A. PACHE.

TIMING APPARATUS.

APPLICATION FILED JUNE 19, 1915.

1,163,362.

Patented Dec. 7, 1915.

2 SHEETS—SHEET 1.

Fig. 1.

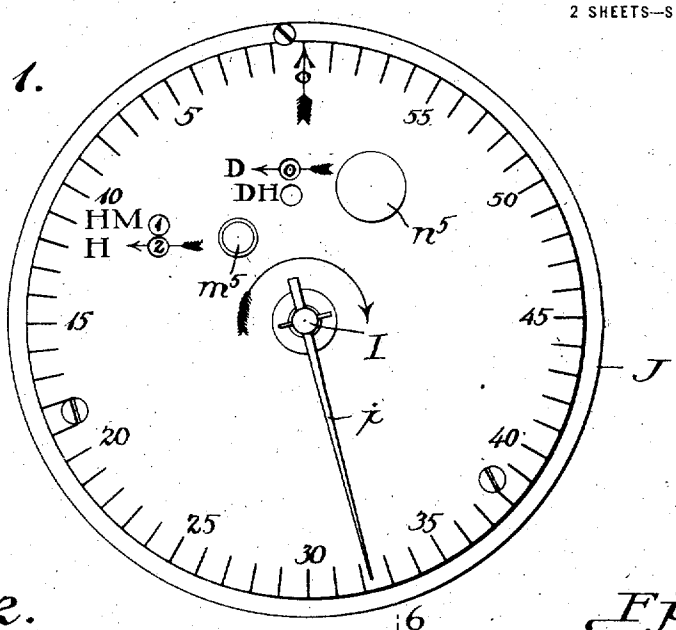


Fig. 2.

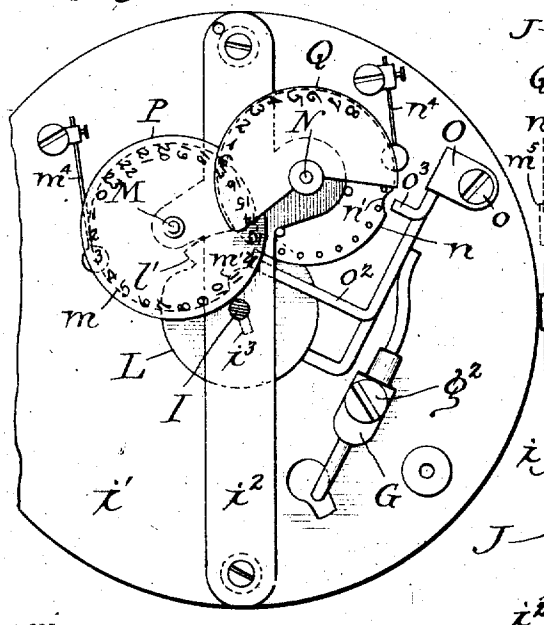
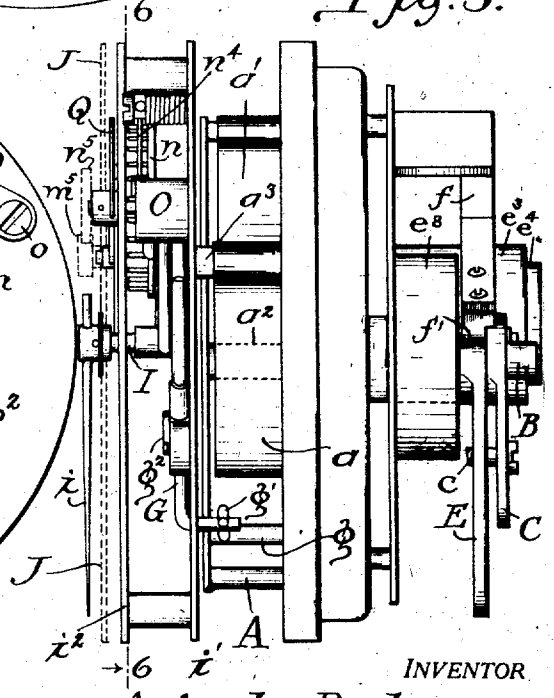


Fig. 3.



WITNESSES:

C. Fabricius

INVENTOR

Auguste Pache.

BY

Jas. H. Griffin

Attorneys

A. PACHE.

TIMING APPARATUS.

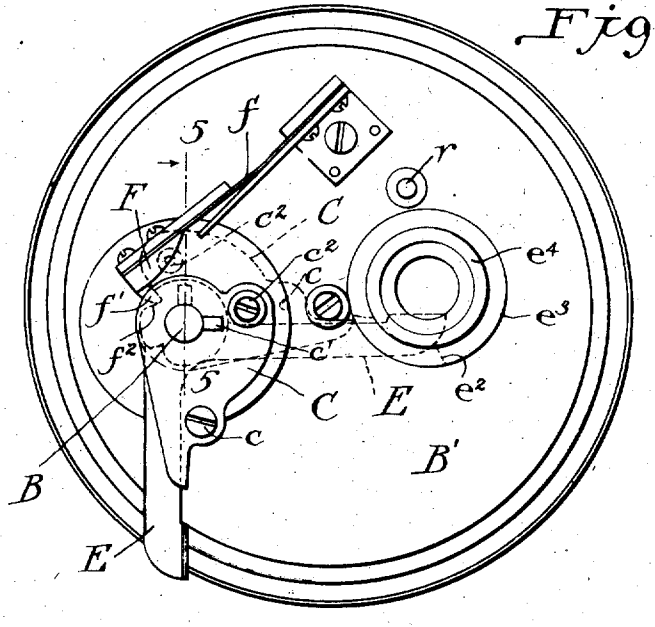
APPLICATION FILED JUNE 19, 1915.

1,163,362.

Patented Dec. 7, 1915.

2 SHEETS—SHEET 2.

Fig. 4.



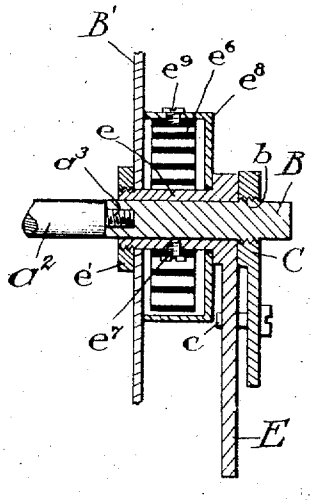


Fig. 5.

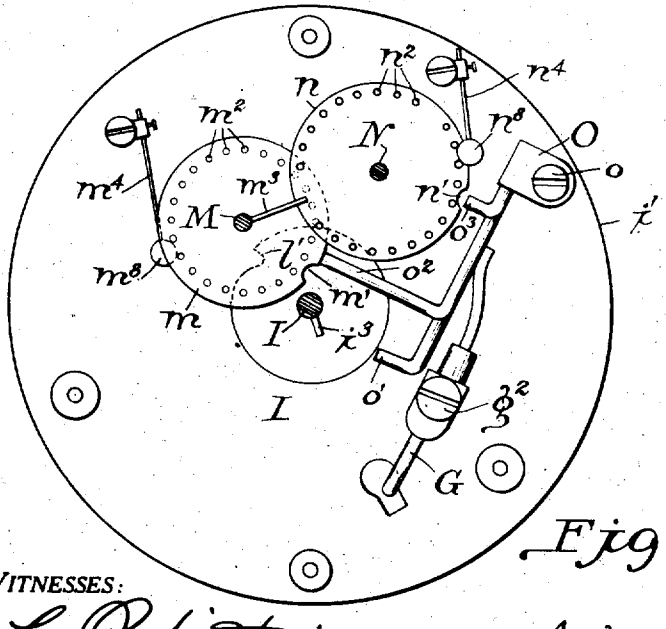
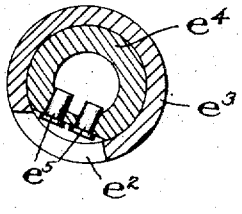


Fig. 6.

Fig. 7.



WITNESSES:

C. Gabrielski

INVENTOR

Auguste Pache.

BY

Jas. H. Griffin

Attorneys

UNITED STATES PATENT OFFICE.

AUGUSTE PACHE, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO LOUIS G. DUQUET, OF NEW YORK, N. Y.

TIMING APPARATUS.

1,163,362. Specification of Letters Patent. Patented Dec. 7, 1915.

Application filed June 19, 1915. Serial No. 34,979.

To all whom it may concern:

Be it known that I, AUGUSTE PACHE, a subject of Switzerland, residing in the city of New York, borough of Manhattan, county and State of New York, have invented a certain new and useful Timing Apparatus, of which the following is a specification.

This invention is a timing apparatus, and the object of the invention is to provide a device particularly applicable for setting off explosives at the expiration of a predetermined period.

The invention may be briefly stated as embodying a time train, means controllable by the time train for setting off the explosive, and means also associated with the time train for determining the period of time to expire before the operation of the means for setting off the explosive.

In one of its practical forms, the invention embodies a time train with which is associated a spring-actuated hammer adapted to set off a percussion-cap. Means is provided for maintaining the hammer in a restrained position until it is desired to fire the cap, which means is governed by the time train, and means is also associated with the time train for precluding the release of the hammer restraining means until the expiration of a predetermined period.

Features of the invention, other than those specified, will be apparent from the hereinafter detailed description taken in conjunction with the accompanying drawings.

In the accompanying drawings, I have illustrated one practical embodiment of the invention, but the construction shown therein is to be understood as illustrative, only, and not as defining the limits of the invention.

Figure 1 is a face view of the apparatus embodying the present invention, said figure showing a dial to allow of the accurate setting of the mechanism to a predetermined period of time. Fig. 2 is a view similar to that shown in Fig. 1, with the exception that the dial and pointing hand are removed. Fig. 3 is a side elevation of the device as shown in Fig. 2, the dial being shown in dotted lines. Fig. 4 is a rear view of the device. Fig. 5 is a detail, transverse section taken on line 5—5 of Fig. 4. Fig. 6 is a section taken in a plane parallel to the plane of the dial, on substantially line 6—6 of Fig. 3, and Fig. 7 is a detail section through the barrel which is adapted to hold percussion-caps or other setting off devices to be operated upon by the hammer at the expiration of a predetermined period.

Referring to the drawings, A indicates a time train which is herein shown as of any well known and conventional form of alarm clock.

a' designates the main spring of the clock, whereas a indicates the spring which actuates the alarm. Alarm spring a is mounted upon the usual arbor a^2, and one end of said spring is secured to the post a^3 of the frame of the clock, all as clearly shown in Fig. 3. In the form of the invention shown, alarm-spring arbor a^2 is provided with a threaded shank a^3 at its rear end, and, onto this shank, is secured an extension axle B which projects beyond the rear plate B′ of the apparatus. Near the free end of axle B are plates b which are engaged by the interiorly threaded hub of a restraining member C.

Positioned intermediate restraining member C and the rear plate B′ of the apparatus is an axle encircling sleeve e, loosely mounted on the axle and provided at its outer end with the hub of a laterally projecting arm E, hereinafter termed the hammer. The other end of the sleeve e projects through the rear plate B′, and a collar e' is threaded thereon to preclude longitudinal movement of the sleeve. Hammer E is adapted for pivotal movement upon axle B and may be brought, under conditions hereinafter specified, into juxtaposition with a slot e^2 of a firing chamber e^3 fixed on the rear plate B′. Within firing chamber e^3 is removably positioned a hollow firing barrel e^4, from one side of which project substantially radial openings into which may be inserted one or more percussion-caps or cartridges e^5. The relation of the parts is such that, when firing barrel e^4 is in proper position within firing chamber e^3, the percussion-caps e^5 will be in juxtaposition with the slot e^2 in chamber e^3, see Fig. 7. Accordingly, if hammer E is swung with sufficient force into said slot, it will engage with the ends of the percussion-caps and cause them to be exploded. The mechanism for accomplishing this result will next be described.

Encircling sleeve e is a spiral spring e^6, one end of which is secured to the sleeve by screws e^7, and the other end of which is se-

cured to the wall of a stationary casing e^8 by means of a screw e^9. Spring e^6 serves to normally maintain the hammer in slot e^2 of the firing chamber. Passing through restraining plate C is a pin c which projects into the plane of hammer E and is adapted, when said plate C is moved in a counter-clockwise direction from the position shown in dotted lines in Fig. 4, to engage with the forward edge of hammer E and rotate the same against the tension of the spring e^6 into the retracted, full-line position of said figure. To readily carry out this operation, a suitable key, not shown, is provided, which may be positioned upon axle B and, being fixed against relative movement therewith by a pin c' may be operated to rotate said axle in a clockwise direction. When the key is thus actuated, plate C and hammer E may be moved to the retracted position shown in full lines in Fig. 4, means being provided for locking the hammer in this position, against the impelling action of its spring. This means is shown in the form of a latch F which is normally maintained in engagement with the periphery of the hub of the hammer by a spring f and is provided with a finger f' adapted to enter a shouldered depression f^2 formed in the circumference of said hub. Thus, when the parts have been moved to the retracted position, finger f' will enter the depression and lock the hammer against the action of the spring. Bearing in mind that axle B is a continuation of the arbor a^2 for the alarm spring a of the time train, it will be manifest that, when the key is turned in the manner specified, the arbor a^2 will be rotated and the spring a placed under tension. As is usual in alarm clocks, the mechanism of the clock serves to lock the arbor against return rotation until the time has arrived at which the alarm has been set to operate. Consequently, hammer E will be locked in its retracted position by the latch F, and restraining plate C will be maintained in its retracted position by the conventional mechanism of the time train.

In the well known form of time train illustrated, the releasing of alarm spring a is governed, through well known mechanism, from an oscillating arbor g, from which projects a laterally extending arm g'. Arbor g is normally precluded from oscillating by a lever which coöperates with arm g' and normally holds the same against movement. However, when the arm is released by the lever and thus allowed to oscillate, the spring is released and the arbor a^2, to which it is secured, is rotated thereby. According to the present invention, the arm g' of oscillating arbor g is normally engaged and retained against movement by a lever G pivoted to the front plate of the apparatus as by the screw g^2, and one end of which lever projects through an aperture in the front plate and engages with said arm g'. Means are provided for normally holding the lever in engagement with arm g', but said means is operable, under certain conditions, to allow of the movement of said lever out of engagement with said arm. This means constitutes the time-selecting devices next to be described.

In the clock employed in the carrying out of the present invention, the hour hand and the mechanism for rotating the same about the dial of the clock are omitted and, while the arbor I, which normally actuated the minute hand, is retained, said minute hand is replaced by a stouter hand or pointer i. Arbor I extends through the front plate i' of the apparatus, through a supporting spider i^2, and through the center of the dial J, pointer i being positioned adjacent the face of the dial. Intermediate front plate i' and spider i^2, and fixedly positioned upon arbor I, is a disk L. Moreover, stub-shafts M and N are positioned in parallel relation to arbor I and at spaced distances therefrom, in such manner that, at their back ends, they are journaled in the front plate i' of the apparatus, while their forward ends are journaled in, and pass through, the spider i^2. In a manner similar to arbor I, each of the stub-shafts referred to is provided with a fixed disk m, n, respectively, positioned in different planes relative to the face of the front plate, the disk L resting substantially against the front plate, disk m overlapping disk L and in close relation therewith, and, correspondingly, disk n overlapping disk m and in close relation therewith. Each of the several disks referred to is provided in its circumference with a depression, and said depressions are designated l', m' and n' for the disks L, m and n, respectively. Positioned on front plate i' as at o, is a swinging carrier O which is provided with a plurality of fingers o', o^2 and o^3. These fingers are formed rigid with the carrier member O, and their free ends are adapted to normally engage with the periphery of each of the several disks referred to. At the same time, the power arm of the lever G, which governs the operation of the oscillatory arbor g, engages with the rear of said carrier member and operates to maintain fingers o' o^2 and o^3 in engagement with the periphery of said disks by exerting a slight pressure thereon. As long as any one of the fingers remains in engagement with the outer circumference of its respective disk, the lever G will preclude the operation of the oscillatory shaft g, but, at that time when all of the disks are so positioned that the notch in the circumference of each is in juxtaposition with the corresponding finger of the carrier member O, said carrier member will turn

slightly on its point of pivoting, so that all of the fingers enter the notches of their respective disks, with the result that lever G may be shifted to free the arm g' of the oscillatory arbor. With the foregoing in mind, it will be manifest that, since the disk L is fixed to the minute arbor I, said disk will rotate at a timed speed, *i. e.*, it will turn to a certain number of angular degrees for every minute. In order to properly measure these angular degrees, the dial J is provided with a coöperating pointer i fixed to arbor I. The dial, as shown in Fig. 1, is provided with circumferential designations, each of which marks one minute's time in the travel of the pointer i, and the relative position of the pointer to the notch l' of the disk is such that, when the pointer registers with the designation "0", corresponding to the sixty minute mark on the clock, the notch l' will be in juxtaposition with its coöperating finger o' of the carrier member. With this relation of parts, it will be manifest that, if the pointer i is in the position shown in Fig. 1, as designating approximately 32½ minutes to go before reaching the zero mark on the dial, it will take just 32½ minutes before the notch l' will be brought into juxtaposition with its coöperating finger o'. If, at the expiration of that time, the notches of the other two disks are in coöperative relation with their corresponding fingers, the alarm spring a will be released as described. Thus, the time in minutes to elapse before the operation of the alarm spring a may be readily timed from the face of the dial, by simply moving the pointer around the dial to register the number of minutes which it is desired to elapse.

From the foregoing, it will be apparent that disk L corresponds to the minute periods of time and will, accordingly, be hereinafter termed the minute disk. As will hereinafter be explained, moreover, disk m is the hour disk, while disk n is the day disk. Thus, disks L, m and n determine the minutes, hours, and days, respectively, of the time to elapse before the operation of the device, and, for the proper carrying out of their function, all of these disks should operate in timed relation.

Depending from the under side of disk m are a plurality of spaced pins m^2 which are twenty-four in number, corresponding to the twenty-four hours of the day, and upon arbor I is positioned a laterally extending finger i^3 of such length that, once in every rotation of the arbor I, said finger will engage with one of the pins and turn disk m through an angle equal to one twenty-fourth of one complete rotation. Consequently, when the minute hand has traversed the dial twenty-four times, the hour disk will have made one complete rotation. In a corresponding manner, shaft M, which carries hour disk m, is provided with a finger m^3 adapted to engage with upstanding pins n^2 on the day disk n, so that, once in every complete rotation of the hour disk, occupying a space of twenty-four hours, the day disk will be given a forward impulse and, not until all of the disks are in such position that their notches are in register with the corresponding fingers of the carrier member, is the alarm spring a released. Accordingly, the disks may be said, in a measure, to resemble the tumblers of a lock, all of which tumblers must be in a predetermined position before the lock can be actuated.

To preclude inadvertent movement of the disks m and n braking devices are provided, herein shown as small knobs m^8 n^8, which engage with the pins of the respective disks and are resiliently maintained in such position by spring-impelled stems m^4 n^4, respectively. These braking devices exert sufficient pressure upon the pins to preclude inadvertent movement, but are not sufficient to retard the movements of the respective parts at the proper times.

In order that the hour and day disks may be properly adjusted to cover any predetermined time expiration, the shafts M N are extended through apertures in the dial J, and each shaft is provided on its free end with a suitable knob m^5 for shaft M and n^5 for shaft N. To facilitate the setting of the disks, plates P Q are fixed to the respective shafts M and N so as to immediately underlie the dial. On plate P are the numerals 1 to 24, inclusive, designating the hours of the day, and on plate Q are the numerals 1 to 8, inclusive, designating the corresponding number of days. In the dial are formed two apertures over each plate. Over plate P are the apertures "HM", meaning hours and minutes, and "H", meaning hours. Over plate Q, are the apertures "D", meaning days, and "DH", meaning days and hours. Through these apertures the operator may readily ascertain the position of the day and hour disks, while he is setting the same through the medium of the knobs n^5 and m^5.

Assuming that the operator desires to set the apparatus hereinbefore described so that it will become effective at the expiration of one day, one hour, and ten minutes, the following operations are performed: Knob n^5 is set to show the numeral 1 through the day aperture and zero through the days-hours aperture, knob m^5 is set to show the numeral 1 through the hours-minutes aperture and 2 through the hours aperture, and the pointer i is positioned at the zero point on the dial. When thus far regulated, the clock is set for one day and two hours. Since only one day, one hour and ten minutes are required, the pointer is now manu-

ally moved in a clockwise direction to subtract fifty minutes of the two hours, thus leaving the time of one day, one hour and ten minutes. Having thus set the apparatus, it is allowed to run under its own power. During the ten minutes next ensuing, the finger i^3 on the minute arbor will engage with one of the pins m^2 of the hour disk and complete one hour of the original two hours to which this disk was set. As the time train continues to rotate the finger i^3 at the rate of one rotation an hour, the hour disk will be given one complete rotation in a day and, for each complete rotation of the hour disk, the finger m^3 cooperating therewith will give one impulse to the day disk, with the result that, at the end of the allotted time, all of the disks will be brought into such position that the notches in the circumferences thereof will be in juxtaposition with the carrier, member O, and alarm spring a will be released. When the alarm spring is released, it immediately operates its arbor a^2, with the result that the restraining plate C is moved in accordance therewith in a counterclockwise direction from the full-line position shown in Fig. 4 to the dotted-line position therein. However, restraining plate C is provided with a pin c^2 which extends inwardly from the plate and into the plane of the latch F, so that, as the restraining plate is rotated as described, latch F is in the path of the pin c^2. Consequently, as the spring a unwinds, the pin comes into engagement with the latch and forces the same back against the tension of its coöperating spring f, to such extent that the finger f' is disengaged from the depression f^2 of the hammer. Remembering that the spring e^6 has been previously placed under tension by the key, it will be manifest that, as soon as the hammer is released in the manner described, said spring will become active in rotating the hammer, with considerable force, from the retracted, full-line position shown in Fig. 4 to the firing position shown in dotted lines therein. As the hammer thus comes into engagement with the surface of the percussion-caps e^5 in the firing barrel, these caps will be exploded.

From the foregoing, it is apparent that the hammer may be placed in retracted position, *i. e.* set, and the time-selecting devices also set at any one time, to be operative at the expiration of any desired period. I have illustrated, in the drawings, an eight-day clock and, consequently, the day disk is shown as limited to an eight-day period, although, manifestly, this period might be of much greater duration, simply depending upon the addition of more numerals to the plate Q.

In the description of the operation hereinbefore set forth for a period of a day or more, all three disks are employed. However, if the interval of elapsed time is to be less than a day, the day disk would be set to show the numeral zero through the days aperture of the dial, and, in this position, its notch will be juxtaposed with the corresponding figure o^3. In this, which I prefer to term the neutral, position, the finger m^3 coöperating with the hour disk is precluded from affecting the movement of the day disk by the omission of one of the pins n^2 as shown in Fig. 6, so that said finger may pass idly past the day disk without affecting its position.

In the preferred embodiment of the invention, the clock is adapted to cover days, hours, and minutes, though, manifestly, the day disk n, and even the hour disk m, may be eliminated, if the apparatus is to be used for periods equal to, or less than, an hour only. Thus, a device for timing periods of less than an hour's duration may be entirely devoid of the hour and day disks, a disk similar to disk L only being employed. This greatly simplifies the apparatus and is preferable, when short periods only are required.

It will, of course, be understood that the spring a', which drives the time train, may be wound up in the usual manner by applying a key to its arbor r (Fig. 4) in the usual and well known manner.

The device of the present invention may be employed for various uses, the specific embodiment shown being that of setting off explosives through the medium of percussion-caps. The explosive to be fired may be positioned directly within the firing barrel e^4, which may be extended any desired length for the reception of such charge as is necessary, or said percussion-caps may be operated in the firing barrel to set off further devices, which in turn operate on the explosive to be fired. *E. g.*, in dynamiting excavations, the percussion-caps may serve to simultaneously light a plurality of fuses which extend from a position within the firing barrel to the various locations of the shots. Moreover, the hammer may, instead of operating upon the percussion-caps, serve to close an electric circuit which carries out the function required. Thus, while I have illustrated my preferred embodiment, with its particularly intended functions, I do not restrict the present invention to the specific details shown or its uses to the specific uses referred to, but consider the invention as broadly novel as is commensurate with the appended claims.

Having thus fully described the invention, what I claim as new, and desire to secure by Letters Patent, is:

1. In a device of the class described, a power shaft, a spring coöperating therewith, means for locking the spring under tension,

a time train, a shaft driven at a constant speed by said time train, a plurality of tumblers driven in timed relation from said shaft, and unlocking mechanism coöperating with the spring locking means and with the tumblers and operable to release the former when the latter are in predetermined positions, whereby the spring may be released and actuate the power shaft at the expiration of a predetermined period.

2. In a device of the class described, a power shaft, a spring coöperating therewith, means for locking the spring under tension, a time train, a shaft driven at a constant speed by said time train, a plurality of tumblers driven in timed relation from said shaft, unlocking mechanism coöperating with the spring locking means and with the tumblers and operable to release the former when the latter are in predetermined positions, whereby the spring may be released and actuate the power shaft at the expiration of a predetermined period, and means for manually adjusting said tumblers to determine the length of such period of time.

3. In a device of the class described, the combination of a power shaft, a spring driving said power shaft, means for locking the shaft against the tension of the spring, means for governing said locking means, and a plurality of tumblers, driven in timed relation, for actuating the releasing means, one of said tumblers corresponding to the minutes of an hour, another the hours of a day, and another the days of a week, whereby the spring may be released to actuate the shaft at the expiration of a predetermined period.

4. In a device of the class described, a power shaft, a spring coöperating therewith, means for locking the spring under tension, a time train, a shaft driven at a constant speed by said time train, a plurality of tumblers driven in timed relation from said shaft, unlocking mechanism coöperating with the spring locking means and with the tumblers and operable to release the former when the latter are in predetermined positions, and means for regulating said tumblers, whereby the spring may be released and actuate the power shaft at the expiration of a predetermined period.

5. In a device of the class described, a hammer, a spring coöperating with the hammer, means for locking the hammer in retracted position with the spring under tension, a time train, a plurality of tumblers driven in timed relation by the time train, and unlocking mechanism, coöperating with the hammer-locking means, controllable by the tumblers and operable to release the former when the latter are in predetermined positions, whereby the spring is freed to actuate the hammer at the expiration of a predetermined period.

6. In a device of the class described, a hammer, a spring coöperating with the hammer, means for locking the hammer in retracted position with the spring under tension, a time train, a plurality of tumblers driven in timed relation by the time train, unlocking mechanism, coöperating with the hammer-locking means, controllable by the tumblers and operable to release the former when the latter are in predetermined positions, whereby the spring is freed to actuate the hammer at the expiration of a predetermined period, and means for manually adjusting said tumblers to determine the length of such period of time.

7. In a device of the class described, a power shaft, a power spring coiled around said shaft for imparting rotation thereto, means for normally holding said shaft in check, a time train, and means actuated by the time train for releasing the shaft at the expiration of a predetermined period, in combination with a movable arm loosely mounted on the power shaft, an auxiliary spring also coiled around said shaft and cooperating with the movable arm for impelling said arm in one direction, means for locking the arm in such position that the auxiliary spring is under tension, and means, governed by the rotation of the power shaft, for releasing said arm when the power shaft is rotated under the tension of the power spring, whereby said arm is actuated by the auxiliary spring at the expiration of the predetermined period of time.

8. In a device of the class described, a power shaft, a spring for imparting movement thereto, means for normally holding said shaft in check, a time train, and means, actuated by the time train, for releasing said shaft at the expiration of a predetermined period, in combination with a hammer, a spring for operating said hammer, a locking dog normally holding the hammer in check, and means, operable by the power shaft, when the same is released, for tripping the locking dog, thereby allowing the hammer-operating spring to actuate the hammer.

9. In a device of the class described, a power shaft, a spring for imparting movement thereto, means for normally holding said shaft in check, a time train, and means, actuated by the time train, for releasing said shaft at the expiration of a predetermined period, in combination with a hammer rotatably mounted on the power shaft, a spring for operating said hammer, a locking dog normally holding the hammer in check, and means mounted on the power shaft and rotatable therewith, whereby, when said shaft is released, said means en-

gages with the locking dog and releases the hammer.

10. In a device of the class described, a hammer, means for imparting movement to said hammer, and locking means for normally holding said hammer in check, in combination with a time train, a plurality of tumblers driven in timed relation therefrom, and means, dependent for operation upon predetermined relative positions of said tumblers, for releasing the hammer, a dial, and means coöperating with each of said tumblers and extending through the dial whereby the tumblers may be manually regulated to determine the period of time to elapse before the hammer is released.

11. In a device of the class described, a hammer, means for imparting movement to the hammer, and locking means for normally holding said hammer in check, in combination with a time train, a plurality of tumblers driven in timed relation therefrom, and means, dependent for operation upon predetermined relative positions of said tumblers, for releasing the hammer.

12. In a device of the class described, a hammer, means for imparting movement to the hammer, and locking means for normally holding said hammer in check, in combination with a time train, a plurality of tumblers, each preceding tumbler driving the next succeeding tumbler, the time train being the prime mover, whereby all of said tumblers are operated in timed relation, and means, dependent for operation upon predetermined relative positions of said tumblers, for releasing the hammer.

13. In a device of the class described, a hammer, means for imparting movement to the hammer, and locking means for normally holding said hammer in check, in combination with a time train, a tumbler driven in synchronism with and by the time train, a second tumbler intermittently driven by the first tumbler, and means, dependent for operation upon predetermined relative positions of said tumblers, for releasing the hammer.

14. In a device of the class described, a hammer, means for imparting movement to the hammer, and locking means for normally holding said hammer in check, in combination with a time train, a tumbler driven in synchronism with and by the time train, other tumblers intermittently driven by the first tumbler, and means, dependent for operation upon predetermined relative positions of said tumblers, for releasing the hammer.

15. In a device of the class described, a hammer, means for imparting movement to the hammer, and locking means for normally holding said hammer in check, in combination with a time train, a tumbler driven in synchronism with and by the time train, other tumblers intermittently driven by the first tumbler, means for maintaining said other tumblers in quiescent state between the periods when they are driven, and means, dependent for operation upon predetermined relative positions of said tumblers, for releasing the hammer.

16. In a device of the class described, a hammer, means for imparting movement to said hammer, and locking means for normally holding said hammer in check, in combination with a time train, a plurality of tumblers driven in timed relation therefrom, and means, dependent for operation upon predetermined relative positions of said tumblers, for releasing the hammer, a dial, and means coöperating with each of said tumblers and extending through the dial whereby each of the tumblers may be manually, individually regulated to determine the period of time to elapse before the hammer is released.

In testimony whereof I have signed my name to this specification.

AUGUSTE PACHE.