Oct. 28, 1930. E. WAGNER 1,779,923

DEVICE FOR TRANSFORMING A ROTARY MOTION INTO A RECIPROCATING MOTION

Filed Feb. 1, 1927

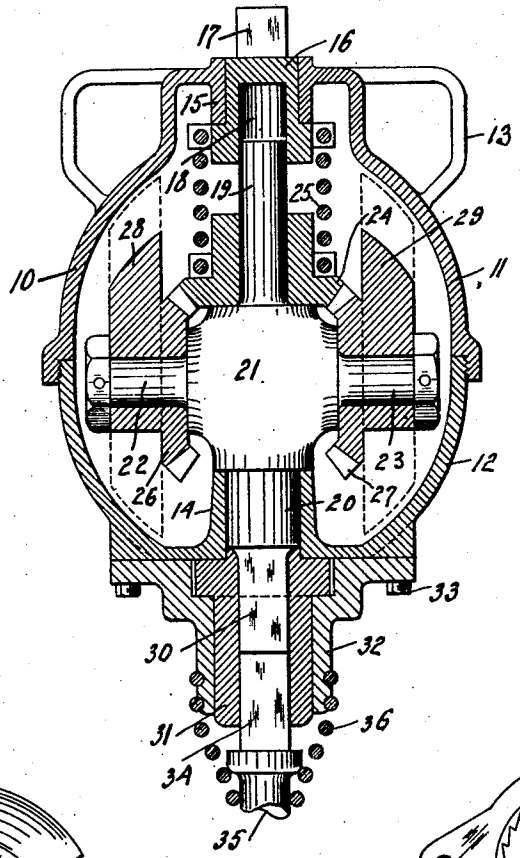


Fig. 1

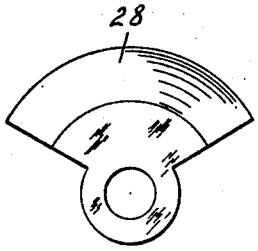


Fig. 3

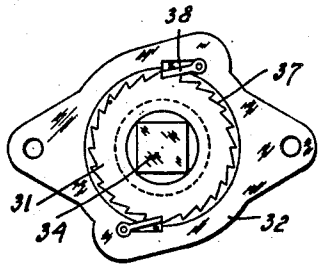


Fig. 4

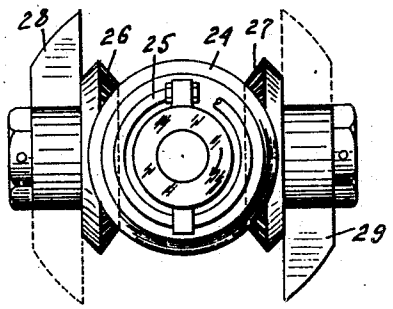


Fig 2

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UNITED STATES PATENT OFFICE

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DEVICE FOR TRANSFORMING A ROTARY MOTION INTO A RECIPROCATING MOTION

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The present invention relates to improvements in a mechanism for utilizing the centrifugal force of rotating unbalanced bodies, especially adapted for use in connection with percussive tools, such as rock drills and the like.

Mechanisms utilizing the centrifugal force of rotating unbalanced masses have been used heretofore for various purposes. They include usually one or more revolving bodies or masses, rotating in the same or opposite directions. The centrifugal forces of two or more revolving bodies rotating in opposite directions may be combined in such a manner that a straight line reciprocating motion is imparted to the revolving masses, their journals and the tool attached thereto. If the masses rotate in two parallel planes, at a certain distance from each other, a secondary oscillating rotation will also be generated, acting at right angles to the main straight line motion. This secondary oscillating motion has not been utilized heretofore in percussive tools.

The main object of the present invention is to construct a tool in which the above-mentioned secondary oscillating rotation is made use of by converting it into rotation of uniform direction, capable of rotating for instance a drill steel.

One of the many possible embodiments of the invention is illustrated in the accompanying drawings, in which Fig. 1 is a vertical section taken through a rock drill constructed in accordance with the present invention; Fig. 2 is a top elevation of the inner moving elements of the device; Fig. 3 is a side elevation of one of the eccentric masses; and Fig. 4 is a top elevation of the elements for imparting rotation to the tool.

In the drawings, the numeral 10 indicates a housing, which is, preferably, made of two sections 11 and 12, detachably fastened together so that access may be had to the interior thereof when required. This housing is provided with handles 13, by which the tool may be pressed against the work, such as rock, coal, etc. The housing section 12 is provided at its lower end with a vertically extending bearing member 14, and in alignment with the said bearing member is provided in the top of the housing section 11 a similarly arranged bearing member 15. In the bearing member 15 is rotatably mounted the driving element 16 of the tool, it being provided with a square extension 17, disposed outside of the housing and adapted to be connected to an electric motor or the like to rotate the same. The driving member 16 is provided with a bore 18 in alignment with the bearing member 14, and in the said bore and bearing member are rotatably and reciprocably mounted the journals 19 and 20, respectively, of a striking element 21. This striking element is substantially cross-shaped, it having fixed to it or made integral with the same two spindles 22 and 23, in alignment with one another at right angles to the vertical axis passing through the journals 19 and 20. On the journal 19 is rotatably mounted a bevel gear 24, connected with the driving element 16 by a spring 25, whereby the rotation of the said driving element is transmitted to the said bevel gear. This spring has also the function of keeping the said gear in mesh with two bevel gears 26 and 27, which are rotatably mounted on the spindles 22 and 23, respectively. With the bevel gears 26 and 27 are associated two bodies 28 and 29, respectively, the same being either eccentrically attached to or made integral with the said bevel gears and rotating thus in opposite directions in parallel planes at a certain distance from one another.

The striking body 21 is provided below its journal 20 with a square extension 30, extending into a similarly shaped bore in a bushing 31, the latter being rotatably mounted in and kept in position on the housing by a sleeve 32,

which is detachably fastened by screws 33, or otherwise, to the bottom of the housing section 12. Into the bore of the bushing extends also the square upper end 34 of a tool 35, for instance a drill steel. This tool is detachably fixed to the sleeve 32, for instance, by a spring 36.

The bushing 31 is provided adjacent its upper end with ratchet teeth 37, with which co-operate spring-pressed pawls 38, carried by the sleeve 32, the arrangement being such that the bushing is permitted to rotate counterclockwise only.

In the positions of the elements shown in full lines in Fig. 1 of the drawings, the centrifugal forces of the masses 28 and 29 both point upwards and thereby tend to move the striking body and the elements connected therewith in the same direction. After having moved in opposite directions one-half of a turn, the centrifugal forces of the said masses both point downwards. In any other positions the horizontal components of the centrifugal forces nullify one another, and the vertical components point up or down but always in the same direction. They generate, therefore, a straight line or linear reciprocating movement, pointing up and down at right angles to the horizontal axis of the striking body 21. The amplitude of this straight line reciprocating movement would vary and be symmetrical relative to the starting position if no spring or outside force were employed. However, the insertion of the spring 25 makes this motion unsymmetrical and increases the striking velocity of the movable elements considerably. By making this spring stronger or weaker, the striking velocity is varied and also the time at which the blow is delivered and similarly the power required for operating the tool. If the spring is too strong, the moving elements of the tool do not change their position relative to the housing of the tool, so that the housing, if not held rigidly, is shaken and the whole system moves as one body. If the spring is too weak, the striking velocity is smaller or the number of blows delivered may differ from the number of revolutions of the eccentric masses. The spring also reduces the shaking action imparted to the hands or device holding the tool.

The turning of the eccentric masses in opposite directions creates, as above stated, a straight line or linear reciprocating movement pointing up and down. In the positions of the masses illustrated in full lines in Fig. 2 of the drawings the horizontal components of the centrifugal forces exert a turning movement about the vertical axis of the striking body, tending to rotate the entire mechanism in a clockwise direction. After these eccentric masses have been rotated one-half of a turn, they are in the positions shown in dotted lines in Fig. 2 of the drawings and tend to rotate the mechanism in a counterclockwise direction. The present invention uses this rotative tendency of the horizontal components of the centrifugal forces to rotate a tool, for instance a drill steel, so that it will strike at a different point after each blow. If the driving element 16 and the driven end 30 of the tool rotate in opposite directions, as illustrated in the drawings, the speed of the eccentric masses 26 and 29 is the sum of the two revolutions, provided that the three bevel gears of the device are of the same diameter. In such case the eccentric masses revolve faster than the driving motor, and the tool is especially suited for drilling hard rock. If the driving element 16 and the driven end 30 rotate in the same direction, the revolving speed of the eccentric masses is the difference in speed of the two former revolutions, they rotating at a slower speed than the driving motor. Such a tool is suitable for drilling soft material, for instance coal.

The mechanism herein described is not influenced by a sticking of the tool, as it will continue to operate without strain or breaking if the drill steel, for instance, cannot move forward or backward or is prevented in its rotation.

The ratchet and pawls above described may be replaced by others to permit a clockwise rotation of the movable elements of the device. The action of the percussive tool, obviously, becomes then different.

It is obvious that, while in the drawings two eccentric masses have been shown, any other suitable number may be employed without departing from the invention. It is also obvious that while herein a spring has been described as forming the connection between the driving element 16 and the bevel gear 24, any other means may be used for this purpose.

What I claim is:

1. A percussive tool of the character described, comprising a housing, two unbalanced bodies therein disposed in parallel planes, a gearing connecting said bodies and rotating the same in opposite directions, whereby the centrifugal forces of the unbalanced bodies impart thereto a straight line reciprocating motion and a rotating oscillating motion perpendicularly to said straight line motion, and means for preventing the rotating oscillating motion of said bodies in one direction and allowing an intermittent rotation thereof only in the other direction relatively to said casing.

2. A percussive tool of the character described, comprising a housing, two unbalanced bodies therein disposed in parallel planes, a gearing connecting said bodies and rotating the same in opposite directions, whereby the centrifugal forces of the unbalanced bodies impart thereto a straight line

reciprocating motion and a rotating oscillating motion perpendicularly to said straight line motion, and means for preventing the rotating oscillating motion of said bodies in the direction of rotation of the driving element of said gearing and allowing an intermittent rotation of said bodies only in the other direction relative to said casing.

Signed at Tokod, in the county of Esztergom, in the Kingdom of Hungary, this 16th day of December, A. D. 1926.

EMANUEL WAGNER.