Nov. 13, 1934. A. VARAUD 1,980,892

MACHINE FOR TIMING TIME FUSES FOR ARTILLERY PROJECTILES

Filed June 15, 1934 4 Sheets-Sheet 1

Fig. 1.

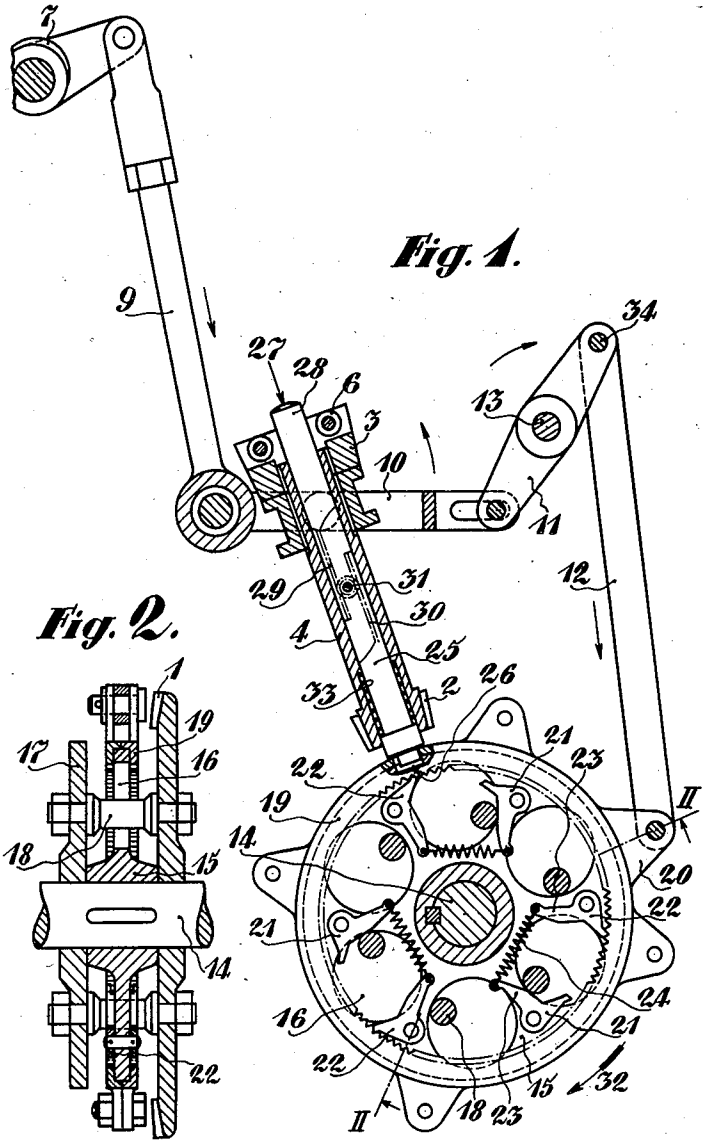


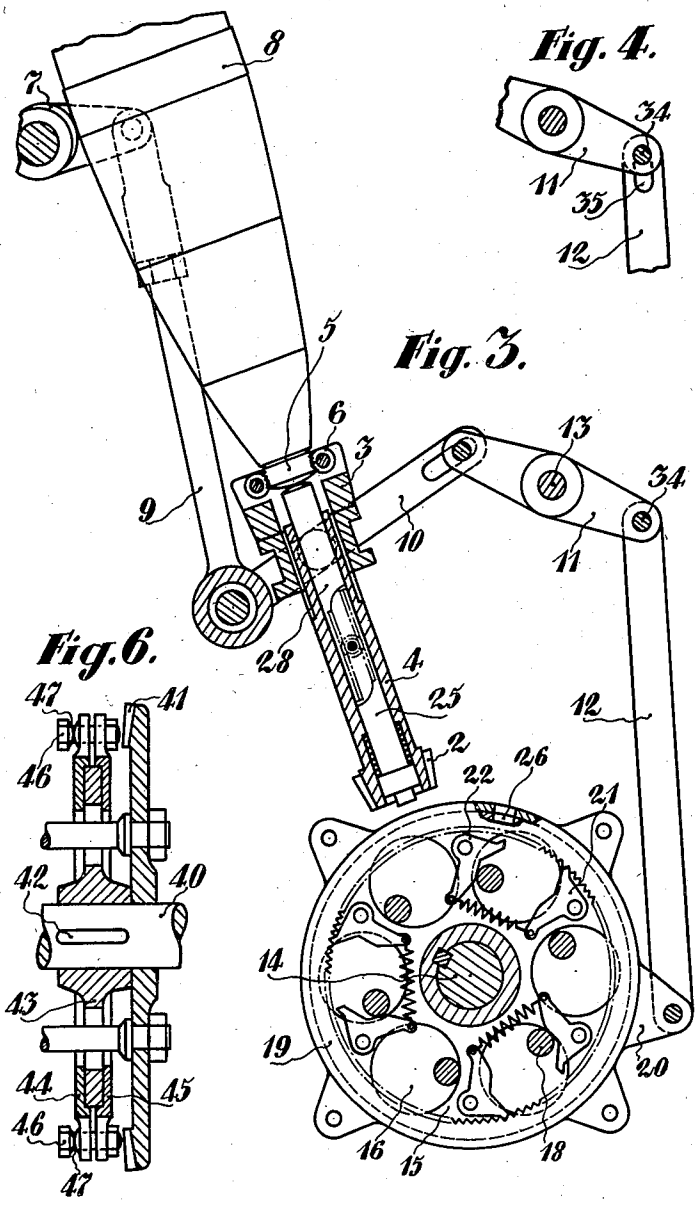
Fig. 2.

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MACHINE FOR TIMING TIME FUSES FOR ARTILLERY PROJECTILES

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MACHINE FOR TIMING TIME FUSES FOR ARTILLERY PROJECTILES

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Fig. 5.

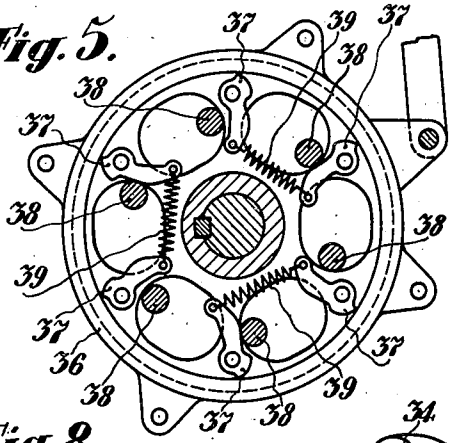
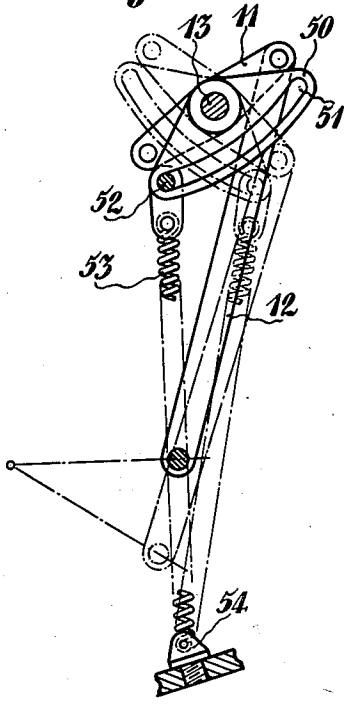


Fig. 8.



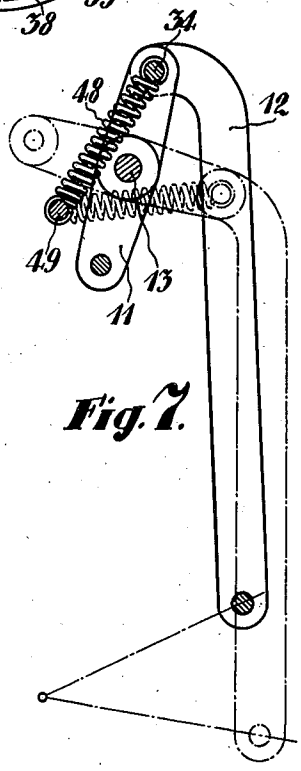


Fig. 7.

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MACHINE FOR TIMING TIME FUSES FOR ARTILLERY PROJECTILES

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Fig. 9.

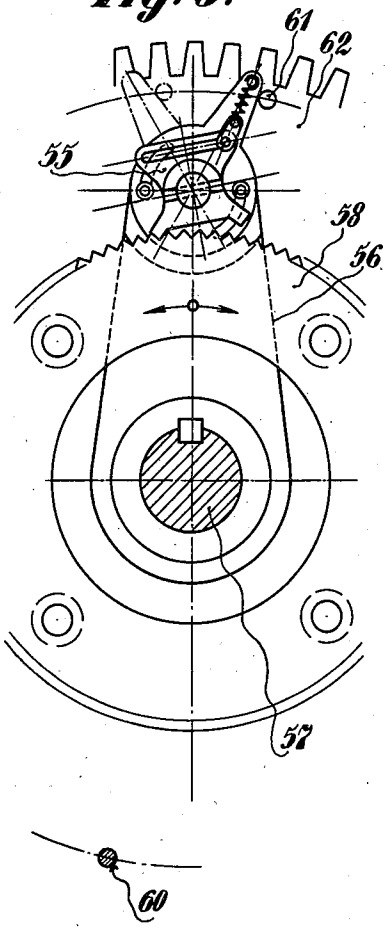
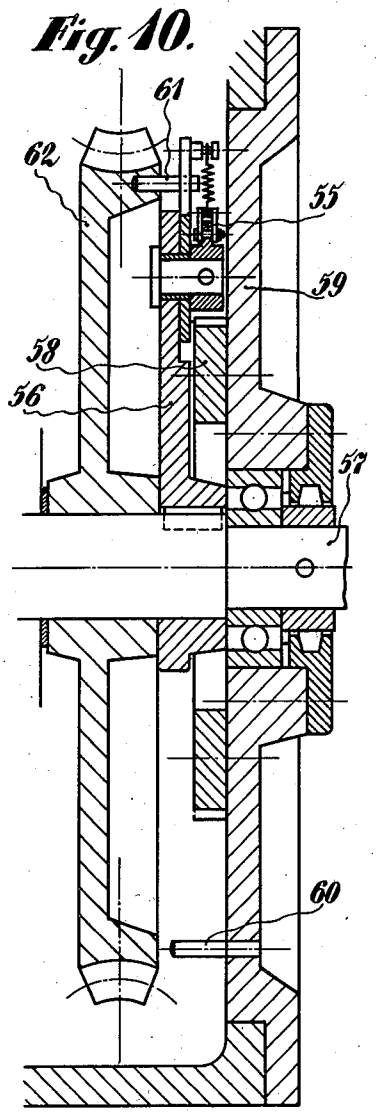


Fig. 10.



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Patented Nov. 13, 1934

1,980,892

UNITED STATES PATENT OFFICE

1,980,892

MACHINE FOR TIMING TIME FUSES FOR ARTILLERY PROJECTILES

André Varaud, Geneva, Switzerland

Application June 15, 1934, Serial No. 730,825
In Switzerland May 3, 1933

20 Claims. (Cl. 86—23)

This invention relates to fuse timing machines and more particularly to the driving mechanism therefor.

In certain known types of fuse timing machines for projectiles it is necessary, when the projectile is introduced thereon, to lock the latter, couple it with the members producing the timing, then liberate it in order to permit its removal from the machine. These operations usually require two separate driving gears, one for the locking and coupling, the other for the timing, an operating lever being provided for each of these operations.

The mechanism according to the invention constitutes a simplification, in the sense that the above operations can be performed by means of one driving member alone.

The mechanism according to the present invention comprises a single driving member which is rotary and concentric with two other members, one of which is intended to produce the locking and coupling of the projectile in and with the timing machine, the other being intended to produce the timing, the whole including means acting in such a way that a rotary reciprocating movement of the single driving member produces in one direction the locking and coupling of the projectile, then its timing, and in the other direction the unlocking and uncoupling of the projectile, and the return of the timing members to zero. A further feature of the invention is the provision of bolting means limiting the displacement of the timing crank to one desired direction to produce the timing of the fuse until an abutment is reached regulating the duration of the timing, its action being then reversed in order to enable the timing crank to return to its starting point, that is to say, to the position of zero.

The drawings represent, by way of example, three forms of construction of a mechanism according to the invention.

Fig. 1 is a fragmentary view partly in elevation, and partly in section of a device according to this invention, the parts being in the position before the timing and introduction of a projectile.

Fig. 2 is a sectional view taken on line II—II of Fig. 1.

Fig. 3 is a view similar to Fig. 1, the projectile however being in place and the mechanism being in the position in which it has locked and coupled the projectile and in which the timing is about to commence.

Fig. 4 is a fragmentary view illustrating a detail modification.

Fig. 5 is a fragmentary view similar to that of Fig. 1, of a second form of construction, in which coupling is effected by eccentric tightening members.

Fig. 6 is a sectional view similar to that of Fig. 2, but relating to a third form of construction, in which coupling is effected by friction.

Figs. 7 and 8 are detail views of modified link and lever constructions employed in the present invention.

Figs. 9 and 10 are fragmentary front elevational and vertical views of means for the automatic control of the direction of rotation of the driving shaft.

An apparatus for carrying out the present invention comprises a support for a projectile for holding the same while the timing operation takes place. The shell support has not been shown in the drawings, however, as there are various types of supports known to the art.

To securely retain the projectile 8 in its support during timing, an eccentric locking member 7 is provided, which is actuated by a link 9.

A coupling member 3 is provided and is equipped with wheels 6 adapted to cooperate with the timing member 5 of projectile 8 (see Fig. 3). The coupling member 3 is slidably mounted on a splined hollow shaft 4 so that it will rotate with this shaft. A pinion 2 is affixed to the hollow shaft 4 for transmitting rotary motion from crown gear 1 (Fig. 2) to shaft 4 and the coupling member 3.

As clearly shown in Figs. 1 and 3, link 9 is connected to a link 10 which, in turn, is connected to one end of a rock lever 11. The other end of lever 11 is connected by a link 12 with a lug 20 on a toothed rim 19 hereinafter described. Link 10, at a point intermediate its ends, is provided with means cooperating with a groove in coupling member 3 for shifting said coupling member. When lever 11 is rocked in a clockwise direction link 10 acts as a lever and rocks in a counter-clockwise direction to move link 9 downwardly and to shift coupling member 3 in an upward direction to couple the same to the timing member 5 of projectile 8.

After the projectile has been introduced into the timing machine, it must first of all be locked and the timing members thereof coupled to the corresponding members of the said machine, that is to say all the members 9, 10, 11, 12 must be moved in the direction indicated by the arrows shown beside these members in Fig. 1.

When this first operation is terminated, the timing crown 1 must be actuated, by rotating it to the angle required for timing which it is desired to obtain.

Having done this, the projectile must be disengaged and separated from the timing machine by movements of the members 9, 10, 11, 12 in an opposite direction to that indicated by the arrows in Fig. 1.

Finally, the projectile being released and uncoupled from the machine, the timing crown 1 must be returned to zero by a rotation equal and contrary to the former which produced the timing.

For this purpose, the driving shaft 14 carries a disc 15 keyed upon it and provided with a certain number of circular orifices 16, six in the present case.

The timing crown 1 is freely rotatably mounted on driving shaft 14 and is connected to a disc 17 by pillars 18. As shown, there are six pillars 18 and each of these passes through one of the circular orifices 16. The rim or crown 19 with interior double set of teeth surrounds the edge of the disc 15, so as to present teeth on both surfaces of the latter.

Pairs of pawls 21, 22 are carried by disc 15 and are adapted to cooperate with the teeth of the rim or crown 19 to selectively prevent and permit relative rotation between the disc and crown. As shown, one pawl of each pair is arranged on one side of an orifice 16 and the other pawl of the pair is arranged on the opposite side of the orifice. Each pawl is provided with an arm 23, and springs 24 resiliently connect the arms of each pair of pawls together, thereby tending to urge the operative portion of both pawls into engagement with the teeth of crown 19. As appears both from Fig. 1 and Fig. 3, the pillars 18 may, according to their position, abut against these extensions 23, which has the effect of causing the pawl thus reached to turn to a position where it ceases to be in engagement with the teeth of the crown 19, whereas the opposite pawl under the influence of the corresponding spring 24, remains in engagement with the said teeth.

The mechanism operates as follows:—

At rest, as shown in Fig. 1, the disc 15 with its pawls occupies such a position that the pillars 18 act on the three pawls 21, which are separated from the teeth of the crown 19, whereas under the action of the springs 24, the pawls 22 are applied against the said teeth, therefore in engagement with them. The whole is locked in this position by a plunger 25 engaging in a corresponding notch 26 of the crown 19 and of the disc 15.

On introducing the projectile into the machine, the front end of the latter exerts a pressure in the direction of the arrow 27 on the rod 28, which action, through the intermediary of the racks 29, 30 and pinion 31 effects the extraction of the plunger 25 from the notch 26. This position of the members 25 and 28 is shown in Fig. 3.

In order to then proceed with the timing, a rotating movement in the direction of the arrow 32 is transmitted to shaft 14, which movement is communicated to the disc 15 and its orifices 16.

The pawls 22 being in engagement with the teeth of the crown 19, the latter is involved in this movement, together with the lug 20 and, consequently, the connecting rod 12 whence results a movement of the latter and of the members 9, 10, 11 in the direction in which the locking of the projectile and its coupling with the timing members is effected.

At a given moment, the different parts of the mechanism occupy the position shown in Fig. 3 which represents the end of the locking and coupling and the commencement of the timing. At this moment and in its rotating movement, the disc 15 has so displaced its orifices 16 that their edges encounter the pillars 18 at a point opposite to the point at which they encountered them at the moment of starting (position of Fig. 1). This encounter which also affects the pawls 21 has the effect of releasing the latter from their engagement with the inner teeth of the crown 19 against which the pawls 22 are now applied, the crown 19 ceases, at this same moment, to be driven by the disc 15, that is to say the locking and coupling of the projectile are terminated, but at this same moment, the pillars 18 are driven by the movement of the disc 15 and, with them, the timing crown 1 and the timing is effected.

It is obvious that, as in any timing machine, the movement of this crown will be limited by a regulatable abutment not illustrated, which determines the value of the timing desired.

When the limit of movement is reached, the shaft 14 is given a return movement in the direction opposite to that indicated by the arrow 32 which starts a further succession of operations.

In the first place, and owing to the fact that the pawls 21 which, after having, during the timing rotation, ridden over the teeth of the crown 19 are now in engagement with the latter, the crown 19 is driven by the rotation of the disc 15 and moves back the connecting rod 12 into its original position shown in Fig. 1 and thus frees the projectile which is no longer locked in the machine nor coupled to the mechanism of the latter. This movement continues until the displacement of the disc 15 is such that the edges of its orifices 16 again encounter the pillars 18. At this moment, the said pillars again acting on the pawls 21 place the latter in the position shown in Fig. 1, in which position the driving of the crown 19 ceases, while the pillars 18, now driven, drive in their turn the timing crown 1 for its return to zero.

It is to be observed that at the moment of the timing (direction of the arrow 32) the shaft 14 has rotated through an angle, which I will call x, corresponding to the play allowed by the orifices 16 of the disc 15 in view of the pillars 18, this angle corresponding to the locking and coupling operation, afterwards the shaft moves through a second angle, which I will call y, corresponding to the timing operation.

At the return (direction opposite to that of the arrow 32) the movement first travels through the angle x of disengagement of the projectile, then through the angle y of return of the timing members to zero.

Whereas x is an invariable angle determined by construction, the angle y naturally varies with the timing value that it is desired to obtain.

As can be seen the projectile can be timed by means of a single driving gear necessitating one movement of the shaft 14 first in one direction and then in the opposite direction.

It is to be remarked that while the movement is through the timing angle y in either direction, there is always a pawl of each pair which rides over the teeth of the crown 19.

As shown in Fig. 2, there is on each side of the disc 15 a set of teeth belonging to the crown 19, so each pawl referred to in the present description is doubled on either side of the disc 15. It is clear however that the pawls could be provided on only one surface of this disc.

The plunger 25, is subjected to the action of a spring 33, so that at the moment of the return to zero, the projectile being extracted from the

machine, the members of the latter are automatically locked owing to the fact that this plunger 25 jumps into the notch 26.

Fig. 4 shows a modification of the pivot 34 articulating the connecting rod 12 to the lever 11, in that the connecting rod 12 has an elongated orifice 35. At the moment of the return to the starting position of the various members of the mechanism, it may happen that the pawls 22 may fail to fall into the teeth in which they are to engage at the position or rest, but will remain, or one of them will remain leaning against the ridge of the said tooth. Owing to the elongated orifice 35 the crown 19 is then enabled to move slightly and the pawl to penetrate correctly into the interdental space. The play allowed by the lengthening of this crifice will not be greater, but preferably slightly less than the play needed to enable the crown to rotate through an arc equal to one tooth.

In the form of construction shown in Fig. 5, the crown 36 is constructed similarly to crown 19 just described, but has no teeth. Since its engaging surface is smooth the pawls are replaced by eccentric tightening members 37 acting exactly as the pawls of the former example act. When the pillars 38 encounter the eccentric tightening members of one of the groups, they are caused to turn and produce, through the intermediary of the springs 39, a tightening effect through the members of the other group. Fig. 5 shows these various members in the position which they occupy at starting, that is to say, before locking has been effected and before the coupling and timing.

A further modification is shown in Fig. 6. On the driving shaft 40 is keyed by means of the key 42 a smooth disc 43 provided with circular orifices as in the other forms. A crown in two parts 44, 45 intended for the driving of the locking and coupling members of the projectile, bears at the edge of the disc 41 on both surfaces of the latter, by reason of an elastic tension caused by the bolts 46 and elastic washers 47. Owing to this tension comparatively high friction is created between the crown 44, 45 and the disc 43.

The working of this mechanism is simple, when the disc 43 is set in motion by means of the shaft 40, the former drives by friction the crown 44, 45, which movement produces the locking and coupling of the projectile. This operation being terminated and the angle of rotation passed completing the play of the pillars in the circular orifices, the disc 43 drives the timing disc 41 through the intermediary of the crown, producing the timing in the way described in the former examples.

At the return movement and through the effect of the friction between disc 43 and crown 44, 45, the unlocking and uncoupling is produced first, after which the replacement at zero of the timing crown 41 is effected by the driving of the pillars by the central disc 43.

It goes without saying that a mixed solution of the different forms of construction above disclosed can be contemplated for instance, a normal drive by pawls and a supplementary friction device in case the driving pawls should get out of order.

Fig. 7 shows a further modification involving the connecting rod 12. The members are represented in full lines in the unlocked-uncoupled position and in broken lines in the reverse position. The parts are secured in these two positions by a spring 48 attached, on one side to the pivot 34, on the other side to a pivot 49 of the framework so arranged that, in both positions of the lever 11 and connecting rod 12, the spring acts first on one side, and then on the other side of the pivot 13. Between these two positions there is a dead point beyond which the spring 48 will extend to pull the pivot 34 into one or the other of its two outermost positions.

Another way of arriving at the same result is represented in Fig. 8. Here a plate 50 is connected to the lever 11 said plate having a slot 51 in which can slide a pin 52 to which is attached a spring 53, the other end of which is secured, at 54, to the framework of the machine. When the pin 52 slides along the slot 51, it starts from a position more distant from the centre 13, and passes through a position nearer this centre, and, at the other end of the slot, is in a more distant position. In properly selecting the position of the point of attachment 54, it can be seen, that left to itself, the plate 50 can occupy, under the action of the spring 53 only the two outermost positions represented in the drawings, one in full lines, the other in broken lines and which correspond to the positions of locking and unlocking of the machine.

The present invention also contemplates the provision of means for insuring that once the driving shaft carrying the disc 15 is placed in motion, it must complete its movement to properly time the fuse of the projectile before it can be moved in the reverse direction.

In Figs. 9 and 10 is illustrated the locking means provided in order to compel the operator to effect the complete operation which corresponds to the prescribed timing. When he has arrived at the end of the course, he has also to bring the crank back to its starting point. This device is composed of a double toothed pawl 55 capable of rocking about a pivot carried by the member 56 keyed on the driving shaft 57.

This pawl cooperates with a toothed ratchet 58 fixed on the stationary casing 59. There is also pivoted to member 56 an arm 63, the rocking movement of which is limited by pin and slot connections with member 56. A spring 64 is attached to the end of arm 63 and to a pin 65 slidably mounted in a slot 66 of pawl 55. As arm 65 is moved from one side of a radial line passing through the axes of shaft 57 and the pivot of pawl 55 to the other side, the spring 64 serves to retain the arm and pawl in the new position.

The arm 65 is actuated by a pin 60 carried by the stationary casing and by a pin 61 carried by a regulating wheel 62 freely mounted on shaft 57 and adapted to be moved to determined fixed position to regulate the timing of the projectile fuse.

At the time of placing a projectile in the timing machine, pawl 55 is in engagement with pin 60 and has been shifted to a position to permit rotation of shaft 57 only in a direction to move pawl 55 away from pin 60. This movement is permitted until pawl 55 engages pin 61 carried by wheel 62 which has been set at a determined position. Upon striking pin 61 pawl 55 is shifted and further movement of shaft 57 in the same direction is prevented and shaft 57 can then be moved only in the opposite direction until pawl 55 is again engaged by pin 60.

What I claim as my invention and desire to secure by Letters Patent of the United States is:—

1. Mechanism for timing fuses for artillery projectiles, comprising a driving member, a second member for locking and coupling the pro-

jectile in the timing machine, a third member for effecting the timing, said driving member being rotary and concentric with said second and said third member, means operable upon a rotary movement of the driving member in one direction to effect first the locking and coupling of the projectile and then its timing, and in the other direction first the unlocking and the uncoupling of the projectile and then the return of the timing members to zero, a timing shaft, locking means allowing the displacement of said timing shaft only in one desired direction to produce the timing of the fuse, an adjustable abutment regulating the duration of this timing and means for reversing the locking means to allow said timing shaft to return it to its starting point.

2. In mechanism for timing fuses for artillery projectiles, a timing device, means for locking a projectile in the mechanism and coupling it to the timing device, a shaft, a rotary member for effecting operation of the locking and coupling means, a driving member in the form of a disc mounted on said shaft and having orifices, a timing member for driving the timing device and having pillars extending through said orifices, the whole being so arranged that play between said pillars and said orifices allows free displacement of said disc in relation to said pillars through an angle corresponding to the angle of rotation of the member effecting the locking and coupling of the projectile, and means for driving said last mentioned member by said driving disc.

3. In mechanism according to claim 1, means for driving the member effecting the locking and coupling of the projectile comprising a crown placed on said member upon which it is applied by elastic pressure, so as to participate in a rotating movement of said member until it reaches a limit position; and means for immobilizing said mechanism until a projectle is introduced into said mechanism.

4. In mechanism according to claim 1, means for immobilizing the same comprising a plunger adapted to engage in a notch of the driving member and of the member intended to produce the locking and coupling of the projectile, and means operable upon the introduction of a projectile into the mechanism for removing the plunger from the notch.

5. In mechanism according to claim 1, means for immobilizing the same comprising an elastic member acting on a transmission lever of the locking and coupling means, said elastic member occupying such a position in relation to the centre of rotation of this lever, that it tends to keep it in one or the other of two furthest positions, on each side of a dead point.

6. In a fuse timing machine, means for locking a projectile to be timed in said machine, a timing member, a driving member, a clutch for connecting said driving member to the projectile locking means, and lost motion means operable for connecting the driving member to the timing member after the driving member has actuated the projectile locking means.

7. In a fuse timing machine, means for locking a projectile to be timed in said machine, a timing member, a driving member, means for connecting said driving member first to the projectile locking means and subsequently to the timing member to effect operation thereof, means for limiting the movement of said driving member to effect the timing of the projectile, and means for adjusting the position of said driving member limiting means.

8. In a fuse timing machine, means for locking a projectile in the machine, a timing member, a coupling device for connecting the timing member to the fuse timing element of the projectile, a drive shaft, means for transmitting motion from the drive shaft to the locking means and coupling device, and lost motion means operable after locking and coupling have been effected to transmit motion from the drive shaft to the timing member to effect timing of the projectile.

9. In a fuse timing machine, means for locking a projectile in the machine, a timing member, means for coupling the timing member to the fuse timing element of the projectile, a drive shaft, means for transmitting motion from the drive shaft first to the locking and coupling means and after locking and coupling have been effected to the timing member to effect timing of the projectile, means for limiting the rotation of the drive shaft to one direction until the timing has been completed and then limiting the rotation of the shaft to the opposite direction until the shaft is returned to its initial position, and means for adjusting the position of the limiting means to vary the rotation of said shaft.

10. In a machine for timing fuses of projectiles, means for locking a projectile in the machine, a timing member, means for coupling the timing member to the fuse of the projectile, a rotary driving member, means including a linkage and rocking lever for connecting the driving member to the means for locking and coupling the projectile to the machine, a lost motion mechanism for connecting the driving member to the timing member, and means associated with said rocking lever for resiliently urging it from a zone intermediate its extreme positions to either of its extreme positions.

11. In a fuse timing machine for projectiles, means for locking and coupling a projectile in said machine, a toothed rotary member for actuating said means, a rotary timing member, a driving disc, lost motion means connecting said driving disc to said timing member, and pawls carried by said disc and engaging the teeth of said toothed rotary member.

12. In a fuse timing machine for projectiles, means for locking and coupling a projectile in said machine, a toothed rotary member for actuating said means, a rotary timing member, a driving disc, lost motion means connecting said driving disc to said timing member, pawls carried by said disc and engaging the teeth of said toothed rotary member, said pawls being arranged in pairs and positions so that they are effective for driving said toothed member in opposite directions, and means including said lost motion means for actuatng said pawls.

13. In a fuse timing machine for projectiles, a rotary timing member, means for locking a projectile in the machine and coupling the same to the timing member, a rotary element for actuating said means, a driving disc, lost motion means connecting said disc to said timing member, and means for frictionally connecting said disc to said rotary element.

14. In a fuse timing machine for projectiles, a rotary timing member, means for locking a projectile in the machine and coupling the same to the timing member, a rotary element for actuating said means, a driving disc, lost motion means connecting said disc to said timing member, eccentric wedging members carried in pairs by said disc for frictionally engaging said rotary element, one wedging member of each pair pro-

viding a driving connection between the disc and element in one direction of rotation and the other wedging member of each pair providing a driving connection between the disc and element in the opposite direction of rotation, and means including the lost motion means for rendering one of said wedging members of each pair inoperative.

15. In a machine for timing fuses of projectiles, means for locking a projectile in the machine, means for adjusting the time setting of the fuse, driving means common to both the locking and fuse adjusting means for effecting actuation thereof, a clutch for connecting said driving means to the projectile locking means, and a lost motion device for connecting the time setting means to said driving means after the driving means has actuated the projectile locking means, said lost motion device including means for actuating the clutch for disconnecting the driving means from the projectile locking means.

16. In a machine for timing fuses of projectiles, means for locking a projectile in the machine, means for adjusting the time setting of the fuse, driving means common to both the locking and fuse adjusting means for effecting actuation thereof, means for retaining the locking and driving means in inoperative position, and means operable upon placing a projectile in the machine for rendering the retaining means ineffective.

17. In a machine for timing fuses of projectiles, a rotary timing element, means for locking a projectile in said machine, means for coupling said timing element to a fuse setting device on the projectile, a rotary disc mounted in axial alignment with said timing element, said disc having an opening therein and said timing element having a projection extending into the opening in said disc to provide a lost motion connection between said disc and timing element, a rotary member positioned adjacent said disc, means for transmitting operative motion from said rotary member to the locking and coupling means, and means operable by the projection on the timing element for connecting and disconnecting the rotary member to said disc.

18. In a machine for timing fuses of projectiles, a rotary timing element, means for locking a projectile in said machine, means for coupling said timing element to a fuse setting device on the projectile, a rotary disc mounted in axial alignment with said timing element, said disc having an opening therein and said timing element having a projection extending into the opening in said disc to provide a lost motion connection between said disc and timing element, a rotary member positioned adjacent said disc, means for transmitting operative motion from said rotary member to the locking and coupling means, means operable by the projection on the timing element for connecting and disconnecting the rotary member to said disc, a shaft for rotating said disc, a wheel freely mounted on said shaft, a stop carried by said wheel, means for adjusting said wheel to various stationary positions, a stationary casing having a stop mounted thereon, a segmental rack carried by said casing, a member keyed to said shaft carrying a double acting spring actuated pawl engaging with said rack, and means carried by said pawl for engaging said stops to shift the pawl to limit rotation of said shaft to one direction.

19. In a machine for timing fuses of projectiles, a rotary timing element, means for locking a projectile in said machine, means for coupling said timing element to a fuse setting device on the projectile, a rotary disc mounted in axial alignment with said timing element, said disc having an opening therein and said timing element having a projection extending into the opening in said disc to provide a lost motion connection between said disc and timing element, a rotary member positioned adjacent said disc, means for transmitting operative motion from said rotary member to the locking and coupling means, and means for frictionally transmitting motion from the disc to said rotary member.

20. In a machine for timing fuses of projectiles, a rotary timing element, means for locking a projectile in said machine, means for coupling said timing element to a fuse setting device on the projectile, a rotary disc mounted in axial alignment with said timing element, said disc having an opening therein and said timing element having a projection extending into the opening in said disc to provide a lost motion connection between said disc and timing element, a rotary member positioned adjacent said disc, means for transmitting operative motion from said rotary member to the locking and coupling means, and reversible pawl and ratchet means for transmitting motion from the disc to said rotary member during relative movement between said disc and timing element.

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