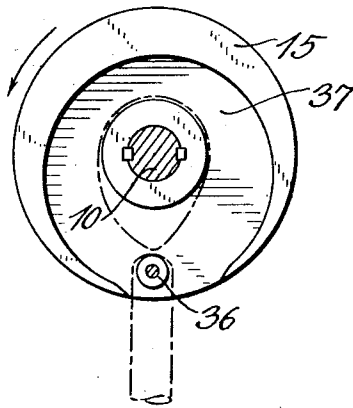


Fig. 6.

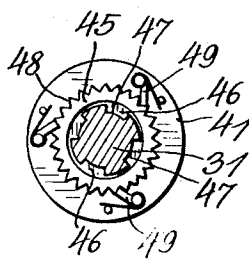


Fig. 7.

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UNITED STATES PATENT OFFICE

1,932,259

ROCK DRILL

Edward J. Warren, Denver, Colo.

Application August 25, 1931. Serial No. 559,247

2 Claims. (Cl. 255—42)

This invention relates to improvements in rock drills and has reference more particularly to drills of this type operated by means of an internal combustion engine, in the manner described and claimed in my copending application, Serial No. 503,417, filed December 19, 1930.

It has been recognized for a long time that rock drills of the ordinary construction which require compressed air are not suitable for prospectors and for use in places where compressed air is not readily available and efforts have therefore been made to produce a rock drill that can be operated successfully by some other means.

It is the object of the present invention to produce a rock drill of the type mentioned which shall be of a simple and rugged construction and which shall also be so designed and constructed that it can be easily controlled and which shall be of sufficiently light weight to make it practicable to transport the same to mines and other places that are difficult of access.

This invention, briefly described, consists of an internal combustion engine having a crank case in which is journaled a crank shaft. The crank shaft is provided with two balance wheels, one of which is integral with the shaft and the other of which is longitudinally movable, but non-rotatably secured to it. The shaft is also provided with a cam located adjacent the movable flywheel. The movable flywheel has the surface nearest the cam provided with a groove that co-operates with a roller on the hammer bar for the purpose of retracting the latter after it has been projected outwardly by means of a cam. A lever is provided for disconnecting the movable wheel from the hammer bar so as to make the parts inoperative without stopping the engine. Associated with the crank case is a drill mechanism so constructed that the hammer bar when it reciprocates imparts to the drill a rotary motion and at the same time subjects it to impacts or hammer blows.

Having thus briefly described the invention, the same will now be described in detail and for this purpose reference will be had to the accompanying drawings in which the preferred embodiment thereof has been illustrated and in which:

Fig. 1 is a side elevation partly in section and partly in elevation showing the construction of the improved mechanism;

Fig. 2 is a section taken on line 2—2, Fig. 1;

Fig. 3 is a section taken on line 3—3, Fig. 3, and shows the manner in which the movable flywheel is connected with the crank shaft;

Fig. 4 is a section taken on line 4—4, Fig. 3; Fig. 5 is a section taken on line 5—5, Fig. 4; Fig. 6 is a view similar to that shown in Fig. 1, but shows the parts in a slightly different position;

Fig. 7 is a section taken on line 7—7, Fig. 1, and shows the pawl and ratchet mechanism employed for rotating the drill; and

Fig. 8 shows a slightly modified form of construction.

In the drawings reference numeral 1 designates the cylinder of an internal combustion engine and 2 the piston that is mounted for reciprocation in the cylinder. The cylinder is provided with a flange 3 that is perforated for the reception of bolts 4 by means of which it is secured in place on the crank case 5. One end of the crank case is closed by a wall 6 having a hub 7 and the other end is closed by a dish-like member 8 having a hub 9. Hubs 7 and 9 form bearings for the crank shaft 10. The crank shaft is provided with a flywheel 11 that is connected with the crank 12 by means of a crank pin which extends through the connecting rod 13. Secured to the crank shaft or formed integral with it is a cam 14. Between the cam 14 and the end closure 8 is a movable flywheel 15. This flywheel is held against rotation by means of splines 16, but can be moved in the direction of the length of the shaft by means which have been shown in Figs. 3 and 4, from which it will be seen that the crank shaft is provided with a diametrical opening 17 and an axial opening 18. A shaft 19 extends inwardly through the axial opening and has its inner end provided with a diametrical opening for the reception of a pin 20. This pin passes through an elongated opening 18 in the shaft and through openings in hub 21 of flywheel 15. Secured to the outer end of shaft 19 is a collar 22 having a groove in its outer surface. Located in the groove is a strap 23 that is connected by means of a pin 24 to a handle 25. One end of the handle is pivoted at 26 to the outer end of bracket 27. By moving the handle from full line to dotted line position, Fig. 4, flywheel 15 will be moved a corresponding distance. The object of moving this flywheel will more fully appear as the description proceeds.

The lower side of the crank case is provided with a downwardly extending tubular extension 28, whose lower end is provided with two or more outstanding lugs 29. The part 28 has an opening whose upper end has been designated by reference numeral 30. Extending through the opening 30 is a hammer bar 31. Opening 30 is

provided with diametrically located grooves 32 and the hammer bar is provided with splines 33 that enter these grooves and hold the bar against rotation. The lower end of opening 30 is provided with a packing gland, the nut of which has been designated by reference numeral 34. The upper end of the hammer bar is provided with a roller 35 that normally engages the surface of cam 14. The hammer bar is also provided on one side with a roller 36 that is adapted to project into the cam groove 37 in the flywheel 15 when the latter is in the full line position shown in Fig. 4. When flywheel 15 is moved to dotted line position, the roller 36 will not engage the groove and therefore will not be affected by the rotation of the flywheel.

From the description already given, it will be seen that when the engine operates so as to rotate the crank shaft and when flywheel 15 is in the position shown in Figs. 2 and 4, the cam 14 will function to move the hammer bar downwardly and the cam surface of groove 37 will cooperate with the roller 36 to return the hammer bar which will therefore be subjected to a reciprocating movement by means of which the drill is operated in a manner which will now be described.

Attention is called in particular to Figs. 5 and 8 from which it will be seen that the tip of cam 14 is in line with the opening in the wall of cam grooves 37. The roller 36 is smaller in diameter than the width of the cam groove. When the cam has operated to move the hammer bar downwardly, the momentum of the latter will function to produce the desired blows. Since the wall of cam groove 37 is open at the point corresponding to the point of greatest eccentricity, the roller 36 cannot strike the inner wall of the cam groove and the entire force of the blow will be transmitted by the hammer to the drill. The fact that the hammer bar is free and "floats" in its bearings at the time between which it receives its last impulse from the cam to the time it strikes the anvil results in an efficient transfer of force and prevents severe shock and vibration. In machines where the length of the hammer bar is greater than the minimum distance between the cam and the anvil, the apparatus is subjected to very severe strains and is inefficient in operation.

The lower end of part 28 has an opening 38 in which is located a socket member 29 and a ring 40. Member 39 has its upper portion 41 of a diameter slightly less than that of opening 38 and has a cylindrical portion 42 directly beneath the part 41. The outer surface of that part of the socket located beneath the cylindrical surface 42 is preferably hexagonal as shown in Fig. 1. Member 39 is provided with an opening 43, whose upper end is enlarged as indicated at 44, and in this enlarged portion is located a sleeve 45, whose inner surface is provided with short threads 46 that engage the grooves 47 in the lower end of the hammer bar. The upper end of sleeve 45 is provided on its outer surface with ratchet teeth 48 that are engaged by pawls 49 pivotally connected to the upper end of socket 39. When the parts are in the position shown in Fig. 1, the lower end of the hammer bar terminates a short distance above the bottom of opening 43, but as the shaft rotates the hammer bar is moved downwardly until it comes in contact with the bottom of this opening and during this movement the sleeve 45 is rotated through a small angle and when the hammer bar returns the pawl and ratchet arrangement shown in Fig. 7 functions to rotate the socket through a small angle.

Ring 40 is provided with an outwardly extending flange 50 and has a cylindrical portion 51 that projects down below this flange. A tubular member 52 is provided at its upper end with a rabbet 53 into which the member 51 extends and is also provided with outwardly extending lugs 54 that are perforated for the reception of the stub bolts 55 whose upper ends are connected with the lugs 29. Coil springs 56 enclose the stub bolts and are held under compression by means of nuts 57. The lower end of member 52 has an inwardly extending flange 58 and is provided with outwardly extending lugs 59 that are perforated for the reception of the parallel arms 60 of the drill retaining member 61. Springs 62 surround the arms 60 and the latter are provided with nuts 63 that engage the upper ends of the spring. Located within the member 52 is a chuck 64. This chuck is provided with a hexagonal opening 65 for the reception of the upper end 66 of the drill 67. The drill is provided with a flange 68' that limits its upward movement. The upper end of chuck 64 has a hexagonal opening 68 within which the hexagonal portion of the socket 39 extends. When the flange 68' of the drill is in the position shown in Fig. 2, the upper end of the hexagonal portion 66 extends a short distance above the bottom of the opening in chuck 64 and the socket member 39 rests on the drill in the manner shown in Figs. 1 and 2. The drill steels are usually provided with axial openings 69 by means of which air or water can be introduced into the hole while the drilling operation is taking place. In order to form a communication between the opening in the drill and the air pipe 70 or the water pipe 71, the lower end of socket 39 has been provided with intersecting openings 72 that form a communication with the interior of the drill and the pipes in the manner shown in Fig. 2. Pipe 70 extends upwardly to the upper end of the cylinder and is provided with a valve 73 by means of which the flow of gas is controlled. The pipe or hose 71 is connected with a water supply whenever water is used during drilling operations.

The engine is, of course, provided with a suitable valve mechanism which has not been described in detail because it does not constitute any portion of this invention, but parts of this mechanism have been shown and the valve stem of one of the valves has been indicated by reference numeral 74. The engine is, of course, connected to a carburetor which has not been shown because it does not involve any novelty, as I merely intended to employ any well known engine suitable for this purpose.

In Fig. 8, a slightly modified form of construction has been shown. In this modification the socket 39 has been omitted and the chuck 64a has been projected upwardly above the upper end of ring 40. The upper end of the chuck is provided with teeth 75 that cooperate with pawl members 76 carried by the rotatable sleeve 77. Sleeve 77 corresponds to sleeve 45 in the other figures and is oscillated in the same manner by the reciprocation of the hammer bar. A small anvil 78 is interposed between the lower end of the hammer bar and the bar end of the drill and this anvil is provided with openings 79 that correspond to openings 72 in the socket shown in Fig. 2.

With the construction shown in Fig. 8, the impact of the hammer bar is transmitted to the drill by the anvil 78 and as this can be made comparatively light, there is scarcely any loss due to

inertia, whereas, with the construction shown in Figs. 1 and 2, the inertia of socket member 39 may be sufficient to interfere to some extent with the operation of the drill. The springs 56 serve to cushion the impact if the hammer bar is reciprocated when the drill is not actually in place or employed for drilling purposes, but when the drill is in use the springs 56 merely serve to hold the parts in position.

10 With the parts assembled as shown and described, it is apparent that when the engine is operated with the flywheel 15 in the position shown in Fig. 2, the hammer bar will be reciprocated and as the result of this reciprocation, impacts will be delivered to the upper end of the drill steel and the latter will also be slowly turned by the action of the pawl and ratchet mechanism. When it is desired to blow dust from the drill holes, valve 73 is opened and this permits gas from the combustion chamber to be transmitted to the interior of the drill for the purpose of cleaning the hole. When water is to be used for drilling, water under pressure is supplied to the pipe 71 and in this way a continuous stream of water is supplied to the opening. When the drill is to be stopped the handle 25 is moved outwardly, thereby moving the flywheel 15 to the dotted line position shown in Fig. 4, whereupon the hammer bar will cease to reciprocate.

30 From the above description it will be seen that the rock drill that forms the subject of this invention is of a very simple and substantial construction and that due to its self-contained motive power, it can be used in places where the ordinary air operated drill could not be used owing to the absence of the compressed air or to the prohibitive expense that would be involved in piping a supply of compressed air to the location. This drill is especially well adapted for prospectors and for road construction work where it is necessary to transport the drill from place to place at frequent intervals.

Having described the invention what is claimed as new is:

1. A device of the class described, comprising, in combination, a crank casing, a crank shaft mounted for rotation therein, a cam secured to the shaft, a hammer bar mounted for reciprocation towards and away from the shaft, said cam having a cam surface adapted to engage the end of the hammer bar to move the same away from the shaft, and means for moving the hammer bar towards the shaft, said means comprising a cam wheel slidably, but nonrotatably secured to the crank shaft, the side of the cam wheel adjacent the hammer bar having a cam groove, the hammer bar having a projection of the proper size and shape to extend into the groove, and means for moving the cam wheel towards and away from the hammer bar so as to connect and disconnect the two.

2. A power drill comprising, in combination, a casing, a shaft extending through the casing and mounted for rotation, a cam secured to the shaft, a cam wheel also secured to the shaft, the surface of the cam wheel adjacent the cam having a cam groove, a hammer bar mounted for reciprocation towards and away from the shaft, the end of the hammer bar nearest the shaft being located between the cams and provided on one side with a projection that extends into the cam groove and on the other side with a projection that extends across the plane of the cam, an anvil located near the other end of the hammer bar, the differences in the distances from the center of rotation to the cam surfaces being sufficiently great at all points in the circumference to permit the hammer bar to move freely for a short distance whereby the hammer bar will be free from contact with the cam when it strikes the anvil, and means for moving the cam wheel longitudinally on the shaft, while the latter is rotating, to disengage the cam wheel from the projection on the hammer bar.

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