

Nov. 12, 1940.

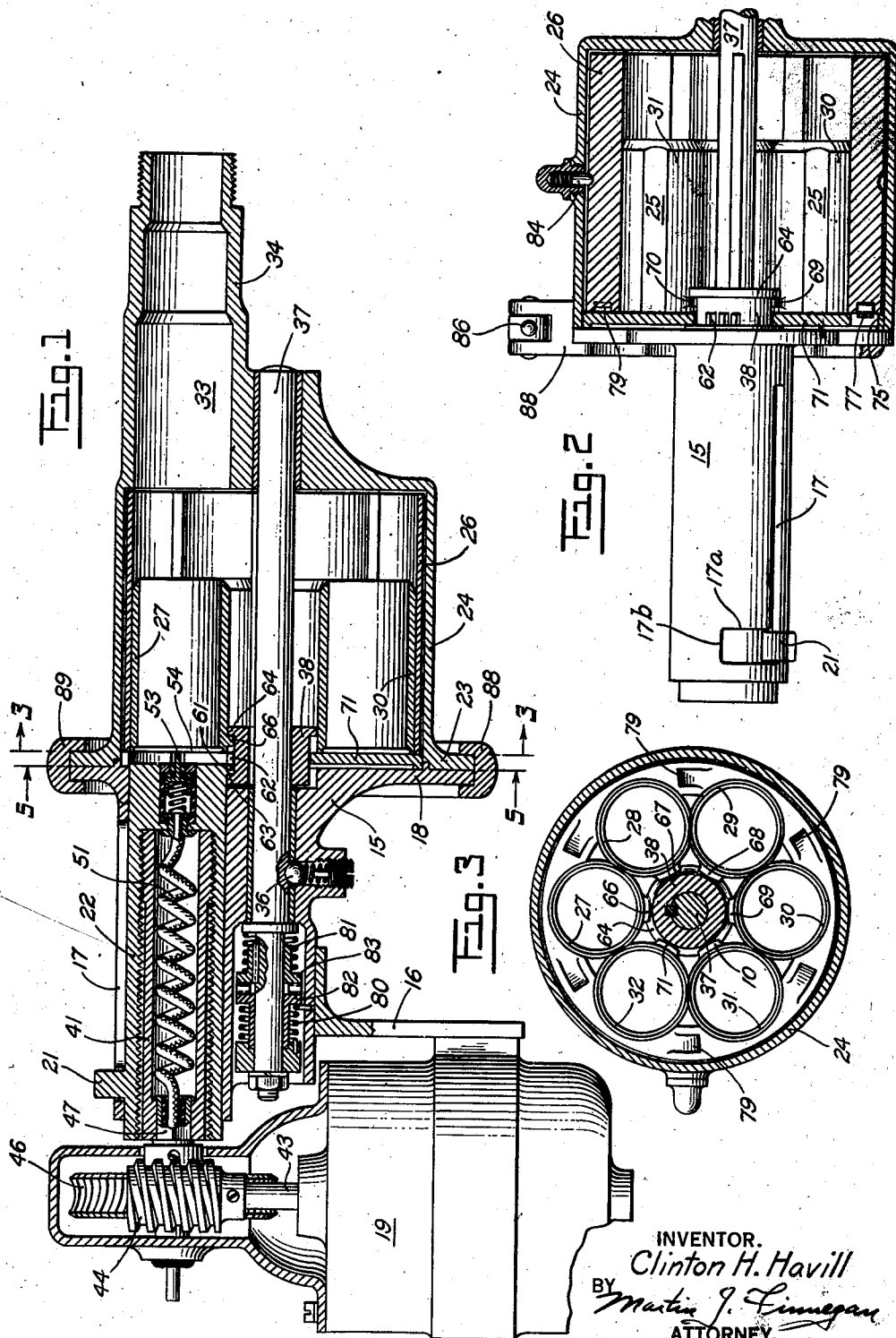
C. H. HAVILL

2,221,706

BREECH CONSTRUCTION AND OPERATION

Filed July 7, 1938

2 Sheets-Sheet 1



INVENTOR.
Clinton H. Havill
BY *Martin J. Linnegren*
ATTORNEY.

Nov. 12, 1940.

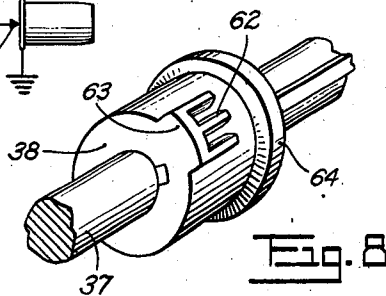
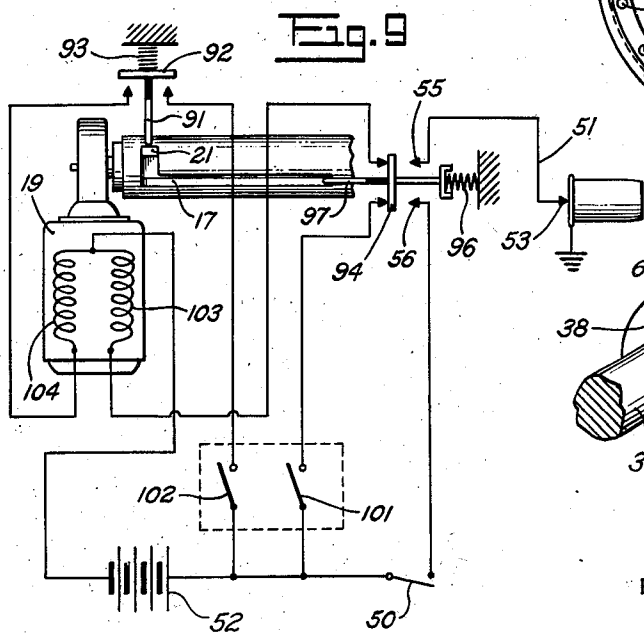
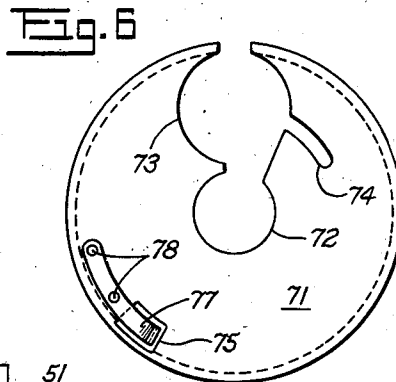
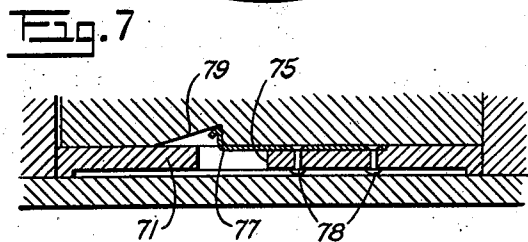
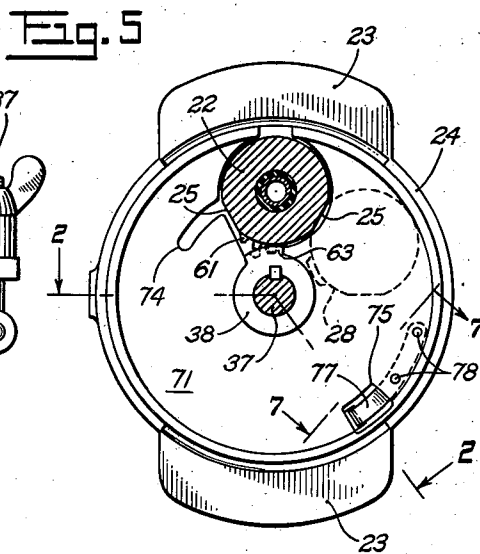
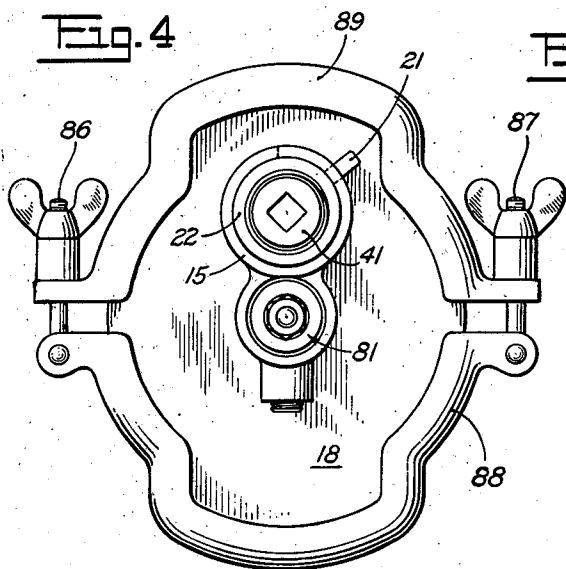
C. H. HAVILL

2,221,706

BREECH CONSTRUCTION AND OPERATION

Filed July 7, 1938

2 Sheets-Sheet 2



INVENTOR.
Clinton H. Havill
BY *Martin J. Linnegan*
ATTORNEY.

UNITED STATES PATENT OFFICE

2,221,706

BREECH CONSTRUCTION AND OPERATION

Clinton H. Havill, South Orange, N. J., assignor to
Eclipse Aviation Corporation, East Orange,
N. J., a corporation of New Jersey

Application July 7, 1938, Serial No. 217,939

7 Claims. (Cl. 42—1)

This invention relates to explosives, and particularly to explosives of the "slow burning" type, in powder form, adapted to be packed in a suitable casing, or cartridge, and ignited to cause generation of a gas to be fed through a conduit, when the cartridge is properly positioned in the firing chamber of the breech.

An object of the invention is to provide novel means for housing and successively firing a group of cartridges, each containing a charge of powder from which the gases generated by the burning of the powder may be directed into a motor adapted to be actuated by the pressure of such gases.

A further object of the invention is to provide, in a cartridge firing breech of the foregoing character, novel means for positioning the cartridges so that each is successively brought into registry with the conduit leading to the motor to be actuated.

Another object of the invention is to provide motor driven means for producing successive lateral and longitudinal movements of the cartridges, the lateral movement being to shift the cartridge into alignment with the outlet conduit and the longitudinal movement being to place the cartridge into the entering passage of the conduit. In this connection a feature of the invention is the provision of novel actuating means whereby all cartridges are shifted laterally as a unit while only the single cartridge which is first to be fired is shifted longitudinally, and whereby longitudinal shifting is brought about automatically in predetermined relationship to the lateral shifting and by the same power actuated means.

Another object of the invention is to provide, in a power actuated cartridge mechanism of the foregoing character, novel means for controlling energization and direction of rotation of the prime mover of the power actuating means and for automatically de-energizing the prime mover and firing the cartridge at the termination of the cartridge positioning action.

These and other objects of the invention will become apparent from inspection of the following specification when read with reference to the accompanying drawings wherein is illustrated the preferred embodiment of the invention. It is to be expressly understood, however, that the drawings are for the purpose of illustration only, and are not designed as a definition of the limits of the invention, reference being had to the appended claims for this purpose.

In the drawings:

Fig. 1 is a longitudinal sectional view of a device embodying the invention;

Fig. 2 is a longitudinal view partly in elevation and partly in longitudinal section of a portion of the device shown in Fig. 1, the path of view being at right angles to that of Fig. 1, and the sectioned portion being taken along the line 2—2 of Fig. 5;

Fig. 3 is a transverse sectional view along the line 3—3 of Fig. 1;

Fig. 4 is an end view in elevation taken from the left-end of Fig. 1 but assuming that the motor drive as shown in Fig. 1 has been removed;

Fig. 5 is a transverse view along the line 5—5 of Fig. 1;

Fig. 6 is an elevation view of the indexing plate as seen from the side opposite to that from which it is viewed in Fig. 5;

Fig. 7 is an enlarged sectional view of the one-way driving means between the indexing plate of Fig. 6 and the cartridge barrel, and taken approximately along the line 7—7 of Fig. 5, the view being schematic rather than an actual mechanical section of these parts;

Fig. 8 is an enlarged perspective view of the cartridge shifting carriage; and

Fig. 9 is a diagrammatic view of the electrical parts and connections of the system.

In the several views the reference character 15 designates a supporting frame having an extending bracket 16, and an L-shaped slot 17 in the cylindrical portion thereof and terminating in a flange 18; the bracket 16 being for the support of the prime mover 19, the slot 17 for the reception of the radial projection 21 constituting part of the motor driven nut 22, and the flange 18 being adapted for registry with a corresponding flange 23 of the housing 24 in which the barrel 26 is rotatable step by step to bring the cartridge containing cylinders 27 to 32, inclusive, successively into alignment with the entrance portion 33 of the outlet conduit 34 which, as shown, is integral with the frame 24. A rod 37 constitutes a guide rail on which the cartridge shifting carriage 38 is splined for longitudinal movement along said rod and for the transmission of a limited degree of rotation thereto as the cartridge containing cylinders are periodically shifted to bring them successively into firing position.

The nut 22 (hereinafter called the driven screw) is actuated in both its longitudinal and rotational movements by the motor driven sleeve 41 (hereinafter called the driving screw) whose outer end is threaded to engage the corresponding

threads formed in the bore of the driven screw 22 and thus transmit rotary and longitudinal movement to the said driven screw in response to the rotation of the screw that is brought about through the driving connections which, as shown, include an armature shaft 43 of the motor, the worm 44 in which the said armature shaft terminates, the worm gear 46 with which the worm 44 is meshed, and the square shaft 47 secured to or integrated with the worm gear 46 and fitting within the correspondingly formed square bore of the left-hand end of the driving screw 41. As shown the worm gear shaft 47 is also centrally bored to allow passage therethrough of a cable 51 by which current may be fed from a suitable source 52 (Fig. 9) to the metallic firing pin 53 which is carried along with the driven screw 22 in which it is centrally mounted, and which is thereby caused to penetrate the outer sealing disc or cap 54 of the cartridge in cylinder 27, thus bringing said pin into circuit-closing position, whereby ignition of the powder may occur upon closure of the normally open switch contacts 55, 56 by the means hereinafter described. It will be understood, of course, that the lead 51, the firing pin 53 and the connections therebetween are suitably insulated from the shaft 47, the screw elements 41 and 22, and the other metallic parts, to prevent short-circuiting of the powder igniting current in advance of reaching the igniting element of the cartridge.

The novel means for causing, first, a lateral movement, and then, a longitudinal movement of the cartridge containing cylinder 27, includes the L-shaped slot 17 and the co-operating element 21 on the driven screw 22, also the teeth 61 thereon to register with and impart rotation to correspondingly formed teeth 62 on the cartridge shifter 38, and further includes the thrust flanges 63 and 64 formed on opposite ends of the shifter 38 and adapted to translate longitudinal movement of the driven screw 22 to the said shifter 38, the flange 63 being directly engaged by the teeth 61 of the screw 22 and the flange 64 being indirectly engaged by said teeth 61, there being an intervening flange or radial projection 66 on the cylindrical surface of the cartridge container 27 and corresponding radial projections 67, 68, 69, 70 and 71 on the cartridge cylinders 28 to 32 inclusive so that each of said cylinders may be successively shifted longitudinally by the successive longitudinal strokes of the driven screw 22 as the said cylinders 28 to 32 inclusive are successively brought into the position which is now occupied by the cylinder 27 as shown in Fig. 3—which position is the only one in which the teeth 61 of the nut 22 are in position to impart such longitudinal shifting to any one of the said cartridge cylinders 27 to 32 inclusive.

The means for transmitting the rotary motion of the shifter 38 (brought about by the meshing of the teeth 61 and 62 and the limited degree of rotation thereof prior to the longitudinal travel of the driven screw 22) to the cartridge cylinders 27 to 32 as a unit, while permitting the reverse rotation of the shifter 38 (also under the control of the driven screw 22) without a corresponding rotation of the said cartridge cylinders, is shown including an indexing plate 71 having a central recess 72 in which the shifter 38 fits, and an adjacent recess 73 to receive and allow passage therethrough of the driven screw 22. A communicating slot 74 receives firing pin 53 and allows limited oscillation of the indexing plate 71 in relation to said pin, and in response to the

corresponding rotation of the shifter 38. As the plate 71 is thus rocked in a counter clockwise direction as viewed in Fig. 5 by the corresponding rocking of the shifter 38 (induced by the driven screw 22) such a rocking movement is transmitted to the cartridge barrel 26 by virtue of the connection therebetween indicated in Figs. 2, 5, 6 and 7. As shown therein the connection includes a resilient hook 77 anchored at one end to the plate 71, as indicated at 78, and having its other end extending into engagement with the straight side of the notch 79 which is cut into the end surface of the barrel 26, there being corresponding notches at angularly spaced intervals around the barrel, the spacing corresponding to the spacing of the cartridges themselves.

With the construction above described it will be seen that counter clockwise rotation of the plate 71 will produce a corresponding counter clockwise rotation of the barrel 26 and hence a shifting of a new cartridge into alignment with the outlet conduit 34, each time the driven screw 22 is caused to rotate to the limited degree permitted by the transverse portion 17a of the bayonet slot 17 in which the projection 21 of the said screw 22 first travels upon energization of the driving motor 19. When, however, on the return stroke of the screw 22, the projection 21 again arrives at the slot 17a and commences to travel along said slot in a counterclockwise direction (and thus tends to carry the shifter 38 and the indexing plate 71 along therewith in said clockwise direction) the hook 77 will merely ride along the sloping surface of the notch 79 with which it is then in registry; therefore the barrel 26 (restrained by the effect of detent 84 which now engages one of the depressions in the barrel surface) will remain undisturbed while the hook 77 continues to travel to the left as viewed in Fig. 7 until—concurrently with the arrival of the projection 21 at the extreme end 17b of the slot 17a—the said hook 77 will have reached a position of registry with the next succeeding notch 79 in the barrel 26; it being understood that the hook 77 is sufficiently resilient and flexible (and that the plate 71 is sufficiently recessed, as indicated at 75) to allow free travel of said hook along the surface of the barrel 26.

In order to assure a full and accurate return rotation of the shifter 38 as the driven screw 22 travels back to its initial position there is provided a spring mechanism 80, 81 surrounding the portions 82, 83, respectively, of a one-way clutch, the said portion 83 of which is keyed to the rock-shaft 37 so that upon rotation of the said rock-shaft and shifter 38 in one direction a torsional stress is set up in spring 80, which torsional stress is effective upon reverse rotation of the driven screw 22 and shifter 38 to insure a closely following reverse rotation of the shifter 38 and thereby cause it to tend to return to the initial setting (in which detent 36 tends to hold it) independently of the action of the teeth 61 thereupon during the concurrent reverse rotation of the driven screw 22. At the end of the said reverse rotation of the screw 22 the projection 21 thereof will have reached the end 17b of the transverse portion 17a of the bayonet slot, and likewise will have engaged and operated the projecting portion 91 of the automatic motor cut-out switch 92, to move said element 92 into the open circuit position as indicated in Fig. 9, in which position it will remain until during the next cycle of operation the projection 21 is again carried downwardly of the slot 17a (as viewed

in Fig. 2) and thus permits the spring 93 to close the switch 92. A similar cut-out switch (which is similarly biased to the closed position by a spring 96) is adapted to be moved to the open position by contact of the projection 21 with the end 97 thereof as the driven screw 22 reaches its foremost position corresponding to the full advance or firing position of the cartridge.

Closure of switch 101 controls energization of the armature and right-hand field winding 103 of the motor 19, while closure of switch 102 controls energization of the armature and left-hand field winding 104 of the motor, it being understood that the direction of rotation of the motor depends upon which of these two windings is energized, and it being noted furthermore that said switches are in series with the switches 94 and 92 respectively, only one of which latter switches is in the closed position when the driven screw 22 is at either extremity of its travel. Therefore, in order to move the driven screw from this extreme position it is necessary to close that particular switch of the two manual switches 101 and 102 which corresponds to the proper direction in which the motor must rotate in order to carry the screw in the direction necessary for a proper indexing and positioning of the cartridge mechanism.

After consumption of all cartridges, they may be removed from the barrel by releasing the nut-retained latches 86 and 87 pivotally mounted in lower section 88 of the barrel clamp, the two sections 88 and 89 thereof being then lifted off to permit separation of the flange 18 of frame piece 15 from the registering flange 23 of the housing 24, whereupon the spent cartridges can be taken out and a fresh supply inserted in the cylinders 27-32, the flats 25 on the cylinders 27-32 facilitating proper alignment thereof, so that the projections 66-71 thereon will successively be in proper angular relation to the actuating flange 64 of the shifter 38.

If in any particular installation it is not desired to have the firing of the cartridges occur automatically the automatic switch 55, 56 may be supplemented by a manual switch 50, in series therewith and normally open. The firing of the cartridge can then occur only by closure of said switch 50, and at a time when member 21 is at the right-hand end of slot 17, as viewed in Fig. 9.

What is claimed is:

1. In a device of the class described, in combination, a supporting frame having a barrel rotatable therein, rotating means for said barrel, said rotating means including a centrally disposed annulus and an indexing plate having a one-way driving connection with said barrel, means for rotating said annulus and indexing plate through an arc of predetermined extent, said barrel containing a plurality of cartridge cylinders and said rotating means further including a screw element engageable with one of said cartridge cylinders to move it axially forward to cartridge firing position, and means on said centrally disposed annulus for engagement with said cylinder to move it axially rearward in response to reversal in the direction of movement of said screw element.

2. In a device of the class described, in combination, a cartridge firing pin, a supporting frame having a barrel rotatable therein, a guide rail extending along the axis of rotation of said barrel, rotating means for said barrel, said rotating means including an annulus splined for

movement along said guide rail, and an indexing plate having a one-way driving connection with said barrel, said barrel containing a plurality of cartridge cylinders shiftable transversely in response to movement of said indexing plate in one direction, to bring the cartridges successively into alignment with said firing pin, and means for moving said annulus and indexing plate through an arc of predetermined extent and for thereafter advancing said annulus, firing pin and one of said cartridges to the firing position.

3. In a device of the class described, in combination, a supporting frame having a slotted portion and a barrel rotatable therein, rotating means for said barrel, said rotating means including an indexing plate having a one-way driving connection with said barrel, and motor driven means for rotating said indexing plate through an arc of predetermined extent, said motor driven means including a member constrained to move along first one and then the other of two intersecting sections of said slotted portion of said frame to limit the degree of rotary movement of said constrained member and to insure a predetermined degree of axial travel at the conclusion of the limited rotary movement thereof.

4. In a device of the class described, in combination, a supporting frame having a slotted portion and a barrel rotatable therein, rotating means for said barrel, said rotating means including an indexing plate having a one-way driving connection with said barrel, and motor driven means for rotating said indexing plate through an arc of predetermined extent, said motor driven means including a member constrained to move along first one and then the other of two intersecting sections of said slotted portion of said frame to limit the degree of rotary movement thereof and to insure a predetermined degree of axial travel at the conclusion of the limited rotary movement thereof, and said motor driven means further including a member cooperating with said barrel to hold the latter against further rotation at the conclusion of the rotary movement of said motor driven means and during the subsequent axial travel thereof.

5. In a device of the class described, in combination, a supporting frame having a slotted portion and a barrel rotatable therein, rotating means for said barrel, said rotating means including an indexing plate having a one-way driving connection with said barrel, and motor driven means for rotating said indexing plate through an arc of predetermined extent, said motor driven means including a member constrained to move along first one and then the other of two intersecting sections of said slotted portion of said frame to limit the degree of rotary movement thereof and to insure a predetermined degree of axial travel at the conclusion of the limited rotary movement thereof, and said motor driven means further including a member cooperating with said barrel to hold the latter against further rotation at the conclusion of the rotary movement of said motor driven means and during the subsequent axial travel thereof, a plurality of cartridge cylinders disposed in said barrel and rotatable therewith, and means for causing said motor driven means to become effective to advance one of said cartridge cylinders axially, in response to the axial travel of said motor driven means.

6. In a device of the class described, in combination, a supporting frame having a slotted portion and a barrel rotatable therein, motor driven

- means for rotating said barrel through an arc of predetermined extent, said motor driven means including a member constrained to move along first one and then the other of two intersecting sections of said slotted portion of said frame to limit the degree of rotary movement thereof and to insure a predetermined degree of axial travel at the conclusion of the limited rotary movement thereof.
7. In a device of the class described, in combination, a cartridge firing pin, a supporting frame having a barrel rotatable therein, a guide rail extending along the axis of rotation of said barrel, rotating means for said barrel, said rotating means including an annulus splined for movement along said guide rail, and an indexing plate having a one-way driving connection with said barrel, said barrel containing a plurality of cartridge cylinders shiftable transversely in response to movement of said indexing plate in one direction, to bring the cartridges successively into alignment with said firing pin, and means for moving said annulus and indexing plate through an arc of predetermined extent and for thereafter advancing said annulus, firing pin and one of said cartridges to the firing position, said last-named means including a screw element meshing with said annulus for unitary movement therewith, both angularly and axially.
- CLINTON H. HAVILL.