

July 19, 1938.

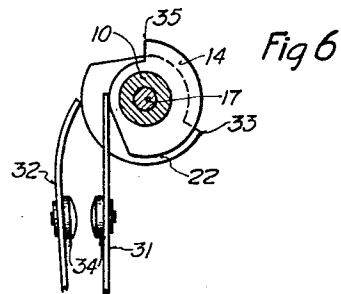
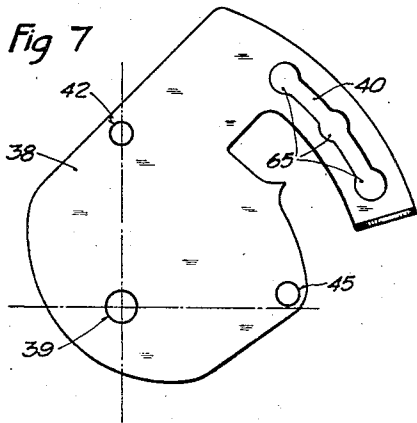
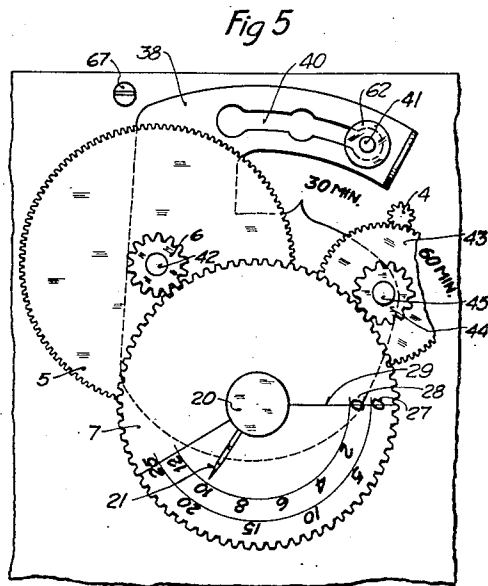
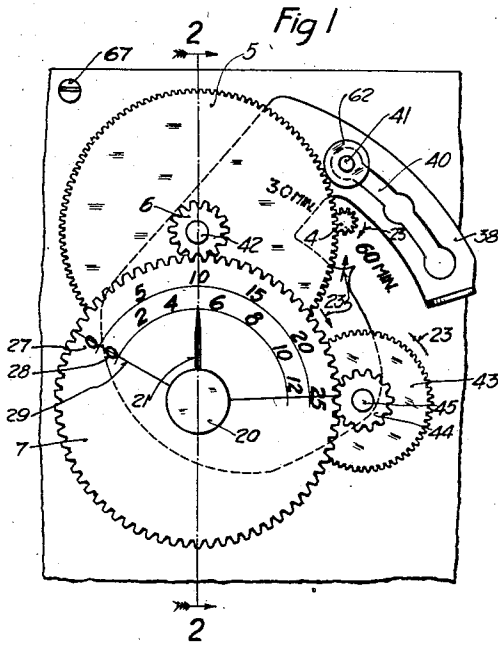
E. F. SWENSEN

2,124,045

TIMING INSTRUMENT

Filed Nov. 21, 1935

2 Sheets-Sheet 1



Inventor
Emil F. Swensen

July 19, 1938.

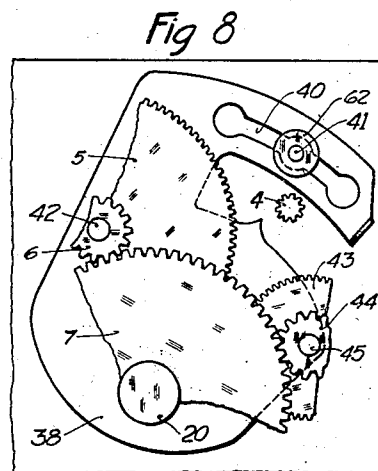
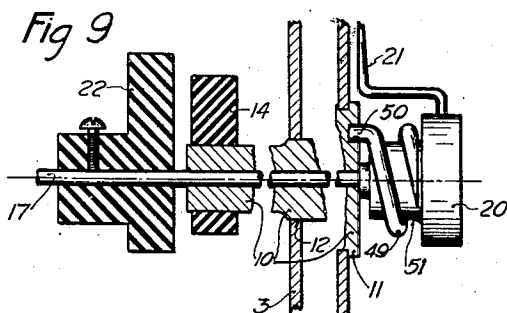
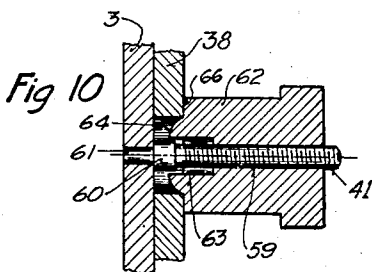
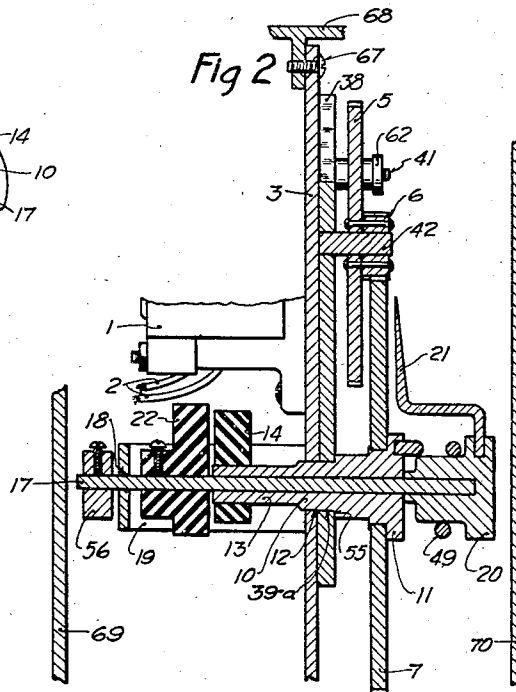
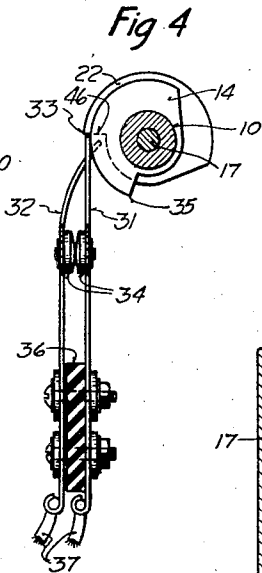
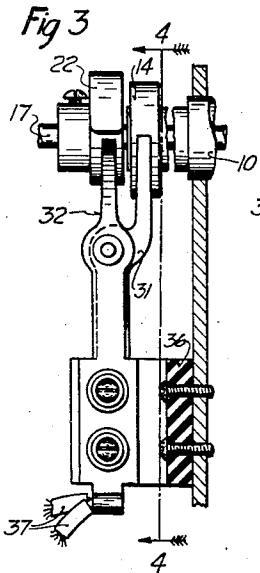
E. F. SWENSEN

2,124,045

TIMING INSTRUMENT

Filed Nov. 21, 1935

2 Sheets-Sheet 2



Inventor

Emil F. Swensen

UNITED STATES PATENT OFFICE

2,124,045

TIMING INSTRUMENT

Emil F. Swensen, Manitowoc, Wis., assignor to
Paragon Electric Company, Chicago, Ill.

Application November 21, 1935, Serial No. 50,931

4 Claims. (Cl. 200—38)

The invention refers chiefly to timing instruments, electrically operated, and particularly to that class of same which provides a definite interval between operations, with ability to vary the duration of operation.

That class of instrument, if used in connection with a stoker, for instance, may be used to operate said stoker, say, once in every hour, for a period of, say, 10-minutes of that hour. Also, that class of instrument permits of such duration being re-set to operate for, say, 20 minutes, instead of for the aforesaid 10 minutes. Also, that class of instrument permits of the cycle speed being reduced from the one-hour aforesaid to, say, 30 minutes.

The present invention provides a simplified construction, which construction accomplishes the above named objects more easily, and, accomplishes others in addition. It has many uses besides the use upon a stoker hereinabove instanced.

In particular, in order to afford the choice aforesaid between two different cycle speeds, the present construction provides two alternative speeds for the dial itself. In view of this feature, the invention as a whole may be called a "two-speed-dial timer".

Another important feature of the construction is as follows: The two cams which cause the "make" and "break" of circuit are mounted coaxially with the dial itself; and, further, one of said cams is directly revolvable by a hand-set knob, which knob also is co-axial with the dial, and which carries a pointer, pointing to numerals on the dial. By means of that knob, the cams can be set with their respective drop-off points at the correct angular distance apart, such distance dictating the duration of switch operation. That feature of the invention may be referred to as a "knob and pointer setting for the cams".

Because of said choice of speeds for the dial, and because of said co-axial relation between the dial and the cams, it becomes unnecessary to employ a two-lobe cam, interchangeable with a one-lobe cam, as has been necessary in earlier constructions. Accordingly, there is in the present invention an entire absence of any need for changing cams, and an entire absence of any two-lobe cam.

In order to provide the said choice of speeds for the dial, a special gear-shift mechanism is employed. One feature of said mechanism is the fact that two alternative sets of intermediate gears are both meshed directly into the rim of the dial itself. Another feature is the fact that the

whole of the change-gears are carried on a specially designed rocking arm or lever, and that thereby no removal or interchanging of gears is necessary.

In the timing instruments hitherto known, it has been necessary to set dial trippers to time the make and break of circuit. In the present invention, however, all re-setting is done without the removal of any parts; and, further, no dial trippers are needed, and there is an entire absence of same.

The construction calls for a non-reversible pointer, because, with the "knob and pointer setting" aforesaid of the cams, there would otherwise be danger of revolving the pointer and its cam in the wrong direction, which would buckle the switch-blade of that cam. Special non-reversing means for the pointer are therefore provided.

The arrangement aforesaid, whereby the cams are co-axial with the dial and pointer, lends itself to the isolation of those parts which are dangerous to the operator. With such isolation in view, the invention departs from the usual custom of providing a pair of "clock-plates", with all the mechanism located between them, and provides instead a solitary "clock-plate", which carries practically all the parts of the instrument, some on its front and some on its back, those which must be seen, or must be touched for purposes of adjustment, being carried on its front, while those which are dangerous are carried on its rear, out of reach of human fingers during regular setting and operation of the instrument.

These and other objects are carried out by the construction, as will appear from the fuller description hereinafter.

In the drawings:

Dealing first with some of the figures by groups:

Figs. 1, 2, 3, and 4 show the instrument with the gear-shift set at its 60-minute-interval position; whereas Figs. 5 and 6 show the gear-shift swung over to the left, to the 30-minute-interval position.

Also, Figs. 1, 2, 3, and 4 show the duration-set knob at its 10-minute-duration position, reading the outer arc of numerals on the dial; whereas Fig. 5 shows that knob set also at its 10-minute-duration, but reading the inner arc of numerals.

Also, in Figs. 1, 2, 3, and 4 the circuit is closed, whereas in Figs. 5 and 6 it is open.

Dealing next with the figures individually:

Fig. 1 is a front elevation, partly broken away, and with front of box removed.

Fig. 2 is a side elevation, a section on line 2—2, Fig. 1, partly broken away.

Fig. 3 is a side elevation, broken away, of the cams and contactor blades and associated parts, to be read with Fig. 1, and not with Fig. 5.

Fig. 4 is a front elevation on line 4—4, Fig. 3, showing the cams and contactor blades, the central plate and other parts which come in front of the cams having been removed.

Fig. 5 is a front elevation of the instrument, partly broken away, the gear-shift being swung to the left as explained hereinabove.

Fig. 6 is a front elevation of the cams and contactor blades, corresponding with Fig. 4, the difference being that it is to be read with Fig. 5, not Fig. 1. It is a broken away view. The central plate and other parts which come in front of the cams are removed.

Fig. 7 shows the gear-shift rocker alone, a front elevation, detailed from Fig. 1.

Fig. 8 is a front elevation, broken away, showing the gear-shift mechanism swung to its midway, or "free-wheeling" position.

Fig. 9 is a detail, showing the duration-set knob and its lock to prevent it from reversing; and showing also, more clearly than in Fig. 2, the means by which the "lead" cam is made adjustable relative to the "follow" cam. It is a side elevation, partly in section, broken away, the gear-shift rocker being omitted.

Fig. 10 is a detail showing the lock-knob of the gear-shift mechanism. It is an elevation, partly in section.

Referring to the drawings:

Dealing first with Figs. 1, 2, 3, and 4:

In these figures the instrument is set at its 60-minute interval or cycle.

The motor 1 has current supplied to it by the wires 2, and is attached to the rear of the central plate or "clock-plate" 3, and drives, directly, the motor pinion 4 at the front of said plate, which pinion drives the left intermediate gear-wheel 5, rigid with and concentric with the left intermediate pinion 6, which pinion in turn drives the gear-wheel 7, with which it is perpetually in mesh. Said gear-wheel 7 is, at the same time, the dial of the instrument, and is hereinafter referred to indifferently as the dial or the gear-wheel.

The train of wheels thus recited effects two reductions of speed, namely, first, from said motor pinion 4 to said gear-wheel 5, and, second, from said pinion 6 to the dial. The whole train effects a reduction, from the motor speed, down to a speed of one revolution of the dial in 60 minutes.

Said gear 5 and pinion 6 together form what may be called the left intermediate unit.

Said dial 7 is mounted rigidly upon the bushing 10, seen best in Fig. 2, which bushing, having its head 11 at the front of said central plate 3, has its bearing 12 in said plate 3, and has its stem 13 extending backward from that plate and carrying the "follow" cam 14, rigidly mounted thereon.

That mounting is seen in Fig. 2, and still more clearly in Fig. 9.

That is to say, said dial and said follow cam are rigidly connected with each other through the medium of said bushing, whereby one revolution of said dial means one revolution of said cam.

Said follow cam 14 is called hereinafter, indifferently, also the front cam because of its

location, or the break-circuit cam, because of its function.

Extending through said bushing 10 is the arbor 17. Said bushing forms a front bearing for said arbor, and the rear end of same is carried in the bearing 18 in the bracket 19.

Rigid with said arbor 17 at its front end is the duration-set knob 20, carrying the pointer 21, which points to numerals upon said dial 7.

Said arbor 17 carries, mounted rigidly thereon, near its rear end, the lead cam 22, called also hereinafter the rear cam because of its location, or the "make-circuit" cam because of its function.

That is to say, said pointer and said lead cam are rigidly connected with each other through the medium of said knob and said arbor, whereby, when said knob is revolved by the operator, said pointer and said lead cam are both also revolved.

Setting the cams

Correct assembling of the cam parts is effected as follows:

First, the pointer is placed pointing to zero on the dial. Then, the two cams are placed with their drop-off points in one and the same radial plane with each other.

For many purposes it does not matter whether that radial plane is the same one in which lie the zero and the pointer. In other words, so long as the zero and the pointer are together and the two cams are together, that is all that is needed, however far apart the cams may be from the pointer and the zero, in respect of their radial planes. For the sake of definiteness, however, throughout the present drawings the zero and the pointer are set just 90 degrees ahead of their respective cams, the word "ahead" here meaning ahead in clockwise direction.

Referring back to Fig. 1: The four direction arrows 23 on that figure indicate that said motor pinion 4 runs in clockwise direction, causing all of said intermediates to run counter-clockwise, and thereby finally causing said dial 7 to run clockwise, whereby said cams, Fig. 4, are caused to run clockwise.

On said dial 7 the outer arc 27 of numerals gives readings for the 60-minute-interval setting of the instrument, which is the setting now being described, while the inner arc 28 gives readings for the 30-minute-interval setting. Both said arcs of numerals begin from zero, the zeros being located on the radial zero graduation line 29.

Figs. 1 to 4 assume it to be desired to set the instrument for a 60-minute-cycle with a duration of 10 minutes out of said 60 minutes.

Accordingly said duration-set knob 20 is shown as having been revolved in clockwise direction until said pointer has a lead of 60 degrees ahead of said zero graduation 29; and, in agreement therewith, said lead cam 22, Fig. 4, is shown as standing 60 degrees ahead of said follow cam 14. As shown particularly in Fig. 4, the inner or right-hand contactor blade 31 is still supported by the high part of its cam, namely, said "follow" cam 14, whereas the outer or left-hand contactor blade 32 has just dropped off from the high point 33 of its cam, namely, said "lead" cam 22, with the result that the two contact buttons 34 have just come into contact with each other, closing the circuit, whereby the 60-minute cycle has just begun.

From Fig. 4 it will be evident that, as the cams continue in their clockwise revolution, when they

have revolved a further 60 degrees said inner blade 31 will drop off from the high point 35 of said follow cam 14, which will cause the circuit to be broken, thereby ending the closed, or "duration" period. Fig. 6 shows approximately how said contactor blades appear relative to each other during any part of the open-circuit portion of the cycle.

Said contactor blades 31 and 32, being live elements, are supported by the angle-bracket 36 of insulating material, seen best in Figs. 3 and 4, which bracket in turn is fastened to said central plate 3. At the lower ends of said blades the conductor wires 37 are attached, leading either to a relay, if one is employed, or direct to a circuit to be controlled.

Gear-shift mechanism

The gear-shift rocker 38, Fig. 7, has through it the hole 39 which serves as a bearing, by means of which it is pivoted upon said bushing 10 at the point 39a, Fig. 2. Upon that bearing it is free to rock from left to right within the limits of the curved slot 40, through which slot extends the lock stud 41, shown in Figs. 1, 2 and 10.

The gear 5 and the pinion 6 aforesaid, which together form the left intermediate unit as hereinabove explained, are pivoted upon the left gear-stud 42, shown in Figs. 1, 2, 7 and 8, which stud is fastened into and therefore moves with, said gear-shift rocker 38. By this means said left intermediate unit is caused to share all movements of said rocker 38.

In similar manner the gear wheel 43 and the pinion 44 are rigid with each other, and together form the right intermediate unit. Also, in similar manner, said right intermediate unit is pivoted upon the right gear-stud 45, which is fastened into said rocker 38, said right intermediate thus sharing all the movements of said rocker 38.

In Fig. 1 said rocker 38 is at its right-hand position, said lock stud 41 being therefore at the left-hand end of said curved slot 40. Placing the rocker there has caused said intermediate gear 5 to mesh with said motor pinion 4, causing, as hereinbefore explained, said dial 7 to turn at the rate of one revolution per hour.

Turning now to Fig. 5: In that figure the said rocker 38 has been swung to its left-hand position, causing said left intermediate gear 5 to be withdrawn out of mesh from said motor pinion 4, while said gear wheel 43 has come into mesh with same.

Because said gear 43 has just half as many teeth as said gear 5, the result of the shifting of gears just described is to speed up said dial 7 to twice its earlier speed, that is, to one revolution every half-hour. Thus the cycle of the instrument has been changed from 60 minutes to 30 minutes.

Free-revolving position

Fig. 8 shows said rocker at its midway position, at which position said stud 41 is midway of the length of said curved slot 40. Said motor pinion 4 is now not in mesh with either of the two sets of intermediates. Therefore, said dial can be revolved freely by the fingers of the operator, the two sets of intermediates aforesaid meantime revolving also, because they are both perpetually in mesh with the dial. Such revolving of the dial independent of the motor enables the dial to be set at any desired initial

position. The ability to do this adds to the adaptability and value of the instrument in many of its uses.

The setting of the cams for the shorter cycle, Figs. 5 and 6

Referring back to Figs. 5 and 6 in which the instrument is set for its half-hour cycle:

Said follow cam 14 is, in Fig. 6, shown with its said high point 33 standing vertically above its axis, which position may be described as due north of said axis. Therefore, because, as hereinbefore stated, for purposes of the present drawings, the zero point on the dial is always to be found 90 degrees ahead of said follow cam, it follows that said zero graduation 29 ought now to be found due east of said axis; and such, in fact, is its position in Fig. 5.

Next, it being now desired, as hereinabove stated, that the duration shall still be 10 minutes, even though the cycle has been shortened to 30 minutes, it follows that said lead cam 22 must be $\frac{1}{3}$ of a revolution, that is, 120 degrees, ahead of said follow cam 14, and not $\frac{1}{2}$ of a revolution only as in Fig. 1. Therefore, said pointer 21 ought to stand, in Fig. 5, 120 degrees clockwise ahead of the zero. Said knob 20 accordingly is shown as having been moved further ahead, relative to the dial, whereby said pointer now points to the numeral 10, read, not on the outer arc, but on the inner arc of numerals.

And, further, the setting forward of said knob ought necessarily to have set forward also high point 35 of said lead cam 22, to a position 120 degrees ahead of the follow cam; and such, in fact, is its position in said Fig. 5.

That is to say, in Figs. 5 and 6 the instrument is set at a cycle of 30 minutes, with a duration of 10 minutes out of said 30.

Non-reversing pointer

From Fig. 4 it is evident that if the operator were to revolve said lead cam 22 in the wrong direction its said contactor blade 32 would catch against the drop-off face 46 of said cam, and would thereby be buckled. A non-reversing mechanism for said knob is therefore provided as follows:

The spiral spring 49, Figs. 2 and 9, is anchored at its end 50 into said bushing 10, and is wound as a left-hand spiral around the boss 51 of said set-knob 20, gripping the same with a light frictional grip.

Said friction and said anchorage, in cooperation, cause said knob, normally, to share all movements of the dial, whereby said dial, revolving, causes to revolve with it said knob and all parts rigid with said knob, namely, said pointer, said arbor 17, and said lead cam 22.

Said friction as between the spring and the boss is normally sufficient to prevent the pointer from running forward under the influence of its own weight and/or under the influence of any forward impulse which said "lead" cam 22 may receive from said outer contactor blade 32, while the latter drops off from said high point 33 of said cam.

When, however, the operator wishes to set the pointer further forward in clockwise direction relative to the dial, said boss is able to slip around inside said spring, because, when going in that direction, its frictional action upon the inside of said spring, easing backward toward said anchorage, tends to open said spring and thereby to increase the internal diameter of the space which

such spring encloses, thereby easing its grip upon the boss.

On the other hand, if the operator attempts to turn the knob counter-clockwise, said spring grips said boss more tightly, preventing movement in that direction, because the frictional effect of the boss upon the inside surface of the spring, pulling away from said anchorage, tends to coil the spring more tightly, thereby decreasing its internal diameter and consequently increasing the friction.

With said non-reversible motion, it is obvious that, should the operator desire to alter his pointer to indicate some less figure, say, 10 minutes instead of 20 minutes, he must move his pointer, not backward, but somewhat less than a complete circle forward.

A "carried" pointer

The pointer herein shown might be described as a "carried" or "jockey" pointer, seeing that it is carried by, and therefore revolves with, the dial. Or, it might be called a "spacing" pointer, or a "duration" pointer, seeing that it is used to indicate a space or distance upon the dial, or a duration of time, and that, when it has been given a spacing or setting relative to the dial, it remains constantly at same. In all these characteristics it is widely different from a pointer as usually meant, namely, one that revolves constantly relative to its dial.

Assembly of bushing and associated parts

Referring back to the bushing 10:

The shoulder 55, formed on said bushing, holds said rocker in comfortable sliding engagement against said central plate 3, said bushing in turn being held from displacement toward the front of the instrument by said set-knob 20 pressing against it, said knob in turn being held from escape forward by said arbor 17 rigid therewith, which arbor in turn is held by the collar 56 at the rear of said bracket 19. Thus all the parts which are co-axial with said arbor 17 are prevented from forward displacement by said collar 56.

The lock-knob

Details of said lock-stud 41 and of the parts which cooperate with same are as follows:

Said stud 41, as detailed in Fig. 10, comprises the threaded portion 59, the thicker portion 60, and the shouldered-down portion 61 riveted into said central plate 3. Upon said threaded portion 59 the lock knob 62 is threaded, said knob being counter-bored as shown at 63 to clear said thicker portion 60. At its lower end said lock knob 62 has the approximately hemispherical guide nipple 64, which guides it into any one of the three enlargements 65, Fig. 7, in said slot 40, enabling it to be screwed down upon its seat 66 against the front of said rocker. This detail provides a handy means of locking the whole gear-shift mechanism at any one of its three positions described hereinbefore.

General arrangement

Referring chiefly to Fig. 2:

Said plate 3 is removably attached by the screw 67 to the case 68, shown broken away. The numeral 69 indicates the rear of said case, while 70 indicates the front of same, said plate 3 standing medially between them and carrying upon itself the removable parts of the instrument, chiefly the following: on its front, the dial, pointer, and set-knob, as also the whole of the

gears; and on its back the contactor blades, out of danger of accidental touch by the operator's screw-driver or fingers, as also the cams and motor.

Said use of said final gear 7 in the double function of gear and dial is made possible by the fact that the gears are placed in front of said plate 3, and thus are in, or close to, the plane in which it is desirable that the dial should be.

Though the dial and the final gear-wheel are herein shown as one disc of metal fulfilling a double function, it is obvious that the dial might be a separate part, concentric with the gear-wheel and laid upon the same.

I claim:

1. In a timing device, the combination of a main plate, gearing carried by said main plate, a pair of cams supported from said main plate and located rearwardly of said main plate and driven from said gearing, adjusting mechanism for changing the relative setting of said cams, said adjusting mechanism being supported from said plate and being operatively connected with one of said cams and having a manipulating portion located on the forward side of said plate, and contacts controlled by said cams and supported from and located on the rear side of said plate, whereby said plate constitutes a unitary support for said gearing, adjusting mechanism, cams and contacts, and whereby said contacts are located on the rear side of said plate away from said adjusting mechanism.

2. In a timing mechanism, a driving pinion, a gear driven from said pinion, electric make and break switch mechanism operated from said gear, said gear having calibrations thereon, a first cam operated from said gear and connected to said gear, indicating means carried by said gear and rotatable therewith, a second cam connected to said indicating means, said electric make and break switch mechanism including two switch means cooperating with each other and individually controlled from said first and second cams, said indicating means being adjustable with respect to said gear to adjust the relative setting of said cams by moving one of said cams with respect to the other of said cams, whereby the relative period of open and closed position of said coacting switch means may be varied by the setting of said indicating means.

3. In a timing mechanism a driving pinion, a gear driven from said pinion, electric make and break switch mechanism operated from said gear, said timing mechanism including a calibrated portion rotatable synchronously with said gear, a first cam operated from said gear and connected to said gear, indicating means carried by said gear and rotatable therewith, a second cam connected to said indicating means, said electric make and break switch mechanism including two switch means cooperating with each other and individually controlled from said first and second cams, said indicating means being adjustable with respect to said gear to adjust the relative setting of said cams by moving one of said cams with respect to the other of said cams, whereby the relative period of open and closed position of said coacting switch means may be varied by the setting of said indicating means.

4. In a timing mechanism, driving means, a driven member driven from said driving means, electric make and break switch mechanism operated from said driven member, a first cam operated from said driven member and connected to said driven member, interval determining

means carried by said driven member and rotatable therewith, a second cam connected to said interval determining means, said electric make and break switch mechanism including two
5 switch means respectively cooperating with said cams and each including a cam follower portion riding upon the respective cam, said interval determining means being coaxial with respect to

said driven member and being rotatable in one direction to vary the relative position of said cams, and means cooperatively connected to both said driven member and said interval determining means for preventing rotation of said interval determining means in the reverse direction. 5

EMIL F. SWENSEN.