May 5, 1936. F. D. BYERS 2,039,679

OSCILLATORY GEAR

Filed April 29, 1935

Fig. 1

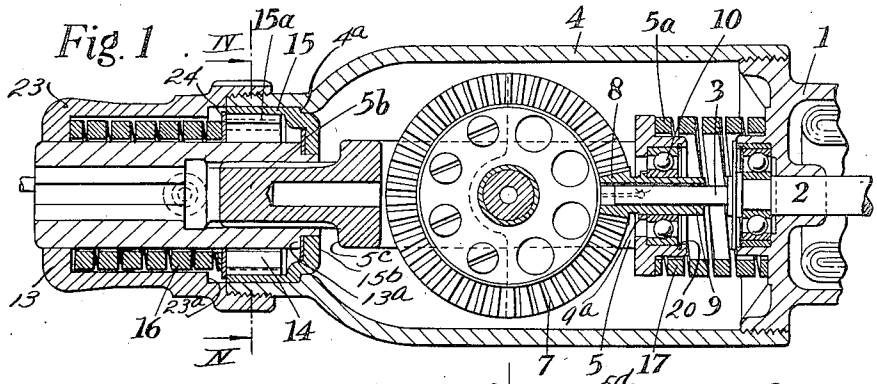


Fig. 2

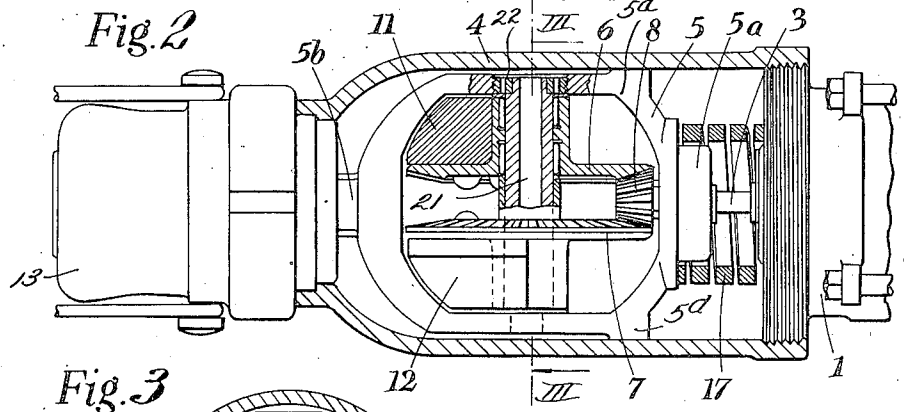


Fig. 3

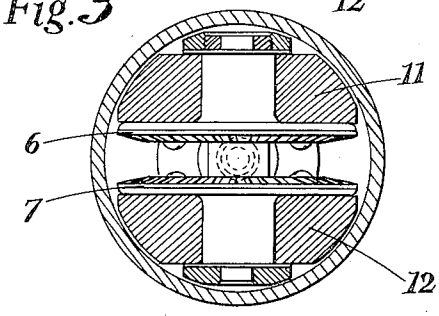


Fig. 4

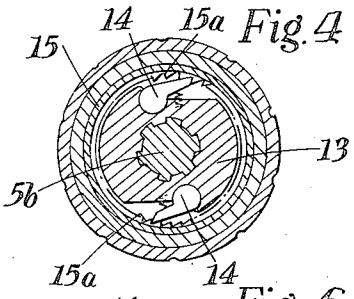


Fig. 5

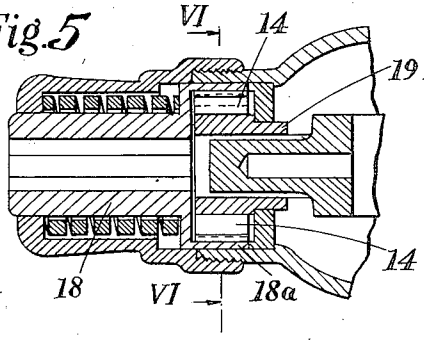
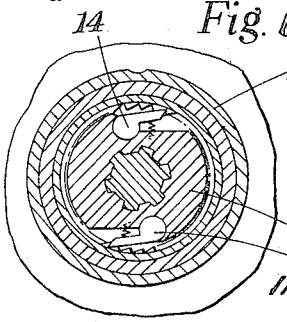


Fig. 6



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OSCILLATORY GEAR

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Application April 29, 1935, Serial No. 18,921
In Great Britain May 5, 1934

3 Claims. (Cl. 255—42)

This invention relates to percussive tools of the kind in which the hammer comprises a reciprocating frame (hereinafter referred to as an "oscillator") on which are mounted for rotation in opposite directions two or more rotary members (hereinafter referred to as "fliers") driven by a bevel pinion splined to a motor shaft, and having their centres of gravity outside their centres of rotation and so disposed that at two points in a revolution the two centres of gravity and the axis of rotation are in the plane of the direction of movement of the oscillator.

In such tools as hitherto constructed the oscillator, which of necessity must function as the hammer, has been built up owing apparently to the difficulty of mounting the fliers and their driving gear. Owing to the severe percussion which the hammer has to sustain such built up structures could not be expected to stand up to the strain very long and they would ultimately work loose and fall to pieces. It is the object of the present invention to provide a form of construction in which this drawback is obviated.

According to the invention the oscillator comprises a closed yoke member formed out of a single piece of material.

The invention will now be described by way of example with reference to the accompanying drawing.

In the said drawing:

Fig. 1 is a longitudinal sectional elevation of an electric pick or hammer drill comprising the mechanism according to the invention.

Fig. 2 is a sectional plan of Fig. 1.

Fig. 3 is a section taken on the line III—III of Fig. 2.

Fig. 4 is a section taken on the line IV—IV of Fig. 1.

Fig. 5 is a partial sectional elevation of an alternative form of ratchet mechanism for the tool holder.

Fig. 6 is a section taken on the line VI—VI of Fig. 5.

Referring more particularly to the drawing, the numeral 1 indicates the motor casing, and 2 the motor shaft which has an extension 3 thereon projecting into an oscillator casing 4. Slidably mounted in the casing 4 is an oscillator 5 in the form of a closed yoke formed of a single piece of material, in which are rotatably mounted two similar coaxial and oppositely disposed bevel wheels or discs 6, 7 driven by a common bevel pinion 8 rigid with a splined sleeve 9 slidable on the motor shaft extension 3 which is correspondingly splined, the sleeve 9 being carried by a journal bearing 10 in a housing 5a in the inner cross member of the oscillator 5. The sleeve 9 has a shoulder 9a adapted to abut against the inner race of the bearing 10, while the outer race of the said bearing 10 is retained in the housing 5a by means of a steel retaining ring 20. By this means the pinion B is constrained against axial movement away from the discs 6, 7.

The discs 6, 7 are rotatably mounted on a hollow spindle 21 which is similarly reduced at both ends, the one end passing into a corresponding bore in one of the yoke arms, and the other end being adapted to fit into the bore of an externally threaded retaining ring 22 adapted to screw into a coaxial threaded bore in the other yoke arm. The spindle 21 can thus be inserted in position without the necessity of dividing the yoke.

Mounted on each of the bevel discs 6, 7 is a semi-circular weight 11, 12 respectively. It is desirable that the mass of the flyweights should be as great as possible, having regard to the space available. The most effective shape is a half-slice of a sphere, the radius being as large as will be admitted by the casing 4. The sides of the yoke are also formed to the same radius, so that the whole unit presents the appearance of Fig. 3, no space being wasted.

The end of the oscillator remote from the motor has formed thereon a splined nose 5b which engages in a correspondingly splined socket in a tool holder 13. The tool holder 13 has mounted thereon pawls 14 which engage with ratchet teeth 15a on a ratchet ring 15 which is housed in the end of the casing 4. The tool holder 13 is mounted to move outwards against a spring 16 housed in a cap 23 in threaded engagement with the outer end of the casing 4. The outer surface of the housing 5a forms a support and means of location for a recoil spring 17, which at its other end rests on a similar cylindrical support formed on the motor casing 1. The projecting surfaces 5d are arranged to support the hammer 5 by revolving or sliding within the casing 4 as in a bearing. The collar on the outside of the housing 5a and the surfaces 5d are formed integrally with the hammer.

The inner end of the tool holder 13 rests in a hole in 15, the tool holder 13 having a shoulder 13a to prevent longitudinal movement through 15. The tool holder also carries an abutment washer 24 for the spring 16. The pressure of the spring 16 transmitted by the tool holder 13 to the ratchet ring 15, holds the ring against a shoulder 4a formed inside the casing 4. Should the hammer

meet with little or no resistance during its forward movement, the faces 5c and 15b will come into contact, and the ratchet ring 15, the tool holder 13, and the pawls 14 will all travel with the hammer, until its energy is absorbed by the spring 16. The maximum travel against the spring is limited by the shoulder 23a on the inside of the cap 23.

The ratchet is thus kept in full engagement, the pawls and ring always occupying the same positions relatively to each other, even during overtravel of the hammer. The relative position of tool and tool holder are also unaltered. The friction between the ring 15 and the casing 4 which determines the torque which may be transmitted by the ratchet, is dependent upon the initial pressure of the spring 16 and may thus be adjusted to a value which will permit the ring to slip when the load becomes excessive.

The mechanism operates as follows:—

When the motor is running, the discs 6, 7 will be driven in opposite directions, and in view of their centres of gravity not being at their centre of rotation a centrifugal force will be set up by each disc along a line joining the centre of rotation and the centres of gravity of the discs; and the following sequence will occur in a complete revolution:—

When the centres of gravity of the discs 6, 7 are both in the plane of the centre line of the oscillator 5, the centrifugal force or forces will act in the same direction and will carry the oscillator 5 in that direction. In the position shown in the drawing this movement will be to the left.

After the discs 6, 7 have turned through a right angle in opposite directions, the centrifugal forces will act in opposite directions at right angles to the centre line of the oscillator 5 so that there will be no resulting force on the oscillator 5; but owing to the two discs being in different planes, there will be about the axis of the oscillator 5 a couple, which will be referred to hereinafter.

When the discs 6, 7 have turned through a further right angle, their centres of gravity will again be in the plane of the axis of the oscillator 5, but at 180° to the previous position they occupied in this plane, so that centrifugal forces will again be set up along the axis of the oscillator 5 but in the opposite direction, with the result that the oscillator 5 will be made to travel in the opposite direction.

When the discs 6, 7 have moved through a third right angle the centrifugal forces are again acting in opposite directions at right angles to the centre line of the oscillator and there will be no resultant movement; and again there will be a couple, but in a direction opposite to that mentioned above.

The movement of the oscillator 5 along its axis towards the motor end of the tool is absorbed by the recoil spring 17, while its movement towards the tool end is utilized to impart a series of impacts against the tool holder 13 or against the tool itself.

The couple referred to above may be utilized for imparting to the tool holder partial rotation about the axis of the oscillator, by mounting the oscillator for rotation about its axis in a holder, and arranging a ratchet mechanism between the oscillator and the holder so that an intermittent rotary motion may be imparted to the tool or other holder.

In the construction shown in Fig. 1 the ratchet 15 being normally held rigid with the oscillator casing 4, and the tool holder 13 being splined with the oscillator 5, an intermittent rotation will be imparted to the tool holder, the couple in the oscillator 5 in the opposite direction being taken up by the casing of the tool.

In the construction shown in Figs. 5 and 6, the ratchet ring 18a is made integral with the tool holder 18 while the pawls 14 are mounted on a pawl carrier 19 which is splined with the oscillator nose 5b. Hence in the one direction of angular oscillation of the oscillator 5 the tool holder 18 is turned, while in the other direction the oscillator 5 moves freely.

In both forms of ratchet it is to be observed that the ratchets move with the hammer.

I claim:

1. A percussive tool of the kind described comprising an oscillator, formed of a single piece closed yoke member, bevel discs mounted in said yoke and weights on said discs, a bevel pinion mounted on the cross piece of said yoke, said bevel pinion meshing with said bevel discs, and a driving shaft with which said bevel pinion is in driving engagement but so as to be axially slidable thereon.

2. A percussive tool of the kind described comprising an oscillator, formed of a single piece closed yoke member, bevel discs mounted in said yoke and weights on said discs, a housing in one of the cross pieces of said yoke, a roller bearing in said housing, a sleeve supported by said roller bearing, a motor shaft splined to said sleeve, a bevel pinion rigid with said sleeve and meshing with said bevel discs, a shoulder on said sleeve adapted to abut against the outer face of the inner race of said roller bearing, and means for retaining the outer race of said roller bearing in said housing.

3. A percussive tool of the kind described comprising an oscillator, formed of a single piece closed yoke member, coaxial bores in the arms of said yoke, a spindle, bevel discs mounted on said spindle, weights on said discs, said spindle having its ends reduced, one of said ends being adapted to fit into one of said bores, the other bore being enlarged to allow of the passage of the spindle therethrough, a ring nut adapted to pass over the reduced end of the spindle located in said enlarged bore, said enlarged bore being threaded to engage with said ring nut.

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