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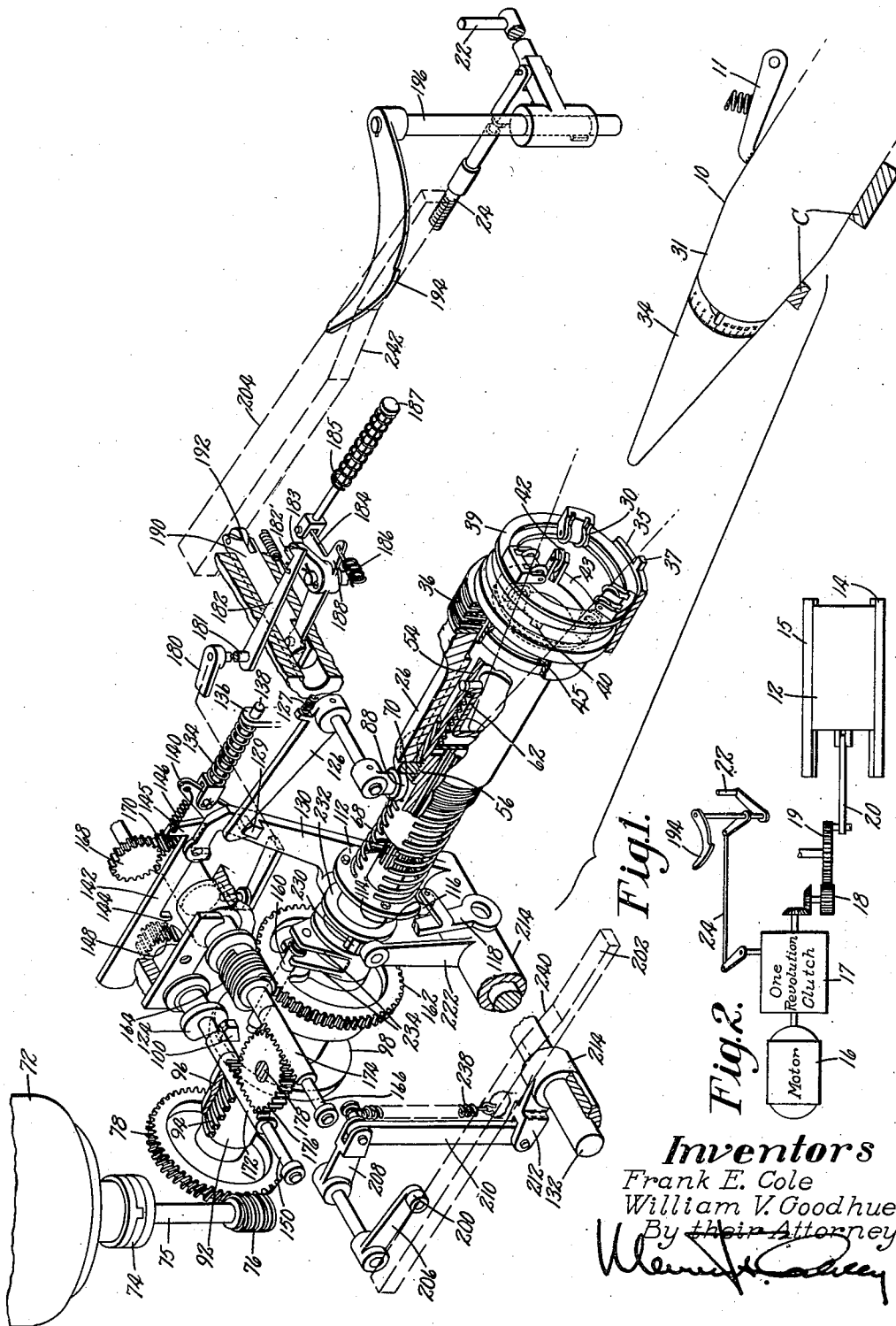
F. E. COLE ET AL.

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FUSE SETTER

Filed July 15, 1946

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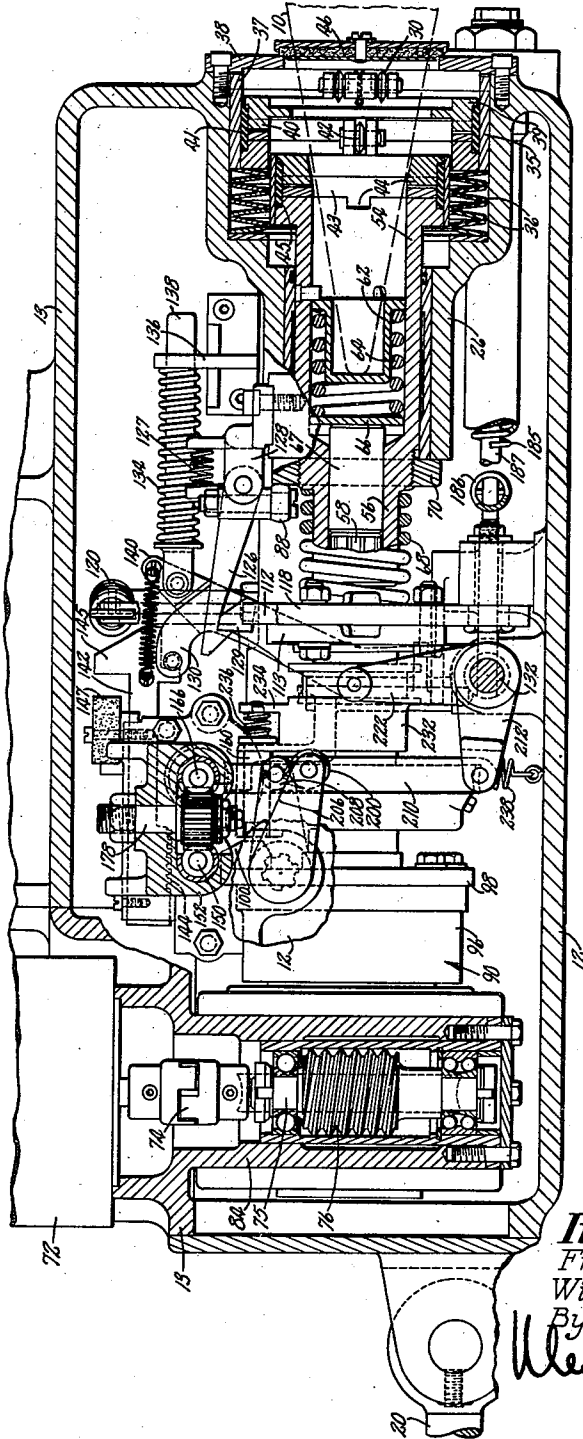
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Fig. 3.



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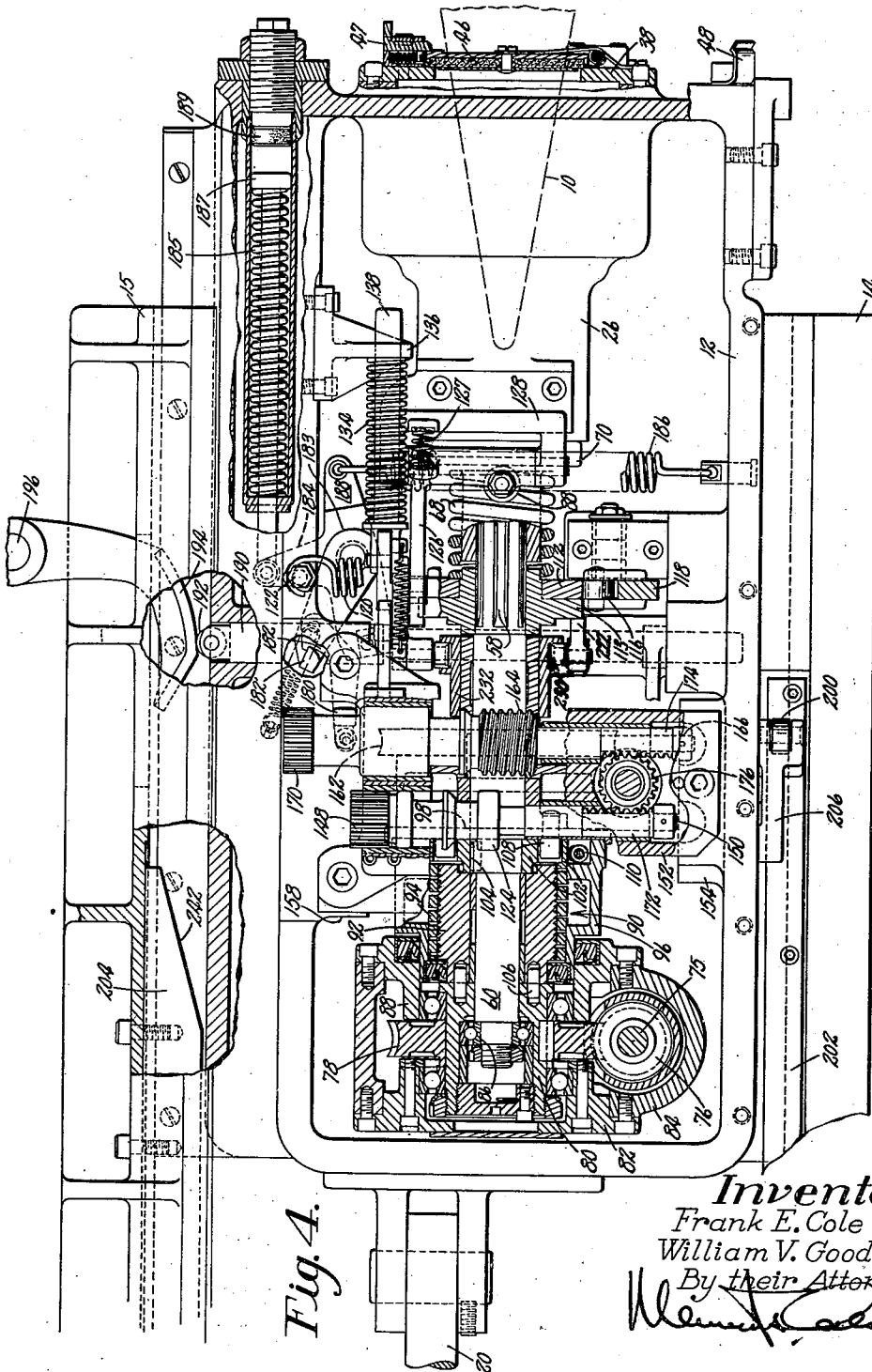
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Fig. 5.

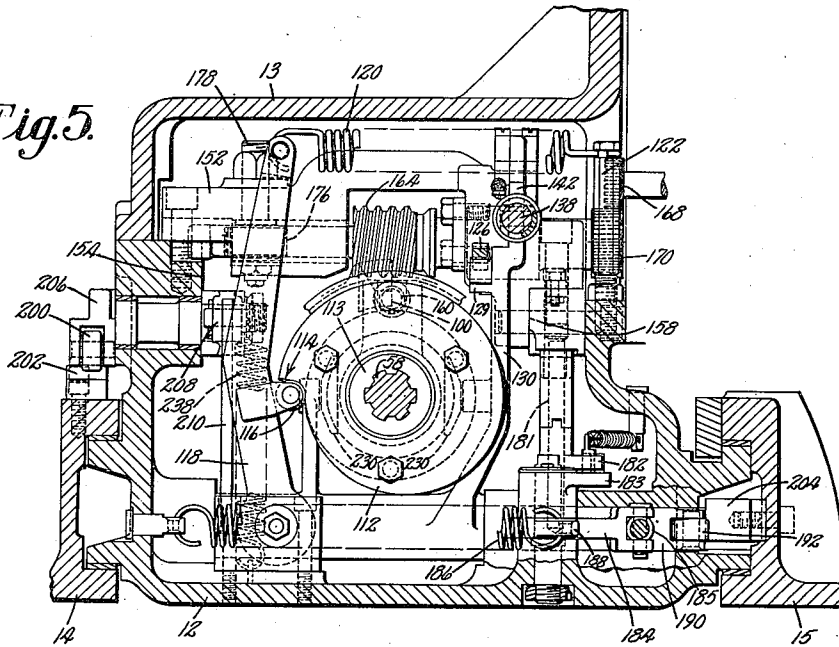
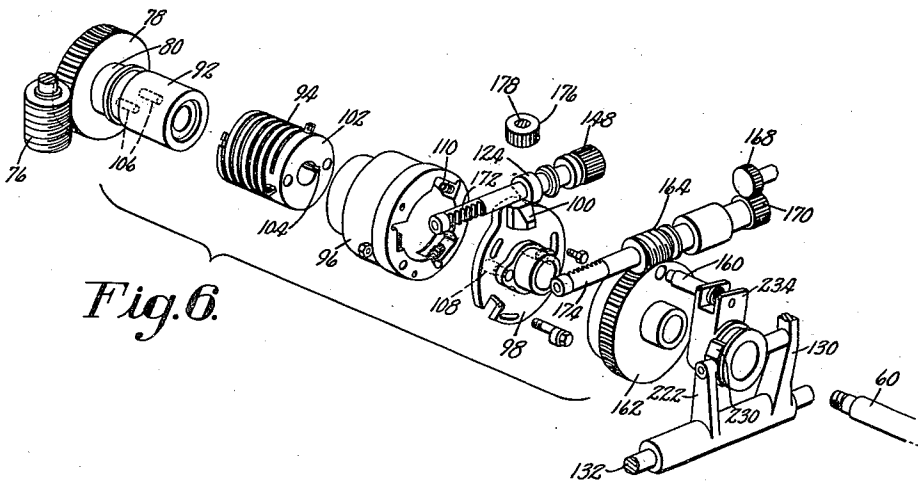


Fig. 6.



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2,442,842

FUSE SETTER

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13 Claims. (Cl. 89—6)

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This invention relates to fuse-setting mechanisms and is herein illustrated as embodied in an arrangement which may readily be combined with a ramming device to enable the cycle of operations to be fast enough so that the device is of particular utility in the firing of explosive shells with time fuses in antiaircraft guns.

One recognized arrangement for setting the fuses of shells just prior to their delivery to a breech-loading gun disposes the fuse-setting mechanism at one side of the gun and arranges for the engagement of that mechanism with a shell which is carried then by the rammer to a position in alinement with the bore of the gun and into the gun. Frequently, such arrangements involve the mounting of the fuse-setting mechanism for sliding movement to bring it over the end of the shell and for subsequent retraction to leave the shell free for lateral movement into alinement with the gun bore.

An object of the invention is the provision of an improved fuse-setting mechanism of the type last described, in which the resetting of the mechanism after it has acted upon a shell is effected during the separation of the mechanism from the shell, so that it will be ready for use in a successive cycle.

A feature of the invention resides in a device for controlling a power mechanism which reciprocates a casing containing the fuse-setting device. The arrangement is such that a power connection to retract the casing is rendered effective upon the completion of the fuse-setting operation. Provision is also made for resetting this device during the retracting movement. As illustrated, the resetting is effected as a result of that movement by engagement of the device, for example, with a fixed cam positioned alongside the movable casing.

Still another feature of the invention is embodied in means for resetting the mechanisms which control the beginning and the extent of the fuse-setting movement. To this end, power means for setting the fuse is made to include a friction clutch controlled by successive stops which start the operation and terminate it, and a fixed cam is provided and herein illustrated as associated with means for resetting the mechanisms which move these stops into and out of operative position.

Other features of the invention reside in an ejector to keep the shell from sticking in the devices which engage it and in self-aligning couplings for the fuse-engaging devices.

These and other features of the invention will

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best be understood from consideration of the following specification taken in connection with the accompanying drawings, in which

Fig. 1 is a diagrammatic view of the working parts of a fuse setter embodying the present invention, the parts being shown in their initial or starting position;

Fig. 2 is a diagram showing how power may be supplied to reciprocate the fuse setter;

Fig. 3 is a vertical section through the fuse setter;

Fig. 4 is a horizontal section through the fuse setter;

Fig. 5 is a transverse vertical section; and

Fig. 6 is an exploded view of a wrap-spring clutch mechanism and associated control stops.

Inasmuch as this fuse setter is of the type which is moved into and out of engagement with a shell 10 (Fig. 1) held in fixed position in a cradle C by means of a clamp 11, the fuse-setter mechanism is mounted within a casing 12 having a cover 13 (Fig. 5), and the casing is arranged for lengthwise reciprocation in ways 14 and 15 which may be mounted upon a gun, if desired, by attaching these ways to the gun cradle. Reciprocatory movement of the fuse-setter casing is effected by power supplied from a motor 16 (Fig. 2) through a one-revolution clutch 17 and one-to-two reducing gears 18, 19, the larger gear 19 acting as a crank for a pitman 20 connected to the casing 12. This mechanism shifts the fuse-setter casing 12 from left to right or from right to left whenever a manual clutch-control handle 22 is moved to the right as viewed in Fig. 1. This control handle is connected to the clutch 17 through a flexible cable 24 and causes one revolution of the output shaft of the clutch and hence a half revolution of the larger gear 19, whenever actuated.

The initial movement of the casing 12 brings fuse-engaging mechanism contained within a neck 26 (Fig. 1), forming a part of the casing, over the pointed end of the shell 10 so that the latter is within the neck 26 in the position indicated in dotted lines. This fuse-engaging mechanism includes three spaced pairs of sharp-edged disks 30 which engage the body 31 of the shell and similarly spaced disks 42 which engage the rotatable fuse portion 34 of the shell. In view of the difficulty of clamping the shell exactly in a predetermined position, the sets of disks 30 and 42 are mounted for self-aligning adjustment and both sets are axially yieldable. The outer disks 30 are held against rotation around the axis of the shell while the inner disks are

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rotatable to turn the portion 34 to any desired setting.

To these ends, the outer disks 30 are carried indirectly by a sleeve 35 slidable in an enlarged portion of the neck 26 against a series of Belleville springs 36. This sleeve is prevented from rotating by lugs 37 thereon which enter notches in an annular closure plate 38 (Fig. 3) held on the casing by screws. The disks 30 are rotatably carried on pins supported by lugs on the outer of three rings 39, the innermost of which is joined to the sleeve 35 by a drive fit. The two outer rings are coupled to the innermost by opposed tongues 40 (Fig. 1) slidably entering notches in the adjacent ring. These tongue and notch couplings are staggered by ninety degrees so as to form in effect an Oldham coupling which renders the disks 30 self-aligning and thus able to compensate for small variations in the position of the cradled shell. The outer peripheries of these rings are grooved to receive an elastic band 41 tending to return the rings to aligned positions. The other set of disks 42, for engagement with the fuse-setting portion 34 of the shell, are carried by a group of rings 43 similarly interconnected by tongues 44 to one another and to a sleeve 54 and are surrounded by an elastic band 45. Associated with the opening in the closure plate 38 is a pivoted cover 46 (Fig. 4) which may be held shut by a latch 47 or may be held open by a spring clip 48. The cover will be held in open position during use of the mechanism but may be closed during periods of transportation or disuse thereof.

As the body 31 of the shell engages the disks 30, the rotatable fuse-setting portion 34 of the shell engages the series of disks 42 carried by and rotatable with the sleeve 54 (Fig. 3) which slides in the neck 26. A reduced portion 56 of this sleeve overlies and fits the fluted end 58 of a fuse-setting shaft 60. Within the sleeve 54, there is an ejector 62 in the form of a flanged cup which is pressed against the tip of the projectile by a preloaded spring 64 which abuts the flange of the cup at the right end and a plate 66 at the left end. This plate rests against a plug 67 abutting the end of the shaft 60. The reduced end 56 of the sleeve 54 is surrounded by a spring 68, urging the sleeve toward the projectile and, threaded on the sleeve, there is a collar 70, for a purpose to be later explained.

Power for the rotation of the fuse-setter shaft 60 is delivered from a vertical motor 72 through a flexible coupling 74 to a shaft 75 carrying a worm 76. The latter engages a worm gear 78 which is splined (Fig. 4) to a hub 80 mounted on ball bearings within a suitable casing 82 forming part of the cover 13. The shaft 75 is similarly provided with bearings (Fig. 3) in an upright casing portion 84. The power of the motor 72 is delivered to the fuse-setter shaft 60 through an interposed wrap-spring clutch 90 which comprises a hub 92, a surrounding wrap-spring 94, a casing 96 and an end plate 98. On this end plate is a stop lug 100 (Fig. 6). The end plate 98 is adjustably attached to the casing 96, and the free end of the spring 94 is pinned to the left end of the casing. The other end of the spring which has a closure 102 is connected to the shaft 60 by means of a key in a keyway 104. On the other hand, the hub 92 of the clutch is joined by pins 106 to the worm gear hub 80. It will be noted that the left or inner end of the fuse-setting shaft 60 is supported by bearings 86 within the hub 80. In the closure 102 for the end of the spring are openings loosely

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receiving pins 108 which are carried by the end plate 98. The engagement of the clutch spring 94 with the hub 92 is effected by auxiliary or booster springs, one of which is shown at 110, which are interposed between the spring closure 102 and the casing 96. These springs apply a wrapping action to the clutch spring 94 when the end plate 98 is free to rotate. If, however, the stop lug 100 on the end plate 98 is held against rotative movement, then, the spring 94 is loose upon the hub 92 and no driving action is effected.

To prevent excessive wear due to too much friction between the spring 94 and the hub 92 when no power is being transmitted, a clutch-releasing cam 112 (Fig. 5) is bolted to a flanged collar 113 (Fig. 4) which is internally ribbed to secure it on the fluted end 58 of the fuse-setter shaft 60 and the cam is provided with a radial surface 114 against which is pressed a roller 116 carried by the mid-portion of a lever 118. This lever is moved toward the periphery of the cam by a heavy spring 120 which is joined to a stud 122 carried by the casing 14 and, when the fuse-setter shaft completes a whole revolution as it is being reset after it has done the desired work, the roller 116 will drop over the corner of the cam and, riding down the radial surface 114, will move the shaft and hence the closed end 102 of the spring 94 clockwise (as viewed in Fig. 1) to a position which will fully release the clutch. The cam 112 is so positioned with respect to the fuse-setter shaft 60 that the roller 116 comes to the brink of the surface 114 just as the stop lug 100 contacts a zero stop 124 (Figs. 1 and 6) which is a segment larger than its supporting rod. The spring 120 is then effective to cause the roller 116, dropping down the radial surface 114 to push the cam and hence the fuse-setter shaft a very small distance clockwise as viewed in Fig. 5.

The wrap-around-spring clutch 90 is rendered effective to drive the fuse-setter shaft as soon as engagement of the shell with the disks 42 has caused a slight endwise movement of the sleeve 54, thereby causing the collar 70 to engage a roller 88 upon a depending portion of a pivoted latch 126 which is carried by a bracket 128 (Figs. 3 and 4) supported upon the neck 26 of the casing and is urged downwardly by a spring 127. This latch 126 when thus tilted up disengages itself from a lug 129 on a lever 130 (Figs. 1 and 3) normally pressed counterclockwise about a supporting spindle 132 by a spring 134 compressed between a bracket 136 and the head of a contained plunger 138, which head is forked and joined to an upward extension 140 of the lever 130. Coacting with a pin in the upper end of this lever 130 is a depending lug on a slidable plate 142 embodying a rack 144 and normally held in engagement with the pin of the lever 130 by a spring 146. When the latch 126 is disengaged, the rack moves to a point where a lug 145 thereon (Fig. 3) hits a stop block 147 and, in so moving, the rack turns a toothed segment 148 fixed on a zero-stop shaft 150 which has on it the zero stop 124. The shaft 150 is capable of limited rotation and is axially slidable for a short distance in suitable bearings provided in a bridge block 152 (Fig. 3) which extends across the casing and is secured at its left end (Fig. 5) to a lug 154 on the inside of the casing 12 and at its other end to a lug 158 on the inner surface of the other side of the casing. In this bridge block 152 are also guides for the rack plate 142. It will be evident from an inspection of Fig. 1 that partial rotation of the segment 148

by the rack 144 will carry the zero stop 124 to a position where it no longer engages the lug 100 and thus allows the end plate 98 of the clutch 90 to be rotated with the fuse-setter shaft 60.

The extent of rotation of the fuse-setter shaft 5 is determined by the engagement of the lug 100 with a data pin 160 which is slidably mounted in a worm gear 162 for movement parallel to the axis of the gear, which meshes with a worm 164 (Fig. 4) upon a short shaft 166 parallel to the stop shaft 150 and capable of slight endwise movement as well as rotation in bearings in the block 152. It is by rotation of this shaft 166 by means of a pinion 168 (Fig. 1) engaging a gear 170 on the shaft that the setting of the fuse is determined. The rotation of this pinion 168 is effected automatically and continuously by means apart from the gun and usually including a director. The two short shafts 150 and 166 are interconnected by reason of the engagement with an intermediate gear 176 (Fig. 4) of racks 172 and 174 which are free to rotate upon the shafts. The gear 176 is freely rotatable upon a stud 178 carried by the bridge block 152 (Fig. 5).

Upon completion of the fuse-setting movement of the shaft 60, the shock of the engagement of the lug 100 with the data pin 160 will cause a slight endwise movement to be imparted to the shaft 166 which will be sufficient to turn a lever 180 (Figs. 1 and 4) upon its upright pivot 181 and thus to rotate a latch 182 (Fig. 5), joined to the lever 180 and at a lower level. This movement of the latch will disengage it from a lug 182' on an upper arm 183 attached to a plunger-bell-crank 184 which is constantly urged to rotate in a clockwise direction, as viewed from above, by a spring 185 (Fig. 4) surrounding a plunger 187 which slides in a casing till it engages an adjustable stop 189 to limit the movement of the bell crank. This movement is also aided by a spring 186 attached to a fourth arm 188 on the lever. The rotation of the bell crank 184 is transmitted (Fig. 1) to a plunger 190 (in alignment with the spindle 132) which carries at its outer end a roll 192 brought by this action against an arm 194 (Fig. 4) attached to the stud 196 of the clutch-release lever 22. This will be effective to re-establish the clutch 17 interposed between the source of power and the pitman 20 so as to move the fuse setter casing 12 to the left away from the end of the shell 10. Any tendency of the knife disks 30 and 42 of the fuse setter to prevent separation of the two is overcome by the spring 64 behind the ejector 62. The compression of this spring is increased when, at the end of the initial movement of the casing toward the shell, the sleeve 54 slides along the plug 67.

The return movement of the casing to the left will be accompanied by a resetting of the fuse-setter mechanism, ready for the next shell. Power for the resetting action will be provided by the engagement of a roll 200 with a track cam 202 (Figs. 1 and 5) supported upon the way 14 and by the engagement of the roller 192 of the plunger 190 with another track cam 204 supported within the way 15.

The roller 200 is mounted on a lever 206 (Figs. 1 and 3) pivoted in the side of the casing and positioned on the outer side thereof. This lever 206 has an extension 208 inside the casing joined by a link 210 to an arm 212 forming part of a sleeve 214 which is rotatable about the supporting rod 132 and is connected to a shipper 230 by an arm 222 and by an extension of the lever 130. The shipper 230 rides between the flanges 75

of a spool 232 which is slidable on the hub of the worm gear 162. The spool has arms 234 (Figs. 1 and 3) which support the data pin 160 and between them there is positioned a spring 236 engaging a shoulder of the data pin to press it toward the end plate 98 of the clutch. The resetting roll 200 is held against the track cam 202 by a spring 238 attached at its lower end to the bottom of the casing and at its upper end to a pin joining the lever arm 208 with the link 210.

It follows, then, that the movement of the casing to the left as the resetting roll 200 rides up an incline 240 of the track cam 202 will cause a withdrawal of the data pin 160 and, through the lever 130 and the rack 144, will rotate the zero stop 124 into position for engagement by the lug 100 as the latter, released by the data pin, turns under the force of the wrap-spring clutch 90 to come back to its zero position. The thump which is imparted to the zero stop 124 by the lug 100 moves the stop shaft 150 slightly endwise and, through the action of the interconnecting gear 176, draws the parallel shaft 166 to the left, as viewed in Fig. 1, so that the latch 182 is moved into position for reengagement with the lug 182' on the plunger-bell-crank 184. The plunger 190 has already been pushed back by reason of engagement of the plunger roll 192 with the deflecting surface 242 upon the track cam 204. Inasmuch as the fuse-setting jaw-carrier sleeve 54 has already moved away from the shell, the spring 68 will have pushed the collar 70 back against the end of the neck 26, thus permitting the latch 126 to be pressed downwardly by its spring 127, ready for engagement with the lug upon the lever 130 as the latter is pushed back against its spring 134 by the action of the resetting roll 200. It will be understood that the wrap-spring clutch 90 was opened upon engagement of the stop lug 100 with the zero stop 124 and that, consequently, the fuse-setter shaft 60 is at rest, ready for operation upon the next shell to be engaged.

In the operation of the device, assuming that a shell has been positioned in the cradle C, the operator will pull upon and then release the handle 22. This will cause the first sliding movement of the casing toward the shell to bring the disks 30 into engagement with a fixed portion of the shell and the disks 42 into engagement with the turnable portion 34. As this sliding movement terminates, the sleeve on which the inner disks 42 are mounted will trip the latch 126 and release the lever 130 to cause the zero stop 124 to be turned out of the way of the lug 100. A turning movement will then be imparted to the fuse portion 34 which will be terminated when the lug 100 hits the stop pin 160. It is then desired to separate the fuse setter from the shell as promptly as possible, and this is done by a second sliding movement of the casing which will be caused by releasing the plunger 190 and allowing it to fly out and hit the clutch-operating lever 194, the release of the plunger resulting from the slight endwise movement imparted to the worm shaft 166 and the consequent turning of the latch 180, 182.

During the return movement of the casing to its starting position, various mechanisms are reset, ready for the next operation. One of these is the plunger 190 which will be reset by engagement of the roller 192 with the inclined portion 242 of the track cam 204. This plunger will be held in reset position by the latch 180, 182. Another resetting operation will be effected by en-

gagement of the roll 200 with the track cam incline 240. This will turn the sleeve 214 clockwise as viewed in Fig. 1 and move the lever 130 back into position to be re-engaged by the latch 126. The data pin will also be withdrawn, thus allowing the lug 189 to turn back until it hits the zero stop 124. The jar imparted by this movement will shift the racks engaging the gear 176 and will thus reset the latch 180, 182. Thus, when the movement of the casing back to its starting position is completed, the fuse setter will be repositioned, ready for the next operation.

Having thus described the invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. A fuse-setting device comprising a casing movable with respect to a shell and having a fuse-setting device rotatably supported by said casing and mounted also for limited endwise movement in the casing upon engagement thereof with a fuse to be set, means for rotating said fuse setter comprising a driven clutch-operated member, zero stop means for engaging said member arranged to disengage the clutch, a withdrawable stop pin for determining the limit of fuse-setting movement of said member, and means rendered effective by endwise movement of the fuse-setting device to withdraw said zero-stop means and to start the fuse-setting operation.

2. In combination, a support for a shell having a fuse to be set, a casing mounted for movement toward and away from said shell support, a fuse-setting mechanism in said casing, means responsive to engagement between said mechanism and the shell for starting the fuse-setting movement, and means rendered operative at the end of the fuse-setting movement for moving the casing to withdraw the fuse-setting mechanism from the shell.

3. In combination, a shell support and a mechanism including a rotatable fuse-setting device mounted for relative movement of approach and separation, power-driven means for rotating the fuse-setting device, a friction clutch interposed in said rotating means, means responsive to engagement between the fuse-setting device and the shell for closing said clutch to start the fuse-setting operation, means for limiting the fuse-setting movement arranged to open said clutch, and means rendered operative in response to the completion of the fuse-setting operation for causing relative movement of separation between the fuse-setting mechanism and the shell support.

4. In combination, a shell support and a mechanism including a rotatable fuse-setting device mounted for relative movement of approach and separation, power-driven means for rotating the fuse-setting device, a friction clutch interposed in said rotating means, means responsive to engagement between the fuse-setting device and the shell for closing said clutch to start the fuse-setting operation, means for limiting the fuse-setting movement arranged to open said clutch, means rendered operative in response to the completion of the fuse-setting operation for causing relative movement of separation between the fuse-setting mechanism and the shell support, and means actuated during said separating movement for resetting said clutch-operating means.

5. In combination, a shell support, a fuse-setting mechanism including a rotatable fuse-engaging device, said support and said mechanism being mounted for relative movement to bring the mechanism into engagement with the

shell, a power mechanism for producing said relative movement, power-driven means including a friction clutch for rotating said fuse-engaging device, a zero stop for holding said clutch open, means operable upon engagement of the device with the fuse to move aside the zero stop to cause a fuse-setting movement, a settable member for limiting the extent of the fuse-setting movement arranged to again open the clutch, and means operable upon completion of the fuse-setting movement, as determined by said settable means, for rendering effective the power mechanism to cause relative separating movement between the fuse-setting mechanism and the shell support.

6. In combination, a fuse-setting mechanism and a shell support mounted for relative movement of approach and separation, power means for effecting the relative movement, means to trigger a fuse-setting operation, spring-loaded means for starting separating movement between the fuse-setting mechanism and the shell support, means rendered operative in response to the completion of the fuse-setting operation for releasing said spring-loaded means to cause said separating movement, and cam means for resetting said spring-loaded means.

7. In combination, a slidably supported casing containing a fuse-setting mechanism, manually controlled power means for sliding the casing to bring the fuse-setting mechanism into engagement with a shell and causing a fuse-setting operation, means rendered operative in response to the completion of the fuse-setting operation for again causing a sliding movement of the casing to separate the fuse setter and the shell, and a cam relatively fixed with respect to the casing for resetting the latter means during a return movement of the casing.

8. In combination, a shell support, a slidably mounted casing having a fuse-setting mechanism therein, power means for reciprocating the casing having a clutch arranged upon each operation to cause a one-way movement of the casing, spring-loaded means to cause one of the clutch operations, means rendered operative in response to the completion of the fuse-setting operation for releasing said spring-loaded means, and a cam fixed beside the casing for resetting said spring-loaded device.

9. In combination, a shell support, a slidably mounted casing having a fuse-setting mechanism therein, power means for reciprocating the casing having a clutch arranged upon successive operations to cause a one-way casing movement of approach or return, settable means for starting a fuse-setting operation, and a cam fixed beside the casing for resetting said settable means upon return movement of the casing.

10. In combination, a shell support, a slidably mounted casing having a fuse-setting mechanism therein, power means for imparting movements of approach and return to the casing, said fuse-setting mechanism including a withdrawable stop for limiting the extent of the fuse-setting movement, a friction clutch in the fuse-setting mechanism arranged to be opened by said stop, a fixed cam beside the casing, and means cooperating with said cam for withdrawing said stop upon return movement of the casing to permit the clutch to return the fuse-setting mechanism to starting position.

11. In a fuse-setting mechanism, a device for engaging the fuse of a shell upon relative movement of the shell and the device to bring them together, an ejector engaging the shell, a loaded

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spring acting on said ejector, and means responsive to the completion of the relative movement between the shell and the fuse-engaging device for increasing the loading on said spring.

12. In a fuse-setting mechanism, successive rings adapted to surround the fixed and fuse portions of a shell presented to the mechanism, at least three shell-engaging devices upon each of said rings, means for rotating one of said rings to effect a fuse-setting operation, means for holding the other ring against rotative movement, annular supports for said rings, and self-aligning

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couplings between said rings and said supports.

13. In a fuse-setting mechanism, adjacent rings substantially in alinement, at least three shell-engaging members on each of said rings adapted respectively to engage the body of the shell and the fuse portion thereof, yielding mounts for said rings, means for rotating the ring which engages the fuse portion with respect to the other, and Oldham couplings for said rings to cause them to be self-aligning.

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