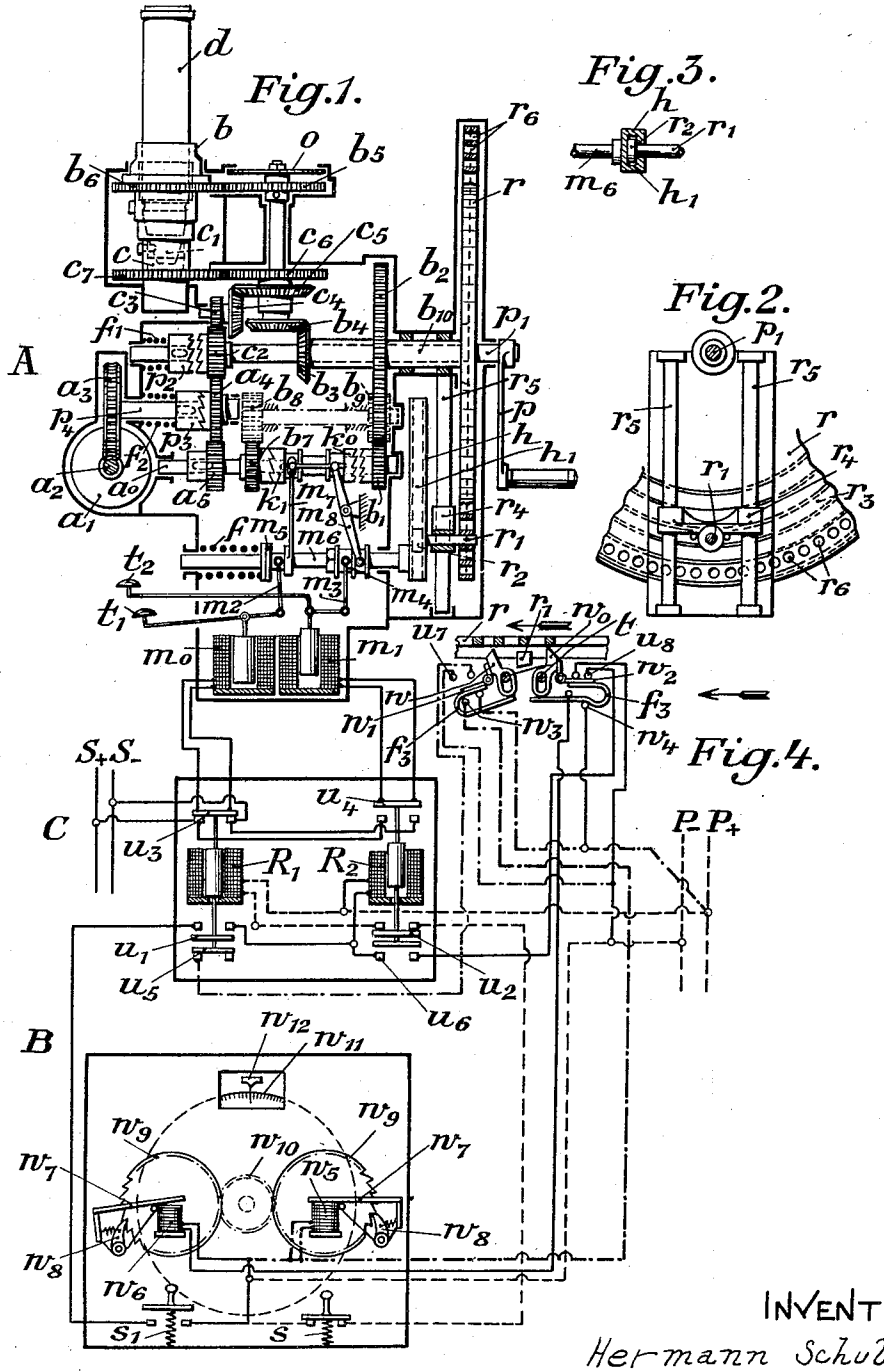
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FUSE SETTING MACHINE

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FUSE SETTING MACHINE

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Our invention has for its object a fuse setting machine which possesses two setting bodies adapted to be displaced independently of one another, one of them being intended to be coupled with the setting ring of the fuse, while the other is adapted to be coupled with the part rigid on the projectile, of the fuse, the mutual position of these two bodies the instant the coupling takes place, after a projectile has been introduced, determining the amount of displacement effected by the machine, of the setting ring of the fuse and therewith the position of the bursting point of the projectile after the shot has gone off.

To set on the setting machine the position of the bursting point of the fuse hitherto the one setting body is turned manually relatively to the other by a special setting gear, the amplitude of this angular displacement being read off on an indicating device. Therefore, to set the fuse a transfer of the respective order was required from the man who is observing the aim to the man operating the setting machine according to the orders given to him. This man had to set the one setting body by hand and to report back to the observer the executed setting operation. In these operations setting errors could not be excluded and, when the projectiles are to be set for rapid fire on quickly moving aims, the setting operation consumes too much time, so that the position of the bursting points can not be varied in the desired manner.

According to our invention the mutual adjustment of the setting bodies of the machine to determine the position of the bursting point of the projectile is effected by the driving member of the one setting body being temporarily coupled with and driven by a permanently rotating driving engine from a place remote from the setting machine through the intermediary of a long distance controlling apparatus. The controlling mechanism serving to act upon the setting machine placed beside the gun is operated by the man who is observing the aim and who is stationed at a suitable remote point, the adjustments of the machine as to the amplitude and direction of rotation being continuously reported from the machine to the observer by means of suitable reporting apparatus.

In this manner the mediator hitherto required between the observing station and the setting machine is eliminated and therewith also the source of errors resulting therefrom. It is merely necessary to put, at the gun, the projectiles into the setting cups of the setting machine which always has imparted to it the correct adjustment, whereupon setting of the fuses takes place automatically in the known manner.

In order that our invention can be more readily understood, an embodiment of a long distance controlled fuse setting machine is illustrated by way of example in the accompanying drawings in which

Figure 1 shows diagrammatically the whole apparatus, comprising three groups of parts, viz. group A: the proper setting machine, group B: the controlling apparatus, and group C: the relay inserted therebetween,

Figures 2 and 3 are fragmentary sections through the setting body locking device of the setting machine,

Figure 4 illustrates the reporting mechanism of the setting machine, with the diagram of the wires leading to the controlling apparatus B and relay C, reference having been made for sake of simplification to the illustration of Figure 1 of the relay.

The driving machine serving to actuate the setting machine A is for example an electric motor a_1 which constantly runs during the time the gun is firing and turns a shaft a_0 through the intermediary of a worm gearing a_2, a_3, and spur wheel gearing a_4, a_5. It is shaft a_0 from which is derived temporarily if required the turning motion of the upper setting body b of the machine, to set the position of the bursting points, by means of the long distance controlling apparatus described hereinafter. The lower setting body c intended to displace the setting ring c_1 of the fuse of projectile d is coupled in known manner with a pinion c_7, upon a projectile being introduced in the cup of the machine, and is then driven from motor a_1 through the gear train c_6, c_5, c_4, c_3, c_2, a_4, a_3, a_2.

The setting body b which is controlled by

the long distance transmission can be driven in one direction of rotation from the permanently rotating shaft a_0 by the clutch k_0 being engaged, through the gears b_1, b_2, bevel wheels b_3, b_4, and gears b_5, b_6, or opposite rotation is imparted to it by clutch k_0 being disengaged and coupling k_1 engaged, through the gearing b_8, b_9. The gears b_1 and b_7 are loose on shaft a_0. The hollow shaft b_{10} of the gear b_2 has rigidly fixed on or integral with it a notch disk r.

The alternative engagement and disengagement of the couplings k_0 and k_1 is effected by alternatively exciting working solenoids m_0 and m_1 the iron cores of which by angle levers m_2 and m_3 are connected to shiftable sleeves m_4 and m_5 mounted on an actuating shaft m_6 which is shiftable to the left against the action of a spring f. By means of levers m_7 and m_8 the sleeves m_4 and m_5 control the clutches k_0 and k_1. According to whether the one or the other of the solenoids m_0, m_1 is excited, the forward or backward clutch k_1 or k_0 is engaged and the notch disk r and the setting body b turned in the one or other direction. The actuating shaft m_6 which can only be shifted but not turned, carries on its right-hand end a lever h extending radially relatively to the notch disk r and having a T-shaped guiding groove h_1 engaged by the head r_2 of a bolt r_1, see Figures 2 and 3, this bolt engaging a spiral groove r_3 of disk r and during rotation of the latter being moved by the spiral groove r_3 from the periphery toward the center of disk r or inversely when disk r revolves in opposite direction. To secure a position normal to disk r, of bolt r_1 the latter is guided by a cross head r_4 which in its turn slides on parallel cross head guides r_5 mounted on the frame of the mechanism. On the ground of the spiral groove r_3 of disk r are provided at equal or unequal distances rest bores r_6 engaged and disengaged by bolt r_1 according to whether shaft m_6 is shifted to the right or left.

When one of the two working solenoids m_6, m_1 is excited, first shaft m_6 is shifted so far to the left against the action of its spring, previous to one of the couplings k_0 or k_1 being engaged, that bolt r_1 does not engage any of the bores r_6 of the spiral groove r_3 of disk r. Keys t_1, t_2 provided on the angle levers m_2, m_3 permit of the actuating shaft m_6 being shifted in the same way by hand independently of the solenoids m_0, m_1.

In the event the power drive of the lower setting body c through shaft a_0 fails to act, this body can be turned manually by a crank p and crank shaft p_1. The gears c_2 and a_4 are loose on their shafts p_1 and p_4. Under the action of springs f_1 and f_2 clutches p_2, p_3 which are splined on the shafts p_1 and p_4, respectively, so engage the gears c_2 and a_4, that they become operative only when driven from their shafts in one direction. With the drive effected by the motor a_1 thus the coupling p_2 resiliently slides on shaft p_1 past the clutch teeth of the revolving gear c_2, and shaft p_1 and hand crank p remain at rest. Inversely, a rotation by the hand crank p, of shaft p_1 is of no influence upon the motor a_1 when it is at rest.

The excitation of the working magnets m_0, m_1 to couple and uncouple the notch disk r and to throw in and out the driving gear for the setting body b in one or other direction is established by electric long distance transmission by means of the controlling apparatus B through a double relay C.

The controlling apparatus B possesses two keys s, s_1 serving to close the circuit for the forward and backward motion of the setting body b, by the alternative depression of which keys a primary circuit P+ P− is closed which includes two magnets R_1, R_2 connected in parallel in the double relay C, whereby one of the two magnets is excited. By this excitation a secondary strong circuit S+ S− is closed which includes the working solenoids m_1, m_2 connected in parallel, and the contacts u_3 or u_4, whereby one of the working magnets m_1 or m_2 is excited. When this takes place, the actuating shaft m_6 is shifted to the left against the action of spring f, bolt r_1 is withdrawn from the respective bore r_6 of disk r and either the forward or the backward clutch k_1 or k_0 is engaged and the rotation of disk r and setting body b in the one or other direction is initiated. The relay magnets R_1, R_2 are connected with breaking contacts u_1, u_2 and so inserted in the primary circuit P+, P−, that when one of them is excited, the supply of current to the other magnet is interrupted automatically. Consequently only one of the two relay magnets can be excited when both keys s, s_1 are depressed unintentionally, and only one of the closing contacts u_3, u_4 can be closed in the secondary circuit S+, S−, so that also only one of the working solenoids m_1, m_2 can be excited. By depressing key s or key s_1 the man who is observing the aim is enabled to turn, forwardly or backwardly the setting body b of the fuse setting machine at the gun. By releasing the two keys s, s_1 the primary and secondary circuit is broken and spring f shifts the actuating shaft m_6 to the right. The setting body is thereby disengaged from shaft a_0 which revolves constantly, and the notch disk and therewith the setting body are stopped.

The amplitude of motion of disk r, that is the number of the notches r_6 running past bolt r_1 while it is out of engagement, constitutes the measure of the entire turning motion of setting body b, the distances existing between the notches r_6 being fractions of angular degrees of this motion. The notches r_6 therefore are utilized to indicate in the controlling apparatus B the

turning motion of disk r and body b, that is to report back these motions. To this end a circuit breaker is provided, which is actuated by the notches r_6 and arranged on the cross head r_4 of bolt r_1, see Figure 4. This breaker is adapted by jumping from notch to notch to open and close a circuit which is parallel to the primary circuit P+ P− and includes an electro-magnetic ratchet gear arranged in connection with the commanding apparatus B. By the current impulses provoked by thus closing and opening action the ratchet gear turns a graduated measuring dial w_{11} which in co-operation with a fixed mark w_{12} indicates the angular motion of disk r and setting body b.

The circuit breaker provided on disk r may consist of two pawls w, w_0 swingingly and longitudinally shiftably mounted on the cross head r_4 by pins t and adapted to enter the rest holes r_6. The ends engaging the holes r_6, of the pawls w, w_0 are sloped in such a manner that upon the notches r_6 passing past them, according to the direction of disk r, always only one of the pawls, for example, pawl w_0, is shifted to and fro on its pin t normally to disk r, while the other pawl, w, is swung about its pin t.

Contact levers w_1, w_2, respectively, abut on the pawls w, w_0 under the action of springs f_3. The contact lever belonging to the pawl which just is only shifted remains at rest, whilst the contact lever of the pawl that just is swung takes part in this swing motion, whereby upon rotation of disk r always one of the two breaking contacts w_3, w_4, for example, contact w_3 is repeatedly opened and closed, whilst the other breaking contact w_4 constantly remains opened. This results in the parallel circuit repeatedly being opened and closed, so that according to the direction of rotation of disk r the one or other magnet w_5, w_6 of the electro-magnetic ratchet gear of the controlling apparatus B will receive current impulses. By these impulses a ratchet lever w_7 arranged above the magnets w_5, w_6 and carrying a pawl w_8 is set in rocking motion in known manner and a ratchet disk w_9 turned stepwise, the rotation of which is transmitted to the dial w_{11} by the gear w_{10}. The rotation of dial w_{11} relatively to the fixed mark w_{12} then indicates the direction of rotation and the amount of the actual rotation of the setting body b.

The circuit breaker, Figure 4, further serves to effect the entrance of bolt r_1 in the notches r_6 in the event the primary circuit P+ P− is broken by depression of key s or s_1 at the instant the bolt r_1 happens to not be opposite a notch r_6. If at the same instant also the secondary circuit S+ S− would happen to be broken so that the working solenoids m_0, m_1 become inoperative and the rotation of disk r is stopped, the bolt r_1 would not enter a notch and body b would remain unlocked. To avoid this, current is supplied further to the relay magnets R_1 or R_2 by another circuit even after the primary circuit P+ P− has been opened by releasing key s or s_1. This other circuit is connected in parallel to the primary circuit and leads from the contacts u_5 and u_0, respectively, through the relay magnets R_1, R_2 to the contacts u_7, u_8 of the breakers w_1, w_2. The disk r will therefore continue turning until pawl w or w_0 breaks the other circuit too by opening the contacts u_7 or u_8, whereupon the working solenoids m_0, m_1 drop, shafts m_6 is shifted by spring f, and the coupling k_0 or k_1 is disengaged. The bolt k_1 then has position to enter a notch whereby disk r and setting body b are locked.

To set the body b the described apparatus operates in the following manner: By depressing for example key s of the control apartus B the primary circuit P+ P− illustrated by dotted lines is closed and the relay magnet R_1 closed. Its iron core is drawn into the exciting winding whereby the circuit leading to the other relay magnet r_2 is interrupted by the contact u_1 which was closed, now being opened. This latter magnet therefore is unable to be excited even when the other key s_1 is depressed. Furthermore by contact u_5 being closed the parallel auxiliary circuit illustrated in dot and dash lines, of the relay magnet R_1 is closed through the breaker u_7 w_2 and, finally, the secondary circuit S+ S− shown in full lines is closed by contact u_3 being closed, and the working solenoid m_0 is excited. The latter attracts its core and by means of angle lever m_2 shifts shaft m_6 with bolt r_1 to the left, spring f being tensioned. The disk r is released by bolt r_1 and clutch k_1 is thrown in by means of lever m_7. Consequently the constantly revolving shaft a_0 through the gears b_7, b_8, b_9, b_2 turns disk r and further through the bevel wheels b_3, b_4 and gear wheels b_5, b_6 also the setting body b as long as the observer depresses key s. As long as disk r is revolving, the circuit breaker, Figure 4, will close and open the circuit, connected in parallel to the primary circuit P+ P− and illustrated by dot and dash lines with small circles, which circuit includes the ratchet gear of the controlling apparatus, by the left-hand pawl w, bridge w_1 and contact w_3, so that the gear w_5, w_7, w_8, w_9, w_{10} turns the dial w_{11} relatively to the mark w_{12} and thereby reports back to the observer the rotary displacement of setting body b. When the desired rotary displacement appears on dial w_{12}, the observer releases key s and the rotation of body b is automatically stopped by bolt r_1 entering that notch r_6 of disk r which is the next one the instant the circuit is broken. When the motion of setting body b should take place in opposite direction, the observer depresses

key s_1 whereby an analogous operation takes place through the other means provided for this inverse motion. When the long distance transmission leading from the controlling apparatus B fails to act, disk r and thereby setting body b can be controlled by the keys t_1 and t_2, the rotary displacement of body b then being read off on a dial o which is provided on the setting machine in direct connection with the members driving setting body b.

What we claim and desire to secure by Letters Patent, is:—

1. A fuse setting machine including a projectile receiving head, a fuse ring gripping device revoluble with respect to said head, a constantly revolving motor, means temporarily to connect the motor operatively with the fuse gripping device to revolve the latter, and a remote control for said means.

2. A fuse setting machine including a projectile receiving head, a fuse ring gripping device revoluble with respect to said head, a constantly revolving motor, means temporarily to connect the motor operatively with the fuse gripping device to revolve the latter, a remote control for said means, and a locking device operatively connected to said means to lock the fuse ring gripping device in set position.

3. A fuse setting machine including a projectile receiving head, a fuse ring gripping device revoluble with respect to said head, a constantly revolving motor, means temporarily to connect the motor operatively with the fuse gripping device to revolve the latter, a remote control for said means, a disk revolving with the gripping device and provided with spaced notches, and a bolt controlled by said means and movable to engage said notches selectively.

4. A fuse setting machine including a projectile receiving head, a fuse ring gripping device revoluble with respect to said head, a constantly revolving motor, a gear train including a clutch and operatively connecting the motor and gripping device to rotate the latter upon closing of the clutch, electro-magnetic means for closing said clutch and including a normally open circuit, and a remote control for closing said circuit.

5. A fuse setting machine including a projectile receiving head, a fuse ring gripping device revoluble with respect to said head, a constantly revolving motor, a pair of gear trains each including a clutch and operatively connecting the motor and gripping device in one direction and another upon selective closing of the clutches, a pair of electro-magnetic means for selectively closing said clutches, and a remote control for said electro-magnetic means.

6. A fuse setting machine including a projectile receiving head, a fuse ring gripping device revoluble with respect to said head, a constantly revolving motor, a pair of gear trains each including a clutch and operatively connecting the motor and gripping device in one direction and another upon selective closing of the clutches, a pair of electro-magnetic means for selectively closing said clutches, and a remote control for said electro-magnetic means and including a pair of relays each arranged to close a circuit through a respective electro-magnetic means and open a circuit through the other electro-magnetic means.

7. A fuse setting machine including a projectile receiving head, a fuse ring gripping device revoluble with respect to said head, a constantly revolving motor, means temporarily to connect the motor operatively with the fuse gripping device to revolve the latter, a remote control for said means, a fuse setting indicator adjacent said remote control, and an operative connection between said indicator and gripping device.

8. A fuse setting machine including a projectile receiving head, a fuse ring gripping device revoluble with respect to said head, a constantly revolving motor, means temporarily to connect the motor operatively with the fuse gripping device to revolve the latter, a remote control for said means, a locking device operatively connected to said means to lock the fuse ring gripping device in set position, a fuse setting indicator adjacent said remote control, and an operative connection between said indicator and gripping device.

9. A fuse setting machine including a projectile receiving head, a fuse ring gripping device revoluble with respect to said head, a constantly revolving motor, means temporarily to connect the motor operatively with the fuse gripping device to revolve the latter, a remote control for said means, a disk revolving with the gripping device and provided with spaced notches, and a bolt controlled by said means and movable to engage said notches selectively, a fuse setting indicator adjacent said remote control, and electro-magnetic means operated by rotation of said disk and operating the indicator in unison therewith.

10. A fuse setting machine including a projectile receiving head, a fuse ring gripping device revoluble with respect to said head, a constantly revolving motor, a gear train including a clutch and operatively connecting the motor and gripping device to rotate the latter upon closing of the clutch, electro-magnetic means for closing said clutch and including a normally open circuit, a remote control for closing said circuit, a disk revolving with the gripping device and provided with spaced notches, and a bolt operatively controlled by said clutch and movable to engage said notches selectively according to the position of the disk.

11. A fuse setting machine including a projectile receiving head, a fuse ring gripping device revoluble with respect to said head, a constantly revolving motor, a gear train including a clutch and operatively connecting the motor and gripping device to rotate the latter upon closing of the clutch, electro-magnetic means for closing said clutch and including a normally open circuit, a remote control for closing said circuit, a disk revolving with the gripping device and provided with spaced notches, a bolt operatively controlled by said clutch and movable to engage said notches selectively according to the position of the disk, and means to maintain the circuit closed after operation of the remote control during the passage of the notch adjacent the bolt into alinement therewith.

In testimony whereof we have affixed our signatures.

HERMANN SCHULER.
ANTON GIETMANN.