May 31, 1932. E. M. BUTLER 1,860,492

MOTOR

Filed April 30, 1929

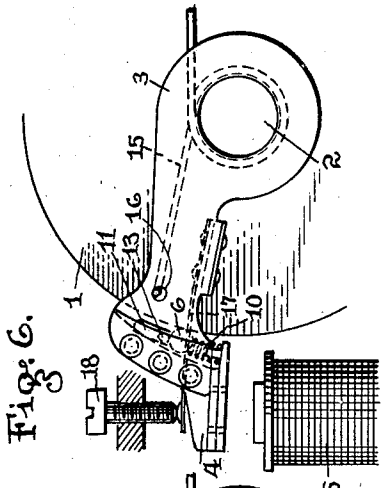


Fig. 6.

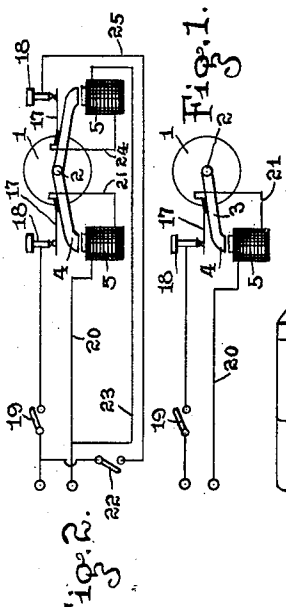


Fig. 2.

Fig. 1.

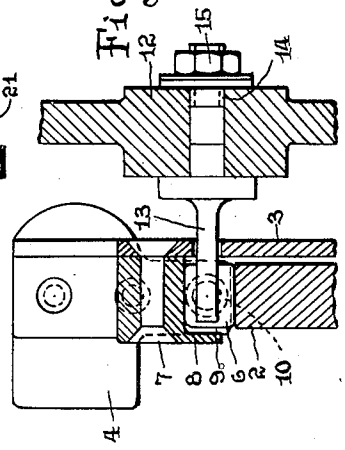


Fig. 7.

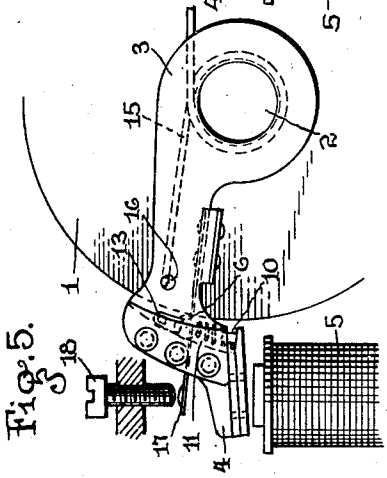


Fig. 5.

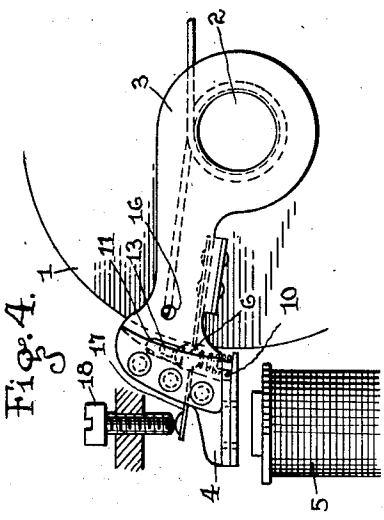


Fig. 4.

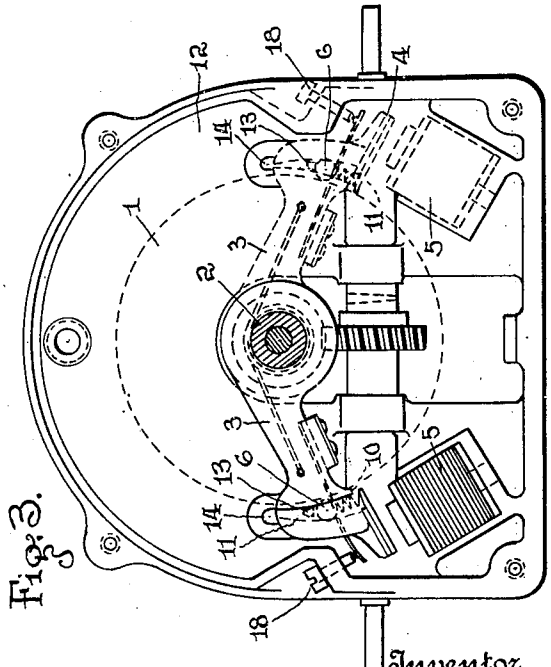


Fig. 3.

Inventor

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By his Attorney

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Patented May 31, 1932 1,860,492

UNITED STATES PATENT OFFICE

EDGAR M. BUTLER, OF BROOKLYN, NEW YORK, ASSIGNOR OF TWENTY-FIVE PER CENT TO ANDERS JORDAHL, OF NEW YORK, N. Y.

MOTOR

Application filed April 30, 1929. Serial No. 359,210.

This invention relates to motors.

The object of this invention is to provide a simple, inexpensive and very efficient low speed motor, and one which is adapted for use in imparting directional movement to devices to be operated thereby in a series of rapid pulses.

The principle of my invention involves the translation of a vibrational or oscillating movement into a rotary one, and is achieved by me, broadly, in providing a disc, an electromagnetically vibrated member, and means disposed between said disc and member adapted to rotate said disc upon movement of said member.

A motor embodying the invention is illustrated in the accompanying drawings, wherein

Fig. 1 is a circuit diagram of a unidirectional motor embodying my invention;

Fig. 2 is a circuit diagram of a reversible motor;

Fig. 3 is a plan view of said reversible motor;

Figs. 4, 5 and 6 are sequence details, and Fig. 7 is a detail in section.

Referring generally to said figures, the motor comprises a disc 1 rigidly mounted on a shaft 2 and an arm or lever 3 loosely mounted on said shaft. The extremity of said arm is provided with a flat portion or armature 4 adapted to be attracted by an electromagnet 5 so as to cause the arm tc vibrate.

The arm is adapted to carry a roller bearing or wedging member 6 intermediate its extremities, and Fig. 7 particularly shows in detail how this member is supported therein. There is riveted at 7 to the arm 3 a housing 8 which is open at the top and on the side facing the disc, and of which an extension 9 of the arm forms the floor or base.

Mounted on said base and disposed in said housing is a coiled spring 10 which supports the roller 6. The housing is so arranged and constructed with respect to said disc that a tapering or wedge-shaped channel or groove 11 is formed between the periphery of said disc and said housing, in which the bearing may freely ride for a very limited distance relative to said arm and upon further travel of said arm in any one direction to be wedged between said housing and the periphery of said disc so as to cause the disc to rotate upon further movement of said arm in the selected direction.

The frame 12 of the motor is provided with a kick-out pin 13 which projects into the groove 11 above the bearing, said pin being adapted, as the name implies, to kick the bearing out of wedge upon the return stroke of said arm. The pin is adjustable by moving it along the slot 14 in the frame 12 and secured by the means indicated at 15.

The arm is held in neutral or inactive position by means of a spring 15, one end of which passes through a hole 16 in the arm and the other extremity being coiled around the shaft. The neutral, normal or inactive position of said arm is shown in Fig. 6. The electromagnet when energized attracts the arm to itself against the pull of the spring 15, and as soon as the electromagnet is de-energized the arm is returned to its neutral position, all as hereafter more fully described.

The arm also carries a contact spring 17 which is insulated from the arm and adapted to make holding contact with an adjustable screw 18 mounted on the frame 12. This screw controls the period of holding contact between it and the spring 17, the rapidity of vibration of the arm and its amplitude, as will be readily understood.

The operation of said motor is as follows: When the circuit is open the position of the arm and associated elements is as shown in Fig. 6. Upon closing the switch 19 of the circuit shown in Fig. 1, a current is caused to pass through a conductor 20, electromagnet 5, conductor 21, contact spring 17, screw 18 (or frame), conductor 20′, and switch 19. The passage of current causes the electromagnet to be energized and attract the arm. Before the arm moves, the bearing 6 lies freely on the spring 10 in groove 11. As the arm continues its downward stroke, it causes the bearing to be wedged against the periphery of the disc due to the tapering construction of the groove which wedges the bearing between the hous-

ing or arm and the disc, and for the remainder of the downstroke the arm, bearing and disc move together. When the arm reaches the end of its downstroke contact is broken between the screw 18 and the contact spring 17, breaking the circuit (Fig. 5) and de-energizing the magnet. The arm is then immediately returned to the neutral position of Fig. 6 by the pull of the spring 15, it being understood that the downward movement of the arm is yieldingly opposed by said spring. However, upon the arm reaching its neutral position, spring 17 contacts again with screw 18 closing the circuit (Fig. 4) and energizes the magnet, attracting the arm, as before, and the whole operation is repeated (assuming of course that switch 19 remains closed).

In order to prevent the bearing from remaining wedged between the arm and the disc upon the up or return stroke (and thus revolving the disc in the reverse direction which it is not desired to do by this disclosure) I provide the pin 13, above described, which kicks the bearing out of wedge should it attempt to move upward with said arm.

In order to obtain an appreciable degree of rotation of said disc by said arm, it is necessary that the current flow through the electromagnet for an appreciable period; this means that the circuit must remain closed during the entire downstroke of the arm. In order to permit this, I provide a spring leaf 17 which is connected in the energizing circuit and makes holding contact with the screw 18. This holding action is accomplished by driving the screw down so as to flex the spring and keep it flexed in the neutral position and for substantially the entire period of the downstroke. Thus, as the arm moves downward the spring continues to bear against the screw, with, of course, increasingly less and less pressure, until finally, when it reaches its unflexed state, it moves bodily with the arm and breaks contact with said screw.

The screw 18 is, of course, adjustable for varying the holding period, and the speed and amplitude of vibration.

It is apparent that at each downstroke the disc is caused to rotate a small distance, so that a very fine adjustment may be made for stopping the disc at any predetermined point in its revolution.

The reversible motor differs from the unidirectional motor in that it has two of the sets of mechanism just described, each adapted to operate on opposite sides of the disc. The circuit for reverse movement (Fig. 2) comprises conductor 23, electromagnet 5, conductor 24, contact spring 17, screw 18, conductor 25, and switch 22.

Having described my invention, what I claim is:

1. A motor comprising a shaft, a disc rigidly mounted thereon, an electromagnetically vibrated arm loosely mounted on said shaft, and a roller disposed between the periphery of said disc and said arm and adapted to be wedged against said disc upon vibration of said arm so as to rotate said disc by imparting rapid and successive impulses thereto.

2. A motor comprising a shaft, a disc rigidly mounted thereon, an electromagnetically vibrated arm loosely mounted on said shaft, a roller disposed between the periphery of said disc and said arm and adapted to be wedged against said disc upon vibration of said arm so as to rotate said disc and means for adjusting the amplitude and/or speed of vibration of said arm.

3. A motor comprising a disc, an electromagnetically vibrated arm, means adapted upon the downstroke of said arm to be wedged between said arm and said disc and rotate the latter, means adapted to disengage said first means from its wedging action upon return of the arm from the stroke, rotating the disc, and means for adjusting the amplitude and/or speed of vibration of said arm.

4. A motor comprising a shaft, a disc rigidly mounted thereon, an electromagnetically vibrated arm loosely mounted on said shaft, means adapted upon the down stroke of said arm to be wedged between said arm and said disc and rotate the latter, means adapted to disengage said first means from its wedging action upon return of the arm from the wedging stroke, and means for adjusting the amplitude and/or speed of vibration of said arm.

5. A motor comprising a shaft, a disc rigidly mounted thereon, an electromagnetically vibrated arm loosely mounted on said shaft, a member disposed between said arm and the periphery of said disc and adapted to be wedged therebetween upon the downstroke of said arm and rotate the disc, means adapted to disengage said first means from its wedging action upon return of the arm from the wedging stroke, and means for adjusting the amplitude and/or speed of vibration of said arm.

6. A motor as described comprising a support, a shaft rotatably mounted in the support, a disc attached to said shaft, an arm loosely supported on said shaft, a wedge member supported between said disc and arm, resilient means for causing the wedge to form a driving connection between the disc and arm in one direction of movement of the arm, means for neutralizing the action of the resilient means during the return movement of the arm to disengage the wedge member, and electro-magnetic means for vibrating said arm.

7. A motor as described comprising a support, a shaft rotatably mounted in the support, a disc attached to said shaft, an arm loosely supported on said shaft, a wedge mem-

ber supported between said disc and arm, resilient means for causing the wedge to form a driving connection between the disc and arm in one direction of movement of the arm, means for neutralizing the action of the resilient means during the return movement of the arm to disengage the wedge member, electro-magnetic means for vibrating said arm in one direction, and means for moving the arm in the other direction.

In testimony whereof, I have signed my name to this specification, this 19th day of April, 1929.

EDGAR M. BUTLER.