March 22, 1949. S. E. CHRISTIANSEN 2,465,198

ELECTROMAGNETIC DRIVING MECHANISM

Filed May 9, 1945

Fig. 1.

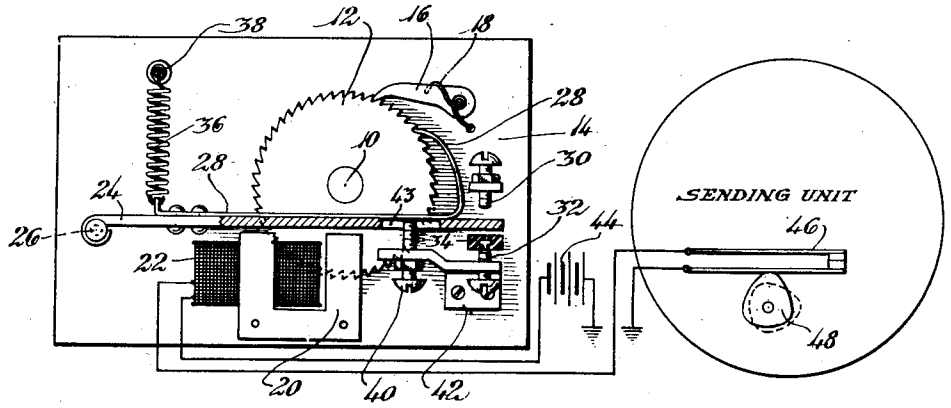


Fig. 2.

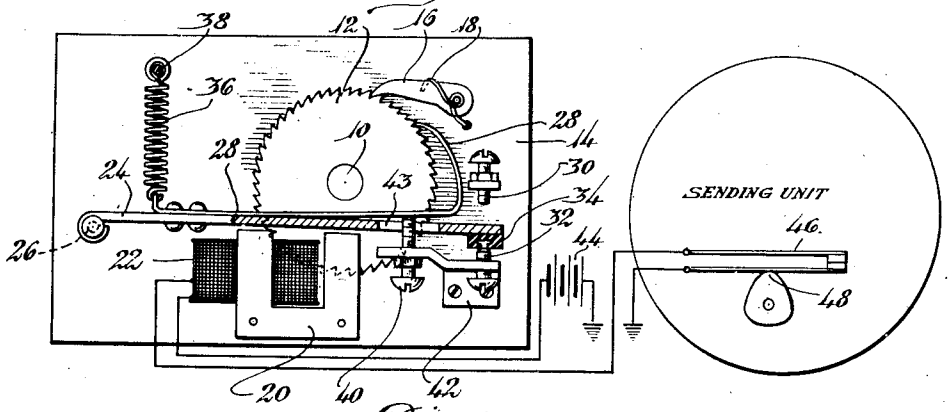
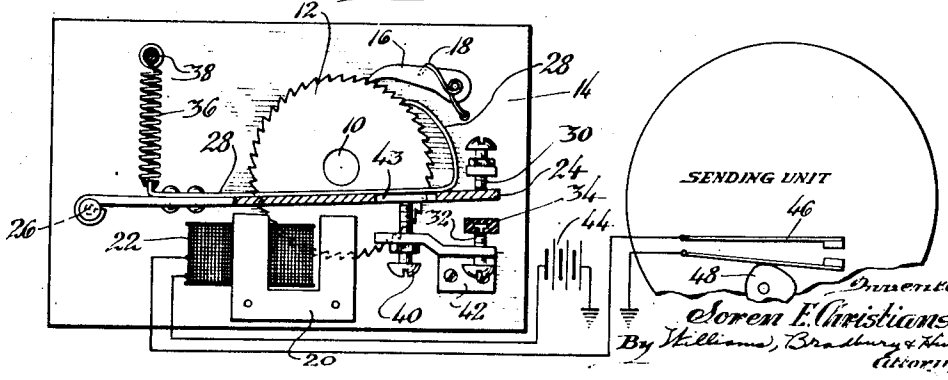


Fig. 3.



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ELECTROMAGNETIC DRIVING MECHANISM

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3 Claims. (Cl. 74—142)

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My invention relates generally to electromagnetic driving mechanisms, and more particularly to means for rotating a part in synchronism with a remotely located apparatus sending electrical pulses to the mechanism.

The invention is herein illustrated as applied to an odometer drive. It has been proposed to drive odometers on vehicles electromagnetically, using a cam on, or driven by, the propeller shaft to close a switch upon each revolution, or a given number of revolutions, of a shaft. This switch completes a circuit through an electromagnet arranged with a pawl to rotate a ratchet wheel. In such mechanisms it has been conventional to have the armature of the electromagnet operate the pawl when the electromagnet is energized and to return the armature by means of a spring. In such arrangements the rapidity of the operating stroke of the armature varied with the voltage of the source of current. In automobiles, the operating voltage may vary considerably, depending upon the condition of the generator, the battery, and the relay mechanism controlling the charging of the battery, as well as upon the load on the electrical system.

The variations in the speed of movement of the armature made it possible, under high voltage conditions, for the pawl to overdrive the ratchet wheel, due to inertia of the moving parts. It also made it necessary that the electromagnet be relatively powerful, since, when energized, it not only had to operate the ratchet wheel, but also to overcome the force of the armature return spring.

In accordance with the principles of my invention, these disadvantages of the prior mechanisms are overcome, and it is therefore the primary object of my invention to provide an improved electromagnetic driving mechanism for converting electrical pulse energy into rotary motion.

A further object is to provide an electromagnetic driving mechanism which utilizes a minimum amount of power, the operation of which is not affected by substantial variation in the voltage of the pulses, and which will be efficient and reliable in operation.

Other objects will appear from the following description, reference being had to the accompanying drawings, in which:

Fig. 1 is an elevational view of the driving mechanism showing the parts in an intermediate position;

Fig. 2 is a similar view, showing the parts in the positions assumed as the armature has completed its stroke toward the electromagnet; and

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Fig. 3 is a similar view showing the parts in their normal positions.

The invention is illustrated as an odometer drive, the odometer not being shown in detail but being driven by a shaft 10 to which a ratchet wheel 12 is secured. The odometer may be of any well known construction. The shaft 10 projects through a mounting plate 14 of the odometer frame. A holding pawl or dog 16 is pivoted on plate 14, the pawl being held against the ratchet wheel by a light spring 18. An electromagnet comprising a U-shaped core 20 having a winding 22 is suitably mounted on the plate 14. A soft iron armature 24 is pivoted on a stud 26 mounted on the plate 14, and has a long leaf spring pawl 28 riveted thereto at a point near the armature pivot. An adjustable stop 30 limits the upward movement of the armature 24, while a similar adjustable stop 32 having a rubber cap 34 limits the downward movement of the armature. A helical coil spring 36 has one end hooked to the end of the leaf spring pawl 28 and has its other end anchored on a stud 38 projecting from the mounting plate 14.

The downward movement of the leaf spring pawl 28 is limited by an adjustable stop 40 carried by a bracket 42 which also serves as a support for the adjustable stop 32. The armature 24 has an opening 43 to permit the pawl 28 to engage the stop 40.

The electromagnet 20, 22 is energized from a suitable source of current, shown as a battery 44, upon closure of a switch 46, this switch being operated in any suitable manner, as by a cam 48 which may be driven from the propeller shaft of the vehicle or may be driven by any other part the number of revolutions of which are to be counted.

When the parts are in normal position, as indicated in Fig. 3, the armature 24 is held in engagement with the stop 30 by the spring 36. The spring 36 is made of sufficient strength to prevent movement of the armature from its rest position due to the vibration which may be encountered, as well as to store up sufficient power to drive the odometer.

When the switch 46 is closed to complete the circuit through the coil 22 of the electromagnet, the armature moves downwardly on the idle stroke through the position shown in Fig. 1, in which the pawl 28 has snapped over one tooth of the ratchet wheel 12. At this intermediate position of the downward movement of the armature the pawl 28 engages its down stop 40 and further move-

ment of the pawl 28 is thus arrested. The armature 24, however, may continue its downward movement until it strikes the rubber bumper 34, as shown in Fig. 2. Any vibratory rebound of the armature from this rubber stop will not have any effect upon the pawl 28, since the latter is held in position by its stop 40.

Upon opening of the switch 46, the armature and parts associated therewith are returned to their normal positions, as shown in Fig. 3, by the spring 36, and during such return movement the pawl 28 advances the ratchet wheel 12 one tooth.

Since the driving force applied to the pawl 28 is derived solely from the spring 36, it will be clear that by selection of a spring of the proper strength, the driving motion of the pawl 28 can be at substantially any desired speed, and will be uniform throughout the useful life of the apparatus, irrespective of changes in the voltage of the source 44.

By virtue of the fact that the armature stroke may be greater than the stroke of the pawl, and that the stroke of the latter is in a sense independent of the armature stroke, it will be apparent that the ratchet wheel may have teeth of very fine pitch and yet be operated reliably through an angle corresponding to the pitch of one tooth without danger of overthrow or failure to operate upon each pulse. The force applied by the spring 18 to the pawl 16 should be relatively light, since this pawl merely prevents reverse movement of the ratchet wheel and does not have to apply any appreciable frictional force for the purpose of retarding overthrow, as might be necessary were the driving pawl 28 positively connected to the armature.

Since the ratchet wheel can be made of very fine tooth pitch, the amount of intermediate speed reducing gearing between the ratchet wheel and the units order odometer dial can be reduced. Such decrease in the number of gears required to obtain this speed reduction lessens the amount of power required to be applied, and this in turn makes it possible to use a less powerful electromagnet. Furthermore, since the stroke of the armature 24 does not determine the length of the stroke of the spring pawl 28, the ratchet wheel may be of fine pitch and the initial air gap may be made small, thereby making it possible to reduce the size of the electromagnet and to decrease the amount of power required for its operation.

While I have shown and described a preferred embodiment of my invention, it will be apparent that numerous variations and modifications thereof may be made without departing from the underlying principles of the invention. I therefore desire, by the following claims, to include within the scope of the invention all such variations and modifications by which substantially the results of my invention may be obtained through the use of substantially the same or equivalent means.

I claim:

1. In an electrical impulse counter, the combination of an electromagnet having a winding for connection to a source of impulses to be counted, a pivoted armature for said electromagnet, stops to limit the stroke of the armature, resilient means to move the armature away from the electromagnet, a leaf spring secured to the armature between the pivot point and the electromagnet, a pawl at the free end of the leaf spring, a ratchet wheel engaged by said pawl, and an adjustable stop limiting the movement of the free end of said leaf spring toward the electromagnet so that the total movement of the free end of said leaf spring will move said pawl only a predetermined distance on the idle stroke.

2. In an electrical impulse counter, the combination of an electromagnet having a movable armature, resilient means to move said armature away from the electromagnet, stops to limit the stroke of the armature, a ratchet wheel, a pawl engaging the ratchet wheel and resiliently secured to the armature so as to be resiliently moved with the armature as the latter is drawn toward the electromagnet and to be positively moved by the armature during a portion of the return stroke of the latter, and a stop independent of the armature limiting the movement of the pawl toward the electromagnet so that the total movement of the pawl will be only a predetermined distance on the idle stroke and less than the total movement of the armature in the same direction.

3. In an electromagnetically operated device, the combination of an electromagnet having a winding for connection to a source of pulses, an armature, resilient means for moving said armature away from the electromagnet, a ratchet wheel, a driving pawl engaging the ratchet wheel, a resilient lost motion connection between the armature and the driving pawl, and means independent of the armature for limiting the stroke of the pawl as the armature moves toward the electromagnet so that the total movement of the pawl will be only a predetermined distance on the idle stroke and less than the total movement of the armature in the same direction.

SOREN E. CHRISTIANSEN.

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