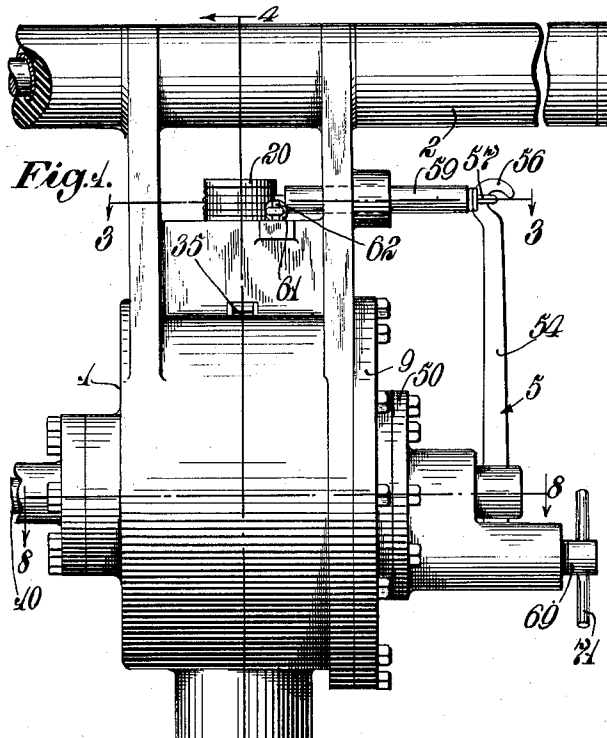
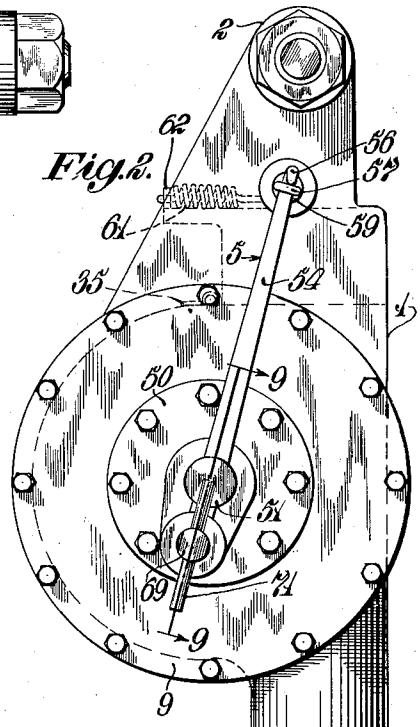
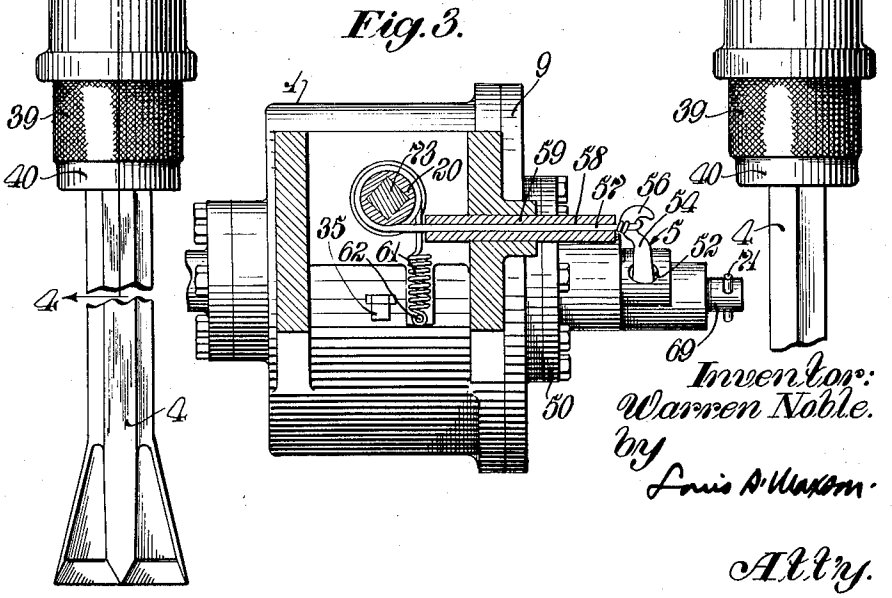
Sept. 28, 1937. W. NOBLE 2,094,184

DRILLING MECHANISM

Filed July 16, 1934 3 Sheets-Sheet 1







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Sept. 28, 1937. W. NOBLE 2,094,184

DRILLING MECHANISM

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Fig. 4.

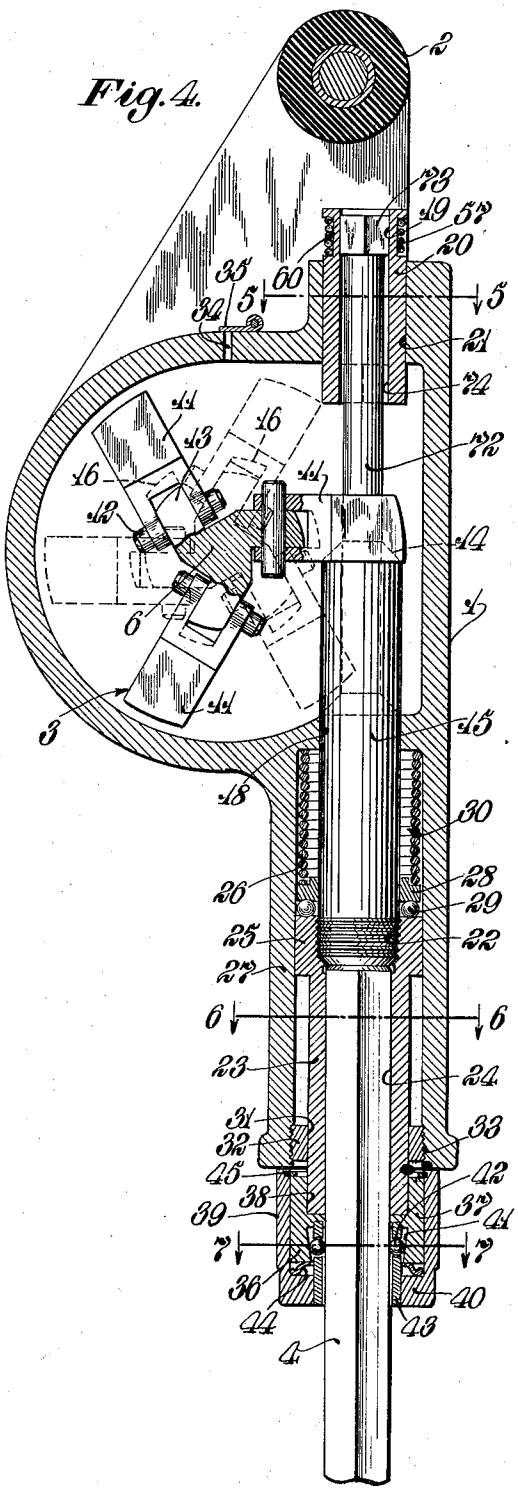


Fig. 5.

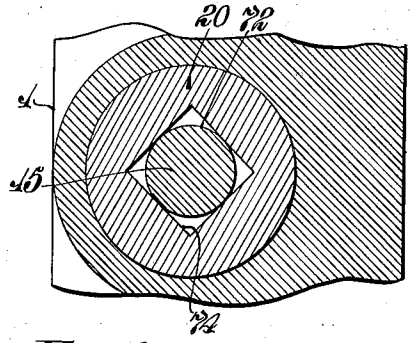


Fig. 6.

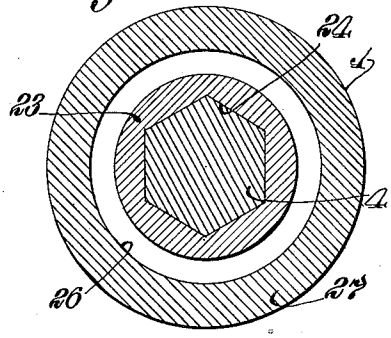
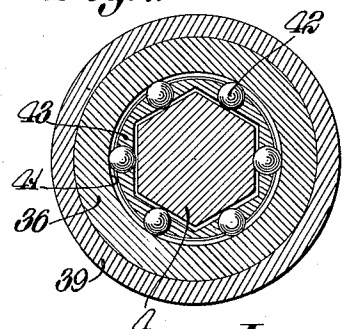


Fig. 7.



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DRILLING MECHANISM

Filed July 16, 1934 3 Sheets-Sheet 3

Fig. 8.

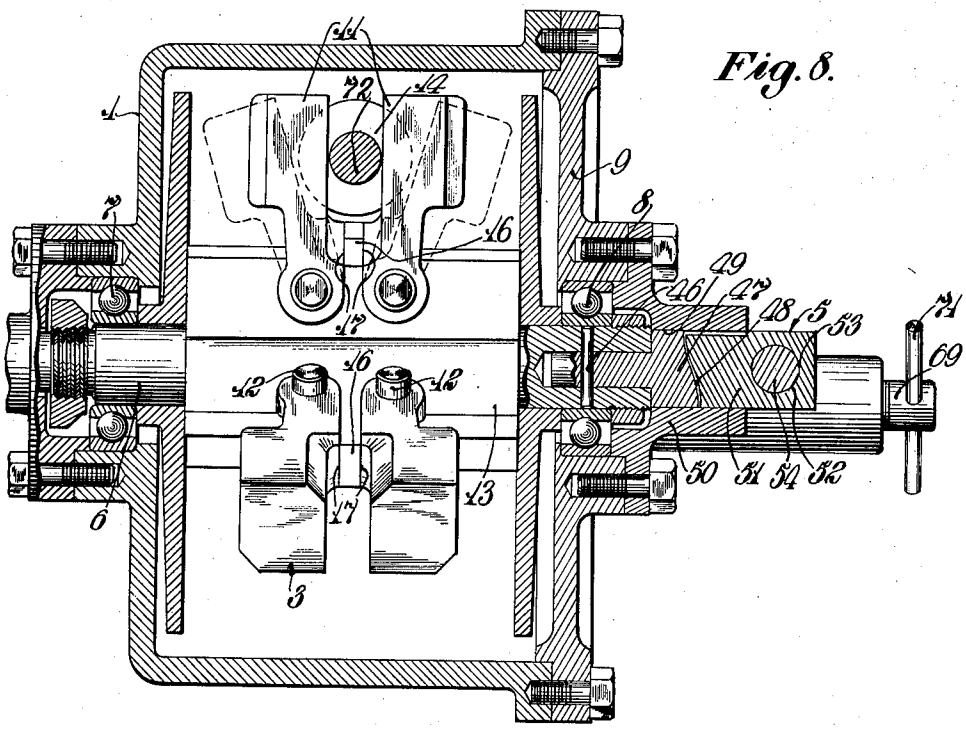
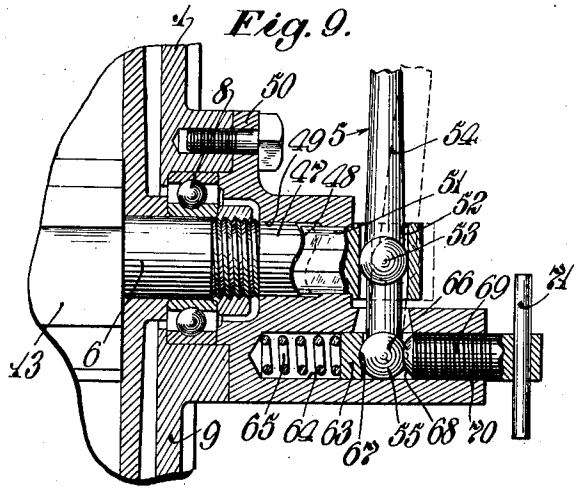


Fig. 9.



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Patented Sept. 28, 1937 2,094,184

UNITED STATES PATENT OFFICE

2,094,184

DRILLING MECHANISM

Warren Noble, Michigan City, Ind., assignor to Sullivan Machinery Company, a corporation of Massachusetts

Application July 16, 1934, Serial No. 735,397

14 Claims. (Cl. 255—41)

This invention relates to drilling mechanisms, and more particularly to improvements in rock drilling mechanisms of the mechanically actuated, free hammer, impact type.

In rock drills of the impact type, it is well understood that the limitation of drilling speed comes in the breaking down of the working face of the shank of the drill steel. As this point is approached with mechanisms limited as to frequency of impact, the reactions upon the drill operator or drill mounting, as the case may be, supporting and controlling the drill become more and more difficult to endure, and the practical limitations in hand-held tools particularly become one of physique. Consequently, the creation of any impact mechanism that can expand the number of blows per unit-time, take advantage of the squared element in the energy equation and derive its power directly from rotary motion without conversion, is of importance.

An object of the present invention is to provide an impact mechanism embodying the virtues above noted. Another object is to provide an improved impact mechanism of the mechanically actuated, free hammer, impact type especially designed for use in rock drilling mechanisms for percussively actuating the drill steel. Yet another object of this invention is to provide an improved rock drilling mechanism of the mechanically actuated, free hammer, impact type which is extremely well balanced in operation, thereby reducing the fatigue of the operator due to excessive shocks and jars transmitted to the drill supporting means by the impact mechanism. A still further object of this invention is to provide an improved impact mechanism which is not only extremely well balanced in operation, but which is more effective in operation than devices of a similar type. A still further object of this invention is to provide an improved rock drilling mechanism of the mechanically actuated, free hammer, impact type which is extremely simple and rugged in design and relatively light in weight. A further object is to provide in a rock drilling mechanism of the above character improved means for imparting rotative movement to the drill steel as the latter is percussively actuated by the impact mechanism. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

In one illustrative embodiment of the invention the improved drilling mechanism may briefly consist of two series of similar weights disposed in symmetrical groups about an axis in such a way as to provide a perfectly balanced rotor. The weight groups may be hinged to the rotor center with the axes of the hinges being in the planes of rotation with the planes of the centers of gravity of the weights axially further apart than the planes of the hinges, so that centrifugal force alines the weights against a common stop. The width of this stop may be such as to let the weight masses clear the shank of an anvil spindle having a broad chamfer at the root of the shank upon which the weights or hammers strike and a prolongation below the anvil chamfer which receives the drill steel. The anvil spindle is preferably guided above and below the anvil chamfer and may be arranged to recede by the action of a spring sufficient to remove the anvil chamfer from the zone of passage of the striking weights or hammers. Pressure on the drill steel compressing this spring brings the anvil chamfer within the zone of the rotating weights or hammers which thus provide impact. Since the weights are in pairs, accurately made and located as to rotation planes about the axes of the anvil spindle they strike the anvil chamfer simultaneously, thus providing balanced impact. The impact by rebound spreads the weights against the component of the centrifugal force with the result that they clear the major diameter of the anvil spindle as the rotation continues and are returned to their central stop.

In the accompanying drawings there is shown for purposes of illustration one form which the invention may assume in practice.

In these drawings,—

Fig. 1 is a front elevational view of the illustrative embodiment of the improved rock drilling mechanism.

Fig. 2 is a side elevational view of the drilling mechanism shown in Fig. 1.

Fig. 3 is a horizontal sectional view taken substantially on line 3—3 of Fig. 1.

Fig. 4 is a central longitudinally extending vertical sectional view taken substantially on line 4—4 of Fig. 1.

Fig. 5 is a cross sectional view taken on line 5—5 of Fig. 4.

Fig. 6 is a cross sectional view taken on line 6—6 of Fig. 4.

Fig. 7 is a cross sectional view taken on line 7—7 of Fig. 4.

Fig. 8 is an enlarged horizontal sectional view taken substantially on line 8—8 of Fig. 1.

Fig. 9 is a fragmentary sectional view taken substantially on line 9—9 of Fig. 2.

In this illustrative embodiment of the invention there is shown a rock drilling mechanism

of the hand held type generally comprising a casing 1 adapted to be supported by a handle 2 and having arranged therein the improved impact mechanism, generally designated 3, for imparting impact blows to the shank of a usual drill steel 4, and having associated therewith improved drill steel rotation means, generally 5.

The improved impact mechanism 3 comprises a rotor shaft 6 journaled in bearings 7 and 8 supported within the sides of the casing 1, the bearing 8 being supported in a detachable cover plate 9 bolted to the main portion of the casing. The rotor shaft 6 is adapted to be driven in any suitable manner such as by a flexible transmission shaft 10 driven from some outside source of power. Pivotally mounted on the rotor shaft are pairs of hammer weights 11, there being shown herein three pairs of such weights spaced equidistantly about the rotor axis. These weights are pivotally mounted on hinge pins 12 supported within the hub 13 of the rotor shaft, and these hinge pins are arranged with their axes in parallel relation in parallel vertical planes spaced equidistantly at opposite sides of a parallel longitudinal vertical plane including the drill steel axis. These pairs of hammer elements 11, 11 are rotated by the rotor shaft 6, and are pivotally mounted so that they may swing inwardly to the full line position shown in Fig. 8. In other words, the hammer weights are held in full extended position by centrifugal force but each time they impact upon the chamfer impact face 14 of the anvil spindle 15, they spread apart or separate from each other to pass the major surface of the anvil spindle and thereafter return to a truly radial position due to the centrifugal force with respect to the axis of the rotor shaft. The hammer weights 11, 11 are herein provided with striking faces to cooperate with the face 14 of the anvil spindle. It will thus be seen that there are provided two series of similar striking weights or hammers disposed in symmetrical groups about the rotor axis in such a way as to provide a perfectly balanced rotor, and that the weight groups are hinged to the rotor hub with the axes of the hinges in the planes of rotation, and the planes of the centers of gravity of the weights are axially further apart than the planes of the hinges so that centrifugal force alines the weights after they strike their blow. These weights are maintained in their alined position, that is their most nearly radial position with respect to the rotor axis, by means of central stops 16 formed on the rotor hub and with which abutment surfaces 17, 17 on the hammer weights are engageable. These hammer weight pairs, upon rotation of the rotor shaft, strike blows simultaneously on the chamfered impact face of the anvil spindle, and when the blow is struck the hammer weights both bound in a direction transverse to the direction of rotation of the hammer weights, giving lateral movements of the hammer weights so that they may pass down past the opposite sides of the anvil spindle. The reaction is one of separation of the hammer weights laterally of their path of movement so that there is a balancing of the forces upon the anvil spindle, the hammer weight which is thrown laterally to one side offsetting the action of the cooperating hammer weight which is thrown laterally to the other side. Centrifugal force is preferably relied upon to keep the hammers in contact with the abutment stops, that is in their most nearly radial position with respect to the rotor axis, although it will be evident that springs or guides might be relied upon to keep the hammers in contact with the stops except at impact and over such period as it might take them to return to contact with the stops after being separated by their being thrown laterally by engaging with the impact chamfer of the anvil spindle.

In this illustrative construction, the anvil spindle 15 is guided at 18 within a bore formed in the casing 1 and the rearward end of this anvil spindle is guided at 19 within a rotatable guide sleeve 20 arranged in a bore 21 formed within the rearward portion of the drill casing. In this instance, the forward end portion of the anvil member 15 is fixed, as by a threaded connection 22, to a chuck member 23 having a polygonal socket 24 for receiving the hexagonal drill steel shank. This chuck member has a cylindrical head 25 guided for reciprocatory movement in a bore 26 formed within the tubular chuck housing 27 integral with the casing. Surrounding the anvil member 15 and interposed between the rear wall of the bore 26 and a race 28 of a thrust bearing 29 is a coiled spring 30, it being noted that the thrust bearing 29 engages the rear face of the chuck sleeve head 25. The forward end of the chuck sleeve 23 is guided within a bore 31 formed in an annular member 32 threaded at 33 within the forward end of the tubular chuck housing 27. The spring 30 urges the impact chamfer of the anvil spindle out of the zone of passage of the hammer weights, so when the drill steel is moved out of contact with the work, striking of the hammer weights on the spindle will cease, while the impact rotor continuously rotates. It will be noted that the chamber in which the impact mechanism is arranged is vented to atmosphere by a passage 34 controlled by a flap valve 35 for relieving any pressure which might be built up by the rotation of the impact mechanism within its chamber.

The drill steel may be retained within the anvil spindle by various means, but in the particular construction shown, the drill steel 4 is retained in operative position within the chuck member 23, that is in a position to receive the impact blows of the anvil spindle by means of a wedge type retaining chuck 36. This chuck comprises an inner member 37 secured as by pressing at 38, to the forward end of the chuck sleeve 23 and having slidably mounted externally thereupon a sleeve-like member 39 having at its forward end an inwardly directed annular flange 40. The inner member 37 is provided with inclined wedge faces 41 with which are engageable wedging balls 42. Secured to the flange 40 of the sleeve-like member 39 are elements 43 for engaging the wedging balls 42 to release the latter. Interposed between the inner surface of the flange 40 and the outer surface of the inner member 37 is a spring 44 for maintaining the member 39 in its outermost position with the balls 42 in their operative wedging position, while carried within the member 39 and engageable with the upper surface of the inner member 37 is a locking ring 45 for retaining the member 39 in position on the member 37. The wedging balls 42 are engageable with the outer surface of the steel shank to lock the shank in position within the chuck sleeve, the balls gripping the drill steel with a wedging action. The drill steel may be readily released from the chuck sleeve simply by pressing the outer sleeve-like member 39 inwardly to cause the elements 43 to engage the balls to move the latter into their released position.

Now referring to the improved mechanism for

imparting rotative movement to the drill steel 4 as the latter is percussively actuated by the impact mechanism, it will be noted that secured by a pin 46 to one end of the rotor shaft 6 is a cam member 47 having a cam surface 48. The cam member 47 is cylindrical in form and is arranged in a bore 49 formed in a member 50 bolted to the cover plate 9. Also arranged in the bore 49 and guided therein is a non-rotatable plunger 51 of polygonal cross section fitted in a correspondingly shaped bore in the cover plate, and this plunger is actuated by the cam member 47 and has its projecting cylindrical end traversed by an opening 52. Pivotally connected at 53 within the opening 52 in the plunger 51 is a lever 54 having at its lower end an adjustable fulcrum 55 and connected at its upper end by a hook portion 56 to one end of a wire 57. This wire is guided at 58 in a tubular guide member 59 secured within the drill casing 1 and extends through the bore in this tubular member and outwardly through the inner end thereof, and the intermediate portion of this wire is wrapped or snubbed about the exterior periphery of a reduced portion 60 of the guide sleeve 20. The inner end of this wire is in the form of a coil spring 61 connected by a pin 62 to the casing. The means for adjusting the position of the fulcrum 55 of this lever comprises a fulcrum positioning member 63 guided in a bore 64 in the member 50 and held in position by a coil spring 65. The fulcrum portion of the lever 54 is in the form of a spherical head 66, and the member 63 is provided with a concave recess 67 for receiving the adjacent side of this head. Engageable with the opposite side of the spherical lever head 66 is a concave recess 68 formed in a set screw 69 threaded at 70 within the outer portion of the bore 63, and this set screw is provided with a rotating handle 71. It will thus be seen that when the cam member 47 is rotated, the plunger 51 is moved axially back and forth, thereby oscillating the lever 54 about its pivot to effect tightening and release of the snubbing portion of the wire 57 with respect to the exterior surface of the sleeve 20; and as a result, due to the tightening and release of the wire, the sleeve 20 is intermittently unidirectionally rotated within the bore 19. This rotative movement of the sleeve 20 is transmited to the drill steel 4 by means of a reduced extension 72 of the anvil spindle 15, and the rearward portion of this reduced extension is formed with a polygonal portion 73 slidably mounted in a similar shaped bore 74 formed axially through the sleeve 20. It will therefore be evident that as the sleeve 20 is intermittently rotated, this rotative movement is transmitted to the drill shank through the reduced portion 72 of the anvil spindle and the chuck sleeve 23. The cam surface on the cam member 47 is preferably so formed as to actuate the rotating mechanism to rotate intermittently the drill steel between the periods of impact of the impact mechanism thereon, so that when a blow is struck on the drill steel the latter is stationary as regards rotary motion.

As a result of this invention, it will be noted that an improved impact mechanism is provided of the mechanically actuated, free hammer, impact type having an improved arrangement of the impact elements whereby an extremely well balanced and symmetrical unit is attained. It will further be noted that the improved drilling mechanism is comparatively light in weight and simple in design in relation to its relative efficiency, the impact element striking a comparatively large number of blows to the steel shank without excessive vibration. It will further be noted that by providing the cam operated lever and snubbing wire type rotation mechanism the drill steel is intermittently rotated as it is percussively actuated in an improved manner. These and other uses and advantages of the invention will, however, be clearly apparent to those skilled in the art.

While I have in this application specifically described one form which my invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration 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 an impact mechanism, a rotating drive member, an anvil, and a plurality of striking members supported on and rotated by said drive member for delivering simultaneously impact blows to said anvil, said anvil disposed with its axis in a plane to which the axis of rotation of said drive member is perpendicular and which plane extends between said striking members, and said drive member providing pivotal support for said striking members on which the latter are swingable laterally, transversely to the planes of rotation of said rotating driving member, towards and from each other, whereby said striking members are separable to pass to opposite sides of said anvil after impact thereon.

2. In an impact mechanism, a rotating drive member, an anvil, and a pair of striking members driven by said drive member for delivering simultaneously impact blows to the anvil, said anvil arranged in the paths of movement of said striking members, and said striking members having mountings on said drive member providing for their lateral movement, transverse to planes perpendicular to the axis of rotation of said drive member, after they strike their blows, thereby to clear said anvil member.

3. In an impact mechanism, a rotating driving member, an anvil, and a pair of striking members driven by said driving member for delivering simultaneous impact blows to the anvil, said anvil having a portion thereof arranged in the path of movement of said striking members, and said striking members pivotally secured to said rotating driving member for movement laterally after they strike their blow, to clear said anvil member, said striking members weighted with respect to their pivots so that after they clear the sides of said anvil member they are returned automatically to their blow-striking position by the action of centrifugal force.

4. In an impact mechanism, a rotating driving member, an impact member having at each of its opposite sides a sloping impact surface and adapted to be percussively actuated, and impact elements mounted on said rotating drive member and actuated thereby and hinged thereto on axes in the planes of rotation of said driving member, for simultaneously striking impact blows on said impact surface of said impact member and thereafter deflecting laterally past the sides of said impact member.

5. In an impact mechanism, a rotating driving member, an impact member having oppositely sloping surfaces and adapted to be percussively actuated, and impact elements mounted on said rotating drive member and actuated thereby for

simultaneously striking impact blows on said impact surface of said impact member and thereafter deflecting laterally past the sides of said impact member, said impact elements pivotally secured to said rotating driving member on parallel axes extending chordally of the circles of rotation thereof and said rotating driving member rotating said impact elements at a speed adequate to return them automatically to their blow delivering position after passing the sides of said impact member, by the action of centrifugal force.

6. In an impact mechanism, a rotating drive member, an impact member having an impact surface and adapted to be percussively actuated, and impact means carried by said rotating drive member and actuated thereby, for delivering simultaneously impact blows to the impact surface of said impact member and pivoted to said rotating drive member on axes in the planes of rotation of said rotating drive member for deflection laterally by reactance past the sides of said impact member.

7. In an impact mechanism, a rotating drive member, an axially reciprocatory impact member arranged with its axis of reciprocation at right angles to a line parallel to the axis of rotation of said drive member, and hammer elements pivotally carried by said drive member and swingable apart thereon and actuated thereby in paths in which said reciprocatory impact member is disposed, for delivering simultaneously impact blows to said impact member.

8. In an impact mechanism, a rotating drive member, an axially reciprocatory impact member arranged with its axis of reciprocation at right angles to the axis of rotation of said drive member, and hammer elements carried by said drive member and actuated thereby in arcuate paths into which said reciprocatory impact member extends in a direction substantially perpendicular to the radius of the arcs of said paths at the point of impact, for delivering simultaneously impact blows to said impact member, said elements swingably mounted on said rotating drive member to provide, after the blows are struck thereby, for deflecting laterally past the sides of said impact member.

9. In an impact mechanism, a rotating drive member, a reciprocatory anvil providing faces sloped to effect lateral deflection of hammers striking the same, and a pair of pivoted hammers driven by said drive member and connected to the latter on parallel laterally offset axes and held in operative blow striking position by the action of centrifugal force engendered by their rotation, said hammers striking simultaneously the anvil and thereafter bouncing laterally about their pivots to clear the sides of said anvil.

10. In an impact mechanism, a rotating drive member, a reciprocatory anvil wedgelike, and a pair of pivoted hammers driven by said drive member and pivotally connected to the latter on parallel laterally offset axes and held in operative blow striking position by the action of centrifugal force, said hammers striking simultaneously the anvil and deflected laterally about their pivots to clear the sides of said anvil, said pivoted hammers automatically returning to their blow striking position after clearing the sides of the anvil by the action of centrifugal force.

11. In an impact mechanism, a rotating drive member, a reciprocatory anvil forwardly tapering, and a pair of exclusively laterally swingable pivoted hammers driven by said drive member and normally held in operative blow striking position by the action of centrifugal force, said hammers positioned to strike simultaneously the anvil and said anvil deflecting them laterally about their pivots to clear the sides of said anvil, said pivoted hammers automatically returned to their blow striking position after clearing the sides of the anvil solely by the action of centrifugal force, and a stop means on said drive member for limiting inward movement of said hammers toward one another when said hammers are in said blow striking position.

12. In a percussive mechanism, a rotatable driving member, driving means therefor, a pair of pivot mountings on said driving member so disposed thereon that their axes trace parallel plane annular surfaces on rotation of said driving member, a pair of hammer elements journaled on said pivot mountings and rotatable in laterally spaced orbits upon rotation of said rotatable driving member, and an element for percussive actuation by said hammers and providing a portion disposed between the circular orbits of said hammers and a wider portion providing surfaces engageable by said hammers and sloped to deflect the latter oppositely.

13. In a percussive mechanism, a rotatable driving member, a pair of laterally offset hammers secured to said member for lateral swinging with respect to each other, and an anvil member having oppositely sloping portions disposed in position to be concurrently struck by and inclined in directions laterally to deflect said hammers.

14. In a percussive mechanism, a rotatable driving member, an anvil member arranged in the planes of rotation of said member and extending parallel to a plane which is perpendicular to such planes and is tangent to the surface of revolution traced by the outermost portions of said rotatable driving member, and hammers laterally swingable relative to each other on said rotatable driving member and rotated thereby for striking mutually-laterally-counterbalancing, substantially concurrent blows on said anvil member.

WARREN NOBLE.

CERTIFICATE OF CORRECTION.

Patent No. 2,094,184. September 28, 1937.

WARREN NOBLE.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, first column, line 61, claim 10, for the words "anvil wedgelike" read wedgelike anvil; and second column, line 12-13, claim 11, for "anvil forwardly tapering" read forwardly tapering anvil; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 7th day of December, A. D. 1937.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)