No. 865,384. PATENTED SEPT. 10, 1907.

C. S. HARDY.

TIMER.

APPLICATION FILED JAN. 21, 1907.

Fig. 1.

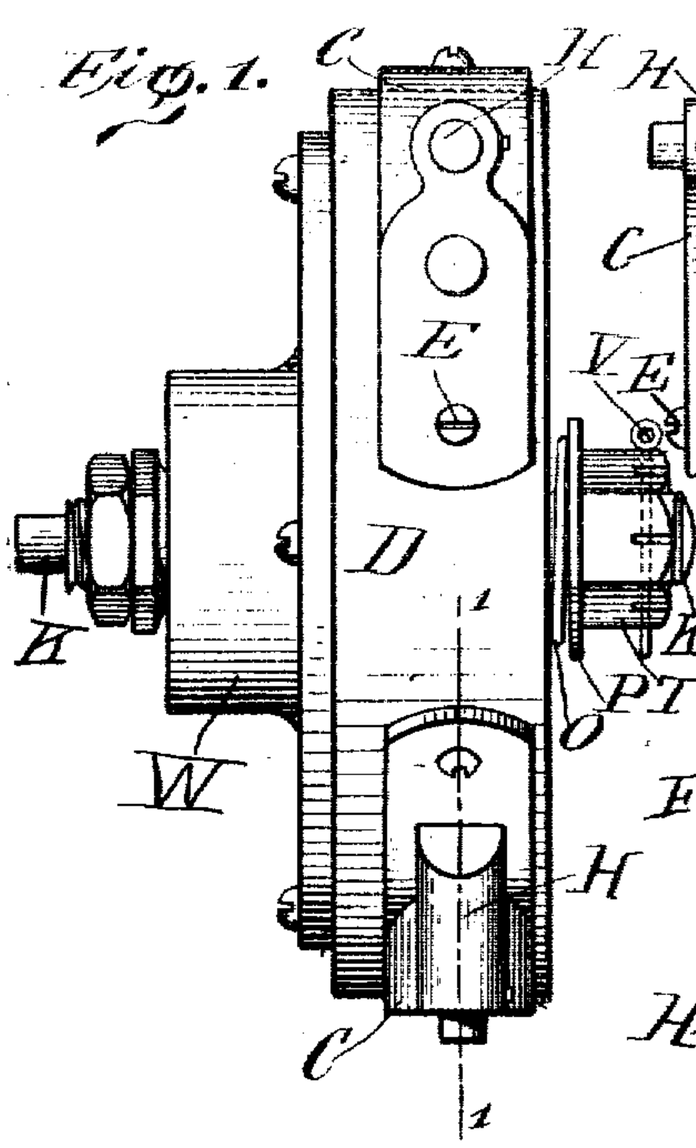


Fig. 2

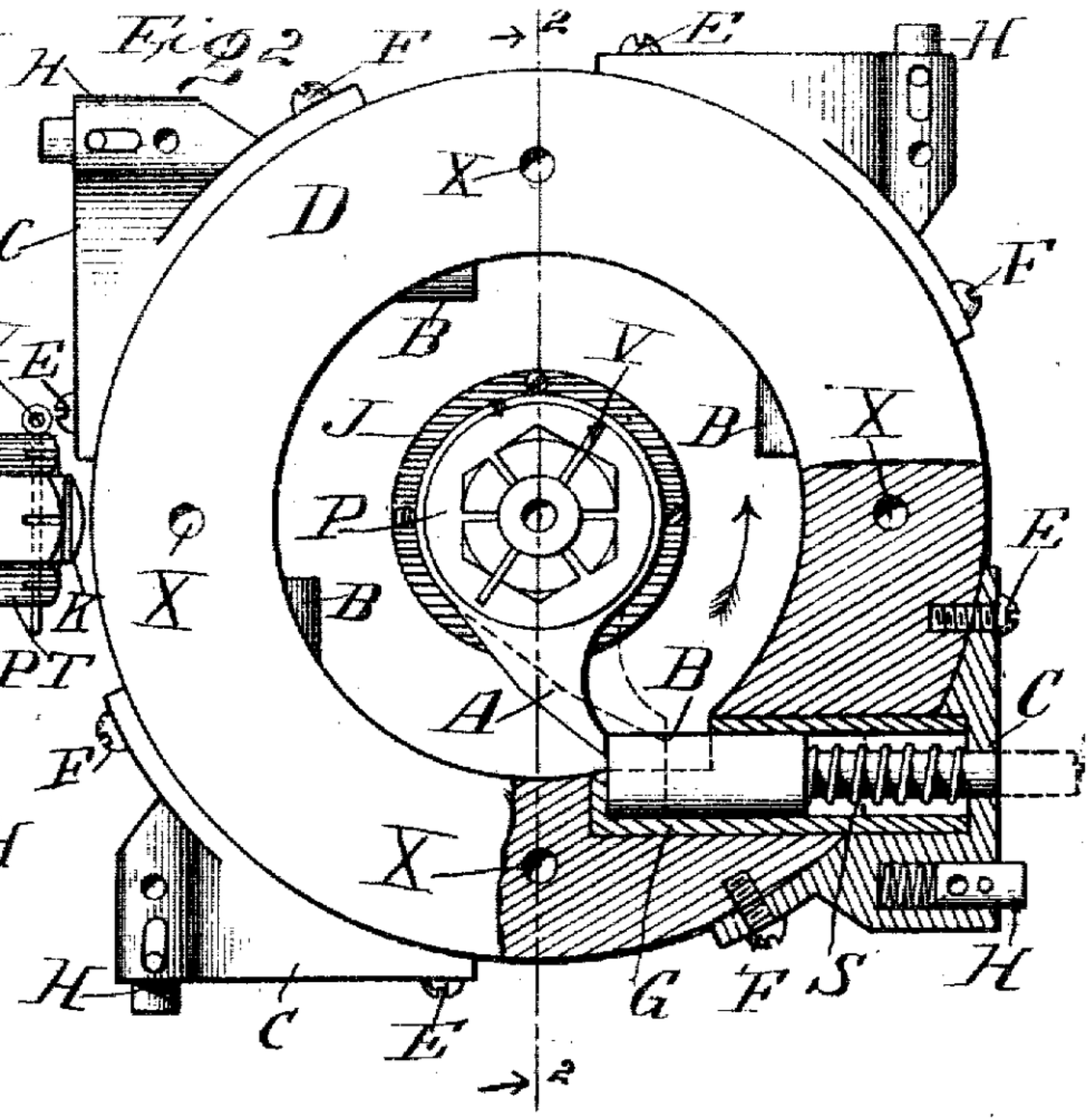


Fig. 3

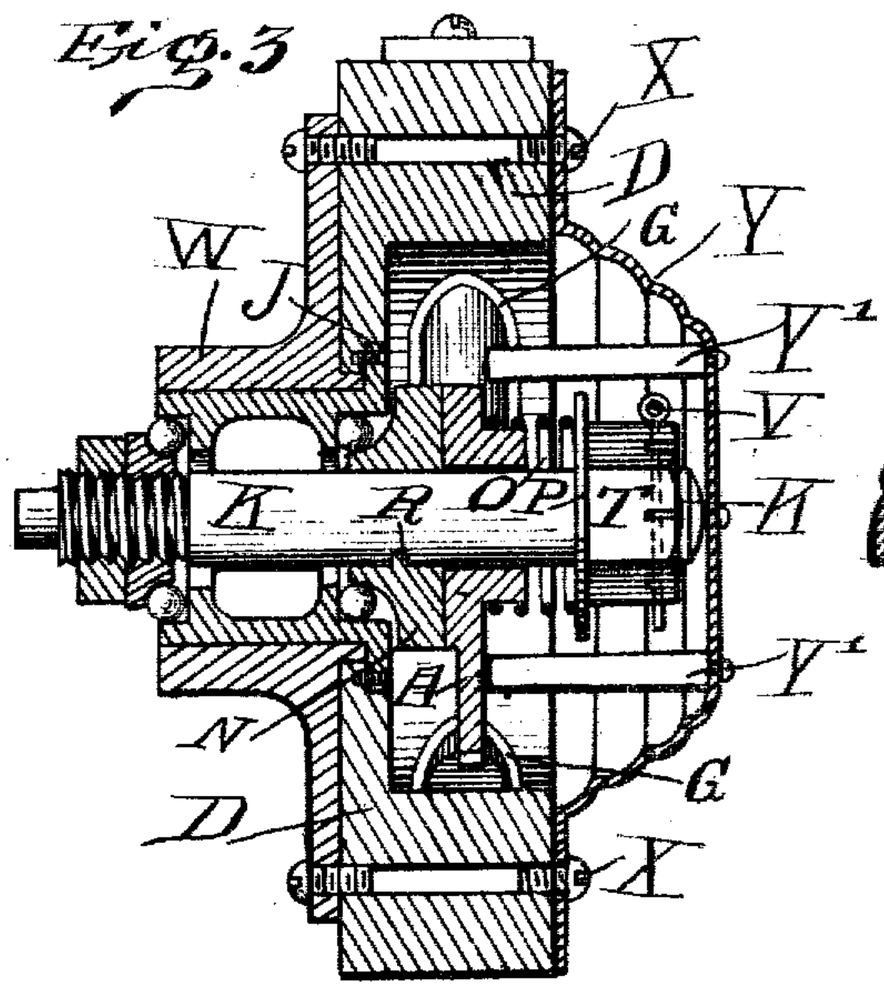
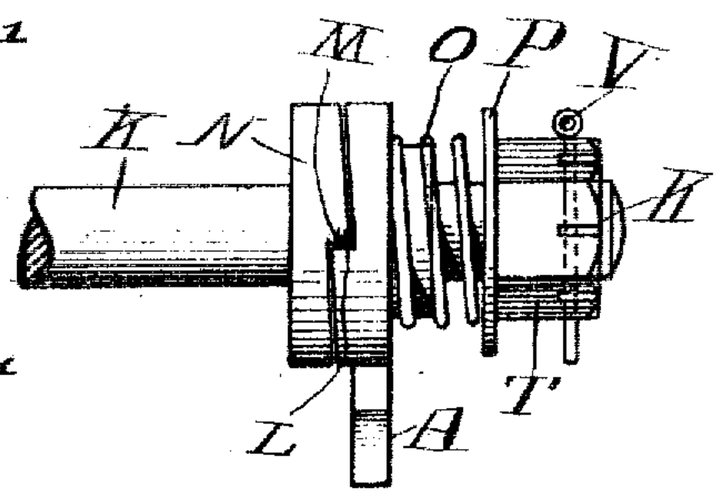


Fig. 4.



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CHARLES S. HARDY, OF SUMMIT, NEW JERSEY.

TIMER.

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Application filed January 21, 1907. Serial No. 353,248.

To all whom it may concern:

Be it known that I, CHARLES S. HARDY, a citizen of the United States of America, and a resident of the city of Summit, State of New Jersey, have invented certain new and useful Improvements in Timers, the principles of which are set forth in the following specification and accompanying drawings, which disclose the form of the invention which I now consider to be the best of the various forms in which those principles may be embodied.

This invention relates to improvements in devices known in the art as timers, and used with the spark-producing apparatus of gas engines, particularly of the type used as automobile motors.

The object of the invention is to produce a reliably-acting and durable timer, one in which the electrical contact is positively made and quickly broken, and without any thrusting-strain tending to injure the structure.

The invention consists in the means, hereinafter disclosed and claimed, for accomplishing this object.

Of the drawings, Figure 1 is a side elevation of the complete device, except that a cover for the right hand side and projecting end of the shaft is removed and not shown; Fig. 2 is a front elevation looking into the interior of the device, the cover being removed, and the lower right hand part of the figure being in section along the line 1—1 of Fig. 1, to show interior parts; Fig. 3 is a section along the line 2—2 of Fig. 2; and Fig. 4 is an elevation of the axial parts shown in section in Fig. 3.

The drawings show four contact-makers, one for each cylinder of a four-cylinder engine. The device will have as many contact-makers as there are engine cylinders.

It is well known that timers have given great trouble, owing not only to the unsatisfactory and unreliable making of contact, but to the thrusting strains which weaken and eventually break down the structure. Efforts to improve the contact-making have increased the thrusting strains, and as the contact-maker moves with considerable velocity, the effects of these strains have been serious. By this invention a satisfactory contact is made, yet without any thrust which can strain the structure. A snap-break action in these devices has been an object of endeavor, but efforts to employ it have resulted in a complication of parts. By this invention the contact is broken with a snap-action, although the contact-maker consists of but one member.

In Fig. 2, the contact maker A, rotated anti-clockwise (see arrow), as by the motor-shaft, is shown in engagement with the movable contact B at the instant when it first makes contact therewith. It then pushes B to the right against a spring S, thus insuring an adequate electrical contact. But A, although moving at high speed, causes no thrusting strain which is not yieldingly met by spring S. This is due to the fact that contact B is made so movable, and is so located, with respect to the direction of motion of A, that substantially all the mechanical energy of A is expended in moving B, and in moving it in substantially the same direction as the direction of motion of A; and substantially none of the energy of A is expended in any thrust which would cause a strain on the structure. The rotating motion of A, however, causes a useful wiping action between A and B which improves the electrical connection, this action being due to the fact that A while in rotation is in engagement with B while B is being forced to move rectilinearly. If desired, the contact B may be so movably mounted as to substantially eliminate the wiping contact action, but the mounting shown is preferred because it permits such action. A and B are made of tool steel, and their rubbing or wiping contact will not cause rapid wearing. The contact B is free to rotate in its bearings when not engaged by A, and the jarring of the structure when in use will cause B to rotate and present to A all parts of the periphery of its operative end so that it will not wear in one place alone.

The part of A which engages with B is flat and at such an angle as to abut squarely against B, thus providing a maximum contact-area. The dotted lines in Fig. 2 show A after its wiping action on B, when it is about to move out of engagement with B. As soon as it so moves, B is snapped back by spring S, and as the edge of A is cut sharply upward to the left, the contact is completely broken by a snap action, notwithstanding that the return movement of B under pressure of spring S is in a direction opposite to that of the movement of A at the time of contact-making impact.

It is not essential that the movement of B be reciprocatory, as the conditions of the invention will be supplied if it be movable so as to be relieved from thrusting strains due to the action of A. It is sufficient if B is movable away from A so that no strain will act on its bearings. In the example shown, the direction of movement of B, although rectilinear, is substantially in line with the direction of movement of A at the time of impact, and this might yet be so if the movement of B were not rectilinear. In addition to the character of its direction of motion, B is so mounted that it receives directly the full impact of A in its direction of movement, and B is so mounted that such thrust does not act obliquely or angularly on the bearings of B so as to impart a strain thereto. Hence B need not itself be movable, provided that the relative arrangement is such, as in the example shown, that while B is directly in the path of movement of A but mounted so as to receive no effective strains on its bearings, yet means are provided for cushioning the impact of contact-making and for permitting A to pass by B after making contact with it. The arrangement shown, consisting in making B movable substantially tangent to the arc of rotation of A, constitutes an ex-

cellent embodiment of the invention. There is not simply relative motion of A or B . . addition to the rotation of A. B is so located with respect to A, that the powerful thrust due to the high speed of A (which thrust continues to exist to a degree even when the parts have such relative freedom of motion, and is an object of the invention in order to secure reliable and certain contact-making), can nevertheless impart no strain to the bearings of B. In not only so locating B, but in permitting it to move under the thrust of A, as shown, not only are the bearings of B freed from all effective strains, but all the supports of B, including that which is substantially in line with the direction of movement of A at the time of impact are freed of all strains, this being accomplished in a simple mechanical manner. But so long as angular strains on the bearings of B are removed by its relative location, such as that shown, the direct strains on the support of B are reduced to a negligible amount by any suitable relative freedom of yielding motion of the parts, which not only permits the continued operatively-unobstructed motion of A, but insures a good contact by primarily taking advantage of the full direct impact of the rapidly-moving contact-maker A in the direction of its movement, owing to the relative location of it. But if alone the relative freedom of yielding motion of the parts be substantially in line with the direction of motion of A at the time of impact, as in the example shown, all angular thrusting strains on the support will be eliminated. The effect is the same as if, simultaneously with the contact-making impact, the motion of A were stopped until its withdrawal from contact with B. In brief, in accordance with this invention, after the contact has been established by the full impact stroke of the contact-maker in its circular direction of movement, all other effects of the impact upon the structure are eliminated, the force which continues to act on the rotating contact-maker serving simply to maintain the contact established by the impact.

An advantage of this invention is that the structure contains no moving parts which require lubrication. The contacts are thus kept clean and in operative condition. The chief defect, however, of the prior devices, is that the contact has been so located with respect of the contact-maker that such thrusting strains existed on its supports as to weaken the structure and make it inaccurately operative and eventually entirely inoperative.

As shown in the lower right hand section of Fig. 2, the spring S has an outer bearing C, which is secured to the support D by means of two screws E and F. The screw E is substantially parallel with the contact B, and screw F is at substantially right angles with it, so that there is no angular strain or any tendency of the screws to loosen under the reciprocatory movement of B. The contact B has the metallic bearing G, which projects into the bearing C, and at its other end has a lateral opening to expose B to the action of A. The bearing G at the same end has an end portion acting as a stop for B, pressed against the stop by spring S. The contact B has a shoulder against which spring S presses, and a projecting part serving to support the spring, and projecting through an opening in the bearing C when moved against the spring S by contact-maker A. Integral with the bearing C is a binding post structure H for the lead to the spark-coil, the contact-maker A being grounded on the vehicle frame through the motor shaft or any other suitable connection to the other side of the spark coil. The binding post structure H is adapted, as shown, to hold the lead securely and in good contact.

The contact-maker A and its coöperative axial members are shown in detail in Figs. 3 and 4. The shaft K is surrounded but does not bear on support J for the bearing, J being secured to the main support D which may be of hard fiber or rubber, or even of metal, if the bearings J, D, etc., be separated from it by insulating bushings. The part A is driven anti-clockwise by the shaft K which in turn may be operated by the motor shaft. The part A is loosely mounted on the shaft K, but is formed with a shoulder L (Fig. 4) which interlocks with a shoulder or stop M on the collar or cam N, the collar being fixed by the key R (Fig. 3) to rotate with the shaft. When the shaft K rotates anti-clockwise, the part A is operated normally and by the interlocking shoulders L and M. A spring O is inserted between the part A and a washer or collar P, and presses the parts A and N together. In case of back-firing of an engine cylinder in cranking, the shaft K will reverse and rotate clockwise, carrying the part A with it, and causing the free end of the latter to engage with another reciprocating contact B. If A could now contact with and pass by all the respective contacts B, the back-firing would continue, manifestly disadvantageously, but as permitted by prior devices. But here this is prevented by the existence of contact B directly in the path of A, but notwithstanding this, shaft K can continue the clockwise movement of its cranking oscillations as far around as it may, without injuring the parts, because the surface of the collar N adjoining the part A is inclined so as to form a cam-surface which, as the collar N continues to move with the shaft clockwise, gradually raises A against the spring O, so that eventually, whichever way shaft K turns and with whichever contact B the contact-maker A engages, the shoulders or stops L and M will reëngage to permit the normal anti-clockwise rotation of A by an anti-clockwise rotation of shaft K. The washer or collar P may be held in place by the nut T, held to shaft K by screw threads and by the key V. The shaft K is preferably mounted on ball bearings, as is shown. A cover Y (Fig. 3) having a configuration similar to that of W may be placed on the other side of the support, and secured thereto by screws engaging in the holes X. The cover Y may have secured to its left hand surface as many stops Y′ as there are contacts B, each stop projecting to the left nearly as far as the right hand surface of the part A when that part is in normal close engagement to the left with the collar N. These stops Y′ do not interfere with the free anti-clockwise movement of A in the absence of lost motion, because they will not be engaged by the contact-maker unless the latter is moved away from collar N, and in that case there is lost motion. But as each stop is located in the direction of motion of the contact-maker arm, it will be engaged thereby to close up any lost motion between shoulders L and M, thus anticipating similar action by the contact B, and insuring a contact at B at the proper

time for firing the corresponding cylinder. These stops may be supported in any other suitable manner as from the support D, in that case provided with a suitable engaging off-set. In order to secure prompt and accurate action, the spring O may be made as strong as desired, and the cam-incline may be as short as desired, so short, in fact, as to amount substantially to a tooth and socket connection between A and N, one side of the socket being square and the other abruptly inclined.

I claim:

1. In a timer, the combination with a contact; of a member, normally operatively rotatable in a single continuous direction, on which member said contact is supported; a second contact; means for supporting the second contact directly in the path of movement of the first contact, whereby the two contacts engage directly with each other; and means for permitting a yielding movement of one contact with respect to the other, in a direction substantially in line with the path of movement of the contact which is supported on the rotatable member, at the time of contact-making impact.

2. In a timer, the combination with a rotatable contact maker, of a contact having its bearings substantially in line with the direction of motion of the contact maker at the time of contact-making impact; and means for permitting a yielding movement of at least one of the parts in a direction substantially in line with the direction of movement of the contact-maker at the instant of contact-making impact.

3. In a timer, the combination with a rotatable contact maker, of a coöperating reciprocable contact mounted to lie in the path of movement of the contact-maker at the time of impact; and means for causing a yielding movement of at least one of the parts in a direction substantially in line with the path of movement of the contact-maker at the time of impact.

4. In a timer, the combination with a rotatable contact maker, of a contact having its bearings substantially in line with the direction of motion of the contact-maker at the time of contact-making impact; and means for permitting the contact-maker to be disengaged from contact.

5. In a timer, the combination with a rotatable contact-maker, of a coöperating reciprocable contact mounted to be movable in a direction substantially in line with the direction of movement of the contact-maker at the instant of contact-making impact.

6. In a timer, the combination with a rotatable contact-maker, of a contact having its bearings substantially in line with the direction of motion of the contact-maker at the time of contact-making impact, said contact being movable in its bearings away from the contact-maker; and means for restoring the contact to its normal operative position in the path of movement of the contact maker.

7. In a timer, the combination with a rotatable contact-maker, of a contact having its bearings substantially in line with the direction of motion of the contact maker at the time of contact-making impact, said contact being movable in its bearings away from the contact maker, and free to rotate in its bearings; and means for restoring the contact to its normal operative position in the path of movement of the contact-maker.

8. In a timer, the combination with a rotatable contact-maker; of a coöperating reciprocable contact; a support therefor; and a metallic bearing for said contact in the support, the bearing being substantially in line with the direction of movement of the contact-maker at the time of impact, and having an opening to expose the contact to the action of the contact-maker.

9. In a timer, the combination with a rotatable contact-maker; of a coöperating reciprocable contact; a support therefor; and a metallic bearing in the support, for the lateral surface of said contact, said bearing having a lateral opening to expose a part of the end of the contact to the action of the contact-maker, and said bearing being substantially in line with the direction of movement of the contact-maker at the time of impact of the contacts.

10. In a timer, the combination with a rotatable contact-maker; of a coöperating reciprocable contact; a support therefor; a metallic bearing for said contact in the support, the bearing being substantially in line with the direction of movement of the contact-maker at the time of impact, and having an opening to expose the contact to the action of the contact-maker; and a spring bearing on the contact to hold it normally in the path of movement of the contact maker.

11. In a timer, the combination with a rotatable contact-maker; of a coöperating reciprocable contact; a support therefor; a metallic bearing for said contact in the support, the bearing being substantially in line with the direction of movement of the contact-maker at the time of impact, and having an opening to expose the contact to the action of the contact-maker; a spring bearing on the contact to hold it normally in the path of movement of the contact-maker; and a bearing for the spring, secured to the support.

12. In a timer, the combination with a contact; of a member which normally and operatively is continuously rotatable in a single direction, on which member said contact is supported; a second contact; means for supporting the second contact normally directly in the normal path of continuous rotation of the first contact, whereby the two contacts engage each other face to face and with the impact of full speed of continuous rotation; at least one of said contacts being movable, by the impact of contact making with the other, out of the normal path of continuous rotation of the first contact, to permit the unobstructed continuous advancing rotation of the first contact and to prevent thrusting strains on the supports; and means for restoring said contact so movable, as soon as the two contacts are separated due to the continuous rotation of the first contact, to its normal operative contact-making position directly in the normal path of the rotation of the contact which is supported on the rotatable member.

13. In a timer, the combination with a contact-maker which normally and operatively is continuously rotatable in a single direction; of a coöperating contact mounted to normally lie directly in the normal path of rotation of the contact-maker, whereby the two contacts engage against each other face to face and with the impact of full speed of continuous rotation; means for permitting the contact-maker in its normal direction of rotation to pass by the contact immediately after having established contact therewith; means for rotating the contact maker; and means for permitting the unlimited movement of said rotating means but not of the contact maker, in the direction opposite to that of the normal rotation of the contact maker.

14. In a timer, the combination with a rotatable contact-maker, of a shaft on which the contact-maker is loosely mounted; a coöperating contact mounted in the path of the contact-maker; a collar rigid with the contact-maker shaft, the contact-maker and collar being provided with interlocking mechanism to cause the rotation of the contact-maker in its normal direction; means for permitting the contact-maker in its normal direction of rotation to pass by the coöperating contact after having established contact therewith; and said collar and contact-maker being provided with unlocking mechanism, to permit the contact-maker to be held by the coöperating contact from rotation in the reverse direction, by permitting the contact-maker shaft to freely rotate in the direction opposite to its normal direction.

15. In a timer, the combination with a rotatable contact-maker, of a shaft on which the contact-maker is loosely mounted; a coöperating contact mounted in the path of the contact-maker; a stop-cam collar on the contact maker shaft; a coöperating stop on the contact-maker, a spring to hold the collar and contact-maker in cooperative relation; and means for permitting the contact maker in its normal direction of rotation to pass by the coöperating contact after having established contact therewith.

16. In a timer, the combination with a contact-maker which normally and operatively is continuously rotatable in a single direction; of a contact mounted to normally lie directly in the path of the rotation of the contact-maker,

whereby the two contacts engage against each other face to face and with the impact of full speed of contact rotation; means for supporting both members in cooperative relation; means for preventing angular thrusting strains on the supporting means; means for permitting the contact-maker in its normal and operative direction of rotation, to pass by the contact after having established contact therewith; means for rotating the contact-maker; and means for permitting unlimited movement of said rotating means but not of the contact-maker, in the direction opposite to that of the normal rotation of the contact-maker.

17. In a timer, the combination with a rotatable contact-maker, of a contact having its bearings substantially in line with the direction of motion of the contact maker at the time of contact-making impact; means for permitting a yielding movement of at least one of the parts in a direction substantially in line with the normal path of movement of the contact-maker at the instant of contact-making impact, when the contact-maker has its normal direction of movement; and means for preventing the contact-maker, in its opposite direction of movement, from passing by the contact.

18. In a timer, the combination with a rotatable contact-maker; of a cooperating contact mounted to lie in the path of movement of the contact-maker; means for causing a yielding movement of at least one of the parts in a direction substantially in line with the normal path of movement of the contact-maker at the time of impact, when the contact-maker has its normal direction of movement; and means for preventing the contact-maker, in its opposite direction of movement, from passing by the contact.

19. In a timer, the combination with a rotatable contact-maker, of a contact having its bearings substantially in line with the direction of movement of the contact-maker at the time of contact-making impact; means for permitting a yielding movement of at least one of the parts in a direction substantially in line with the path of movement of the contact-maker at the time of contact-making impact, when the contact-maker has its normal direction of movement; and means for preventing the disengagement of the contact-maker from contact, in its opposite direction of movement.

20. In a timer, the combination with a contact-maker which normally and operatively is continuously rotatable in a single direction; of a cooperating contact mounted to normally lie directly in the path of rotation of the contact-maker; means for rotating the contact-maker; means for permitting the contact-maker in one direction of rotation to pass by the contact after having established contact therewith; means for permitting the rotating means to operate unlimitedly in the opposite direction without moving the contact-maker past the cooperating contact; and means for taking up lost motion between the contact maker and its rotating means.

21. In a timer, the combination with the rotatable contact-maker; of a cooperating contact reciprocable in substantially the direction of movement of the contact-maker at the time of impact; a support for the contacts; a spring pressing the contact toward the contact-maker; a bearing for the spring; and screws for said bearing, secured in the support, one substantially parallel and the other at substantially right angles with the reciprocable contact.

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