Jan. 27, 1953 J. K. LYON 2,626,596

LOADING AND COCKING MECHANISM FOR TARGET TRAPS

Filed June 23, 1948 6 Sheets-Sheet 1

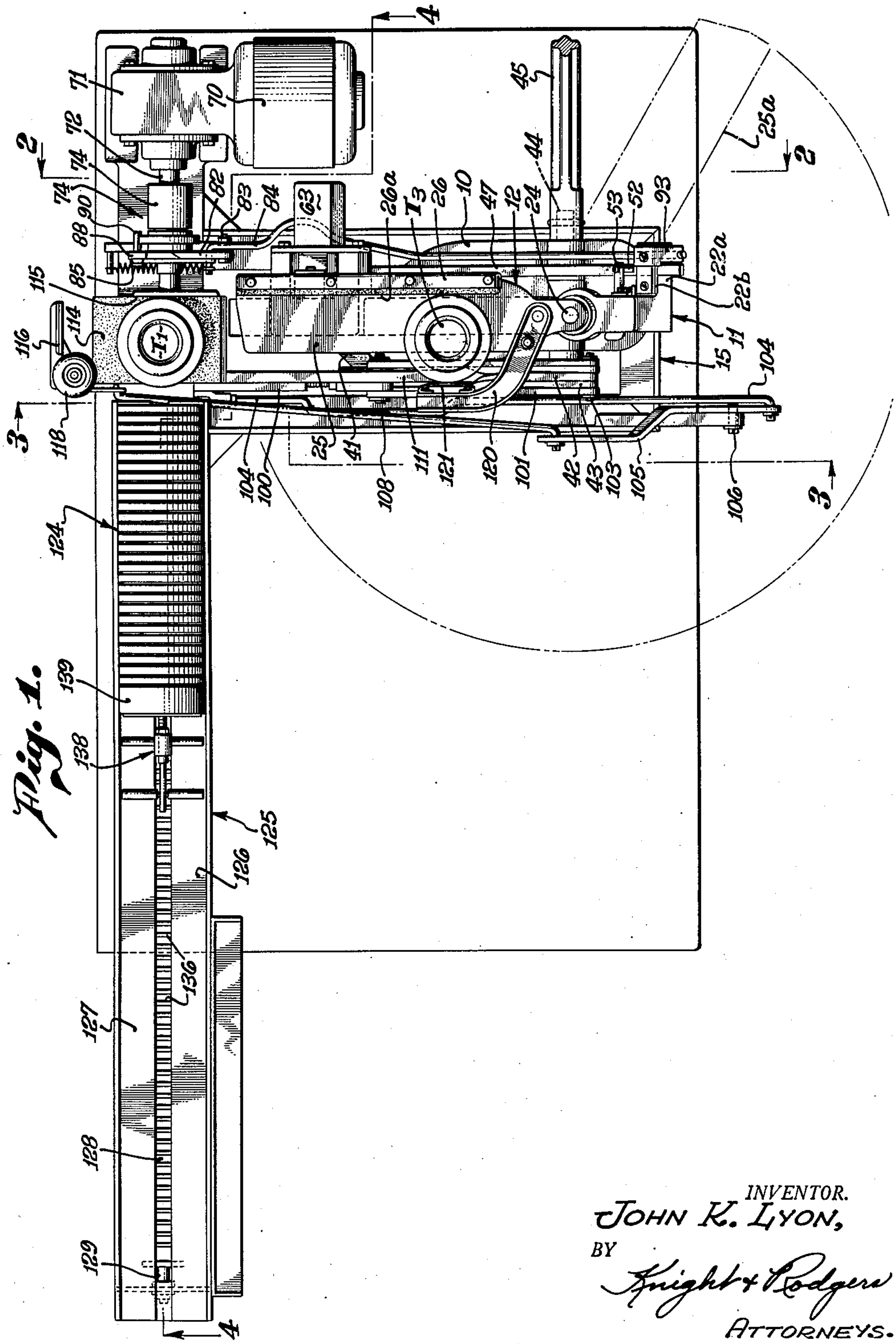

Fig. 1.

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Fig. 2.

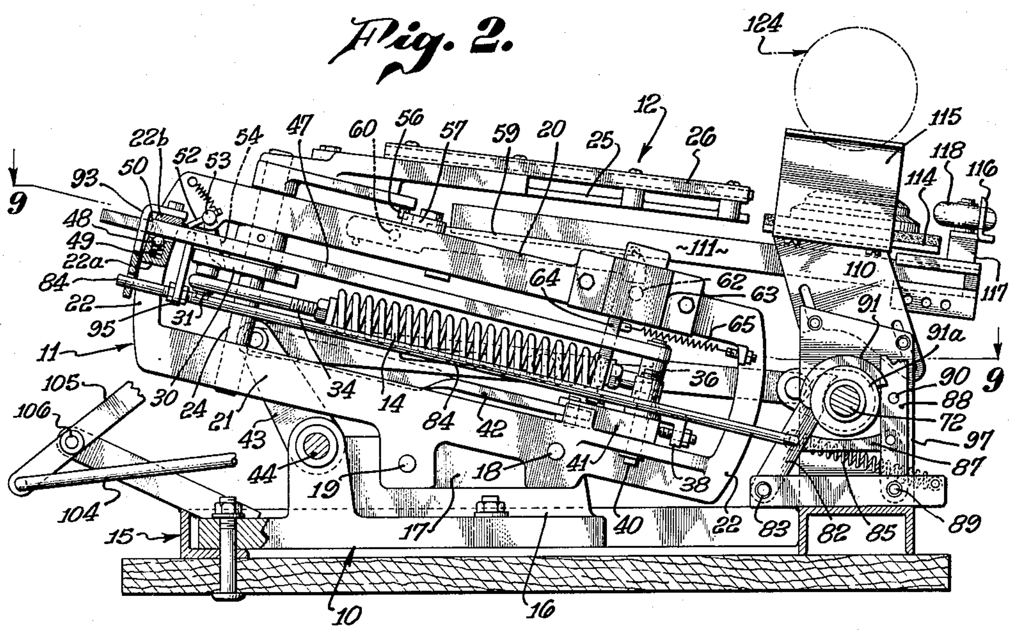
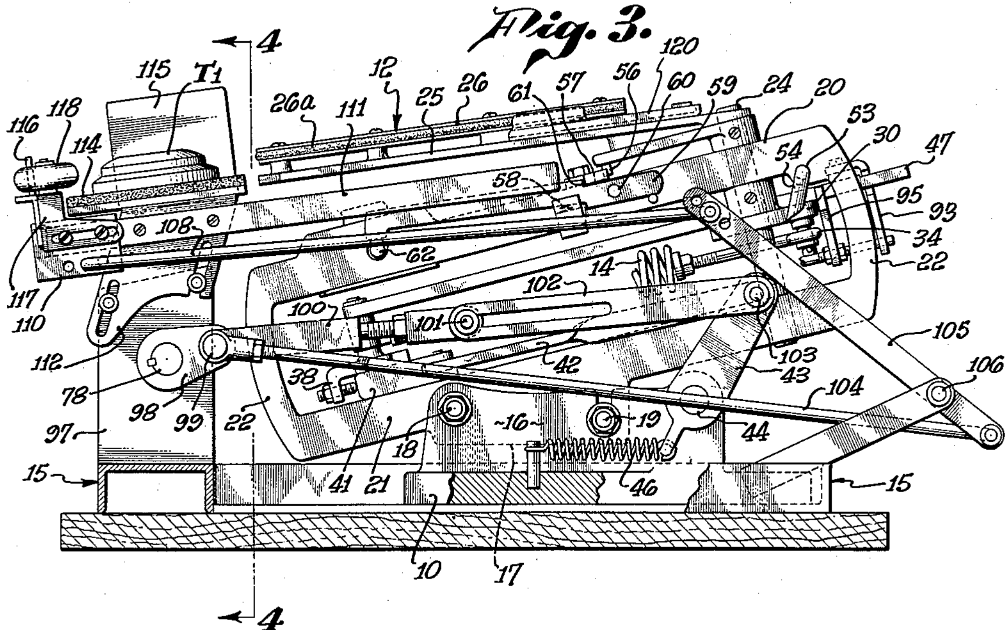


Fig. 3.



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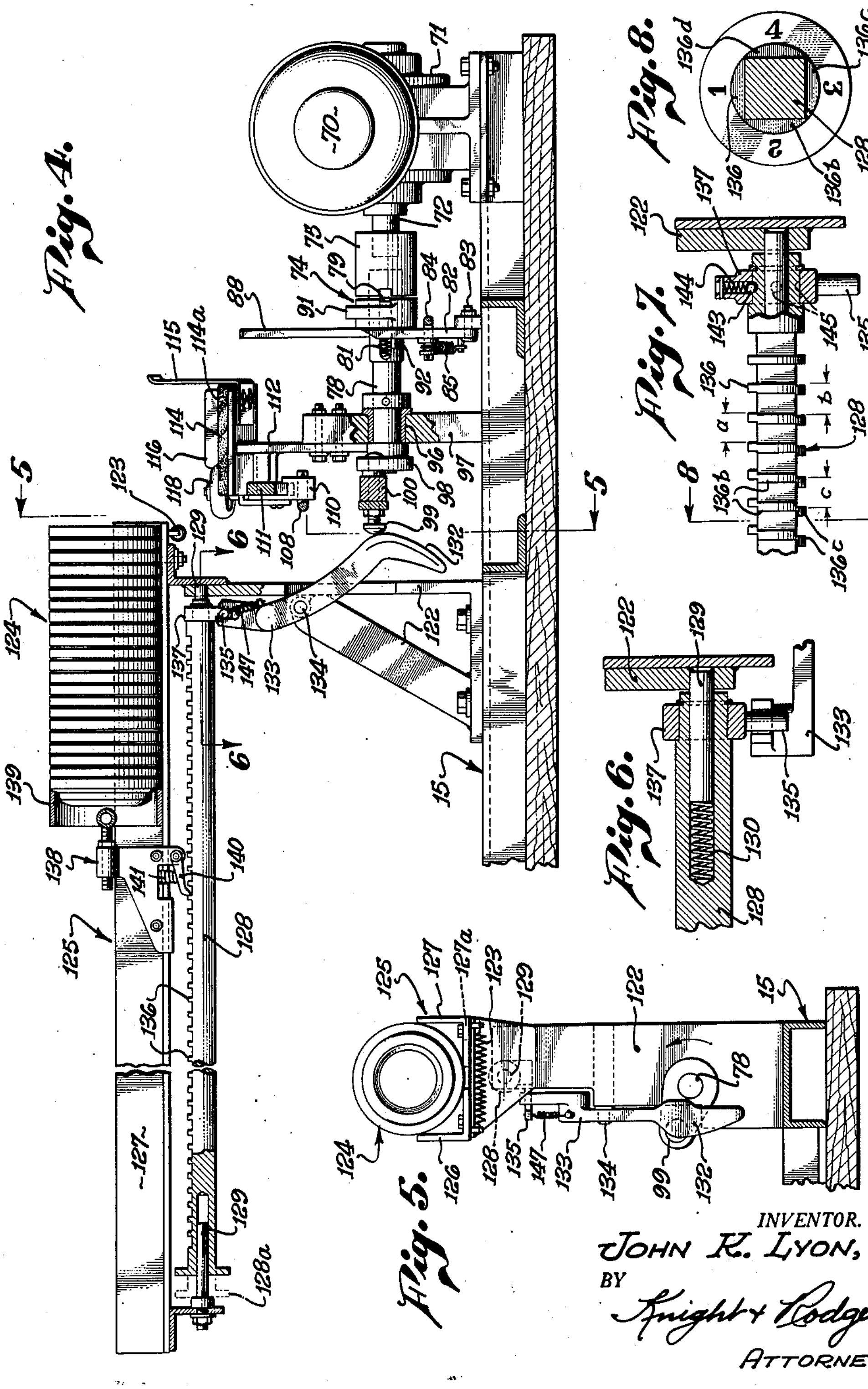
LOADING AND COCKING MECHANISM FOR TARGET TRAPS

Filed June 23, 1948 6 Sheets-Sheet 3



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LOADING AND COCKING MECHANISM FOR TARGET TRAPS

Filed June 23, 1948 6 Sheets-Sheet 4

Fig. 9.

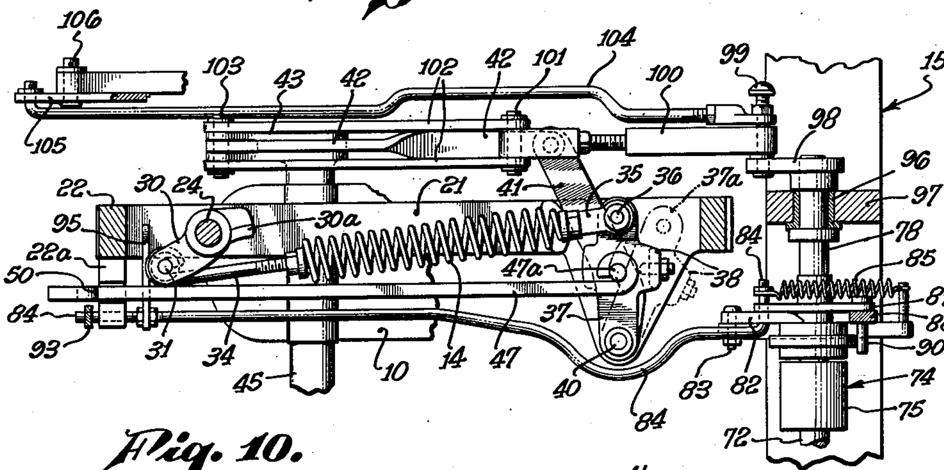
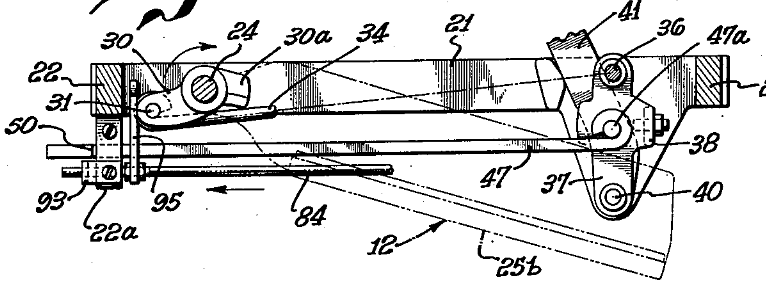


Fig. 10.



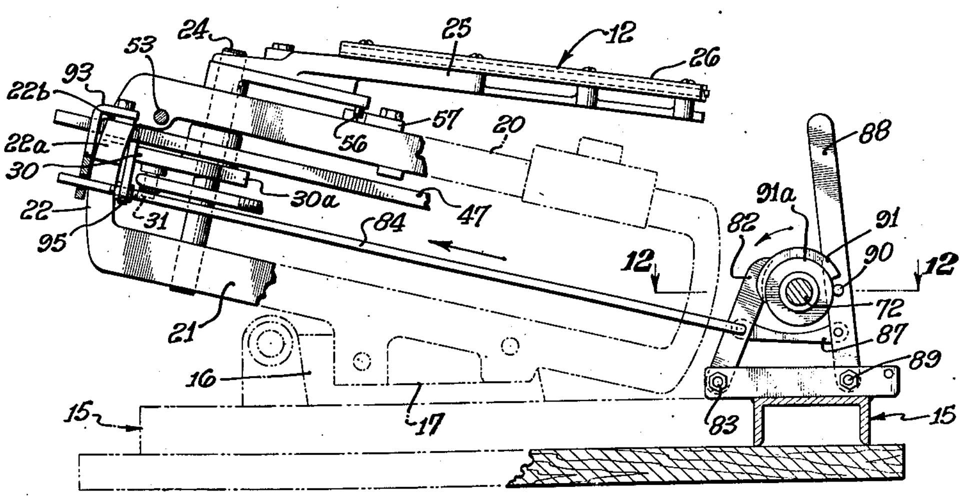


Fig. 11.

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LOADING AND COCKING MECHANISM FOR TARGET TRAPS

Filed June 23, 1948 6 Sheets-Sheet 5

Fig. 12.

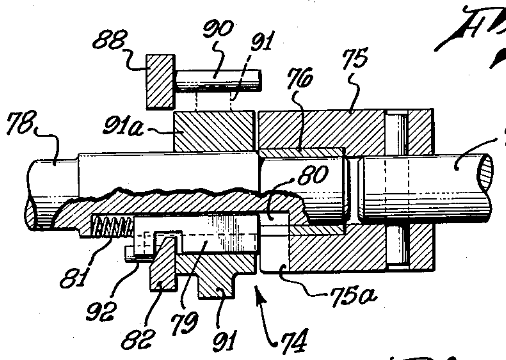


Fig. 13.

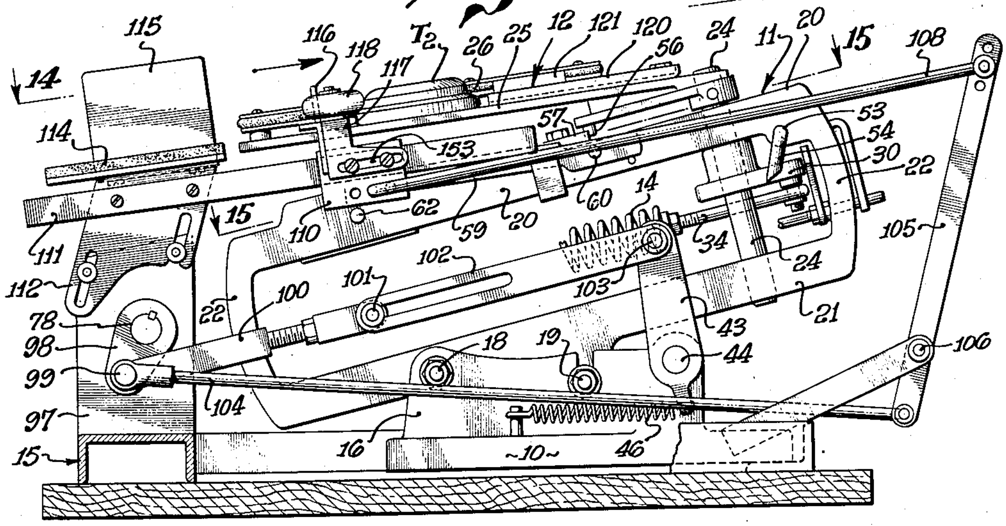
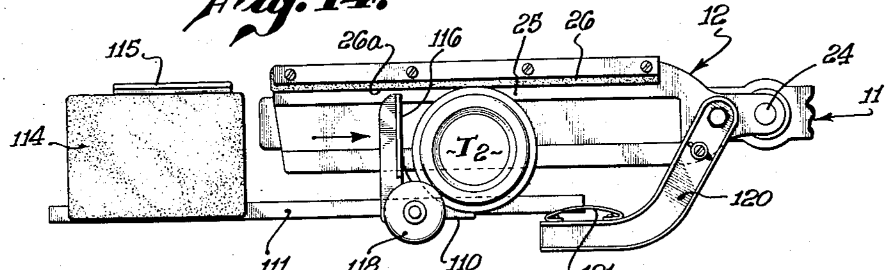


Fig. 14.



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Jan. 27, 1953 J. K. LYON 2,626,596

LOADING AND COCKING MECHANISM FOR TARGET TRAPS

Filed June 23, 1948 6 Sheets-Sheet 6

Fig. 15.

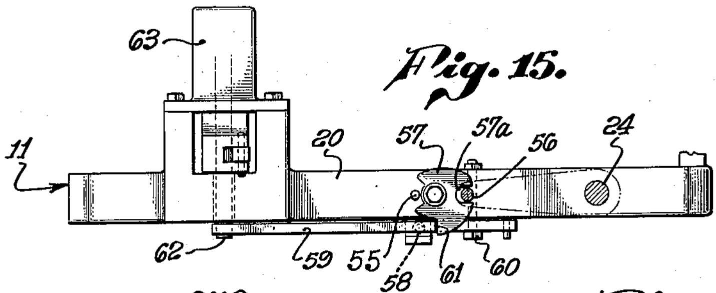


Fig. 16.

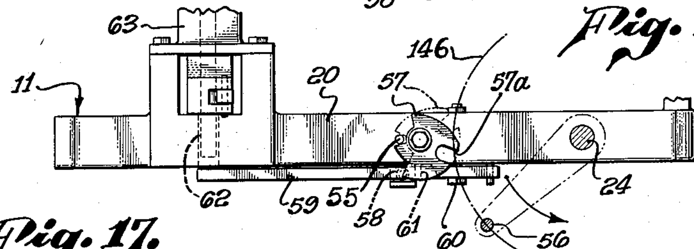
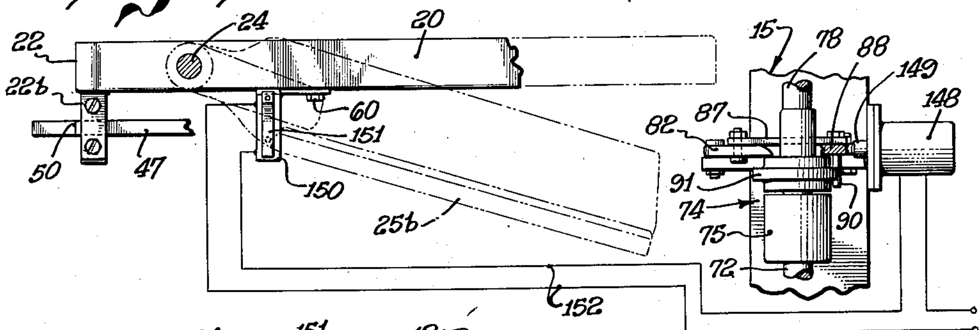


Fig. 17.



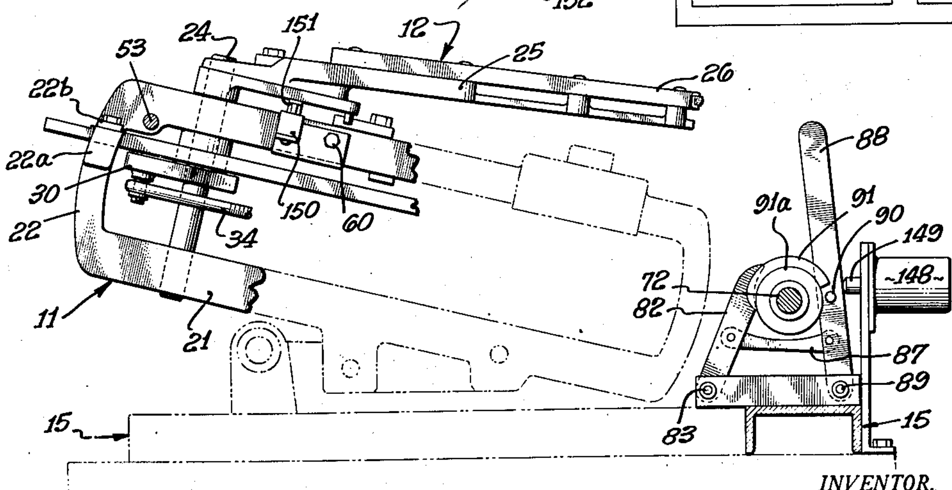


Fig. 18.

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Patented Jan. 27, 1953 **2,626,596**

UNITED STATES PATENT OFFICE

2,626,596

LOADING AND COCKING MECHANISM FOR TARGET TRAPS

John K. Lyon, Pasadena, Calif.

Application June 23, 1948, Serial No. 34,583

14 Claims. (Cl. 124—8)

1

The present invention relates generally to target traps of the type used to throw a clay target into the air in trap or skeet shooting, and more particularly to automatic loading and cocking mechanisms for traps of this character.

It has long been standard practice to load and cock the trap by hand, the trap then being fired by remote control. After each firing, an attendant immediately reloads and recocks the trap which is left in this condition until such time as the shooter signifies a desire for a target, when the trap is again fired.

Manual loading and cocking of the traps is satisfactory in operation, but it is expensive since it requires the full time of one attendant for each trap, and a good deal of the time of this attendant may be spent in waiting between loadings. In skeet shooting, two traps are required so that this game requires the full time of two attendants for the traps alone.

Various kinds of automatically operated traps have been devised; but these have never gone into extensive use. The lack of commercial exploitation may result from any one of a number of factors. One of them may be the relatively high cost of the conventional style of automatic trap. Another may be the inability of known automatic traps to operate continuously without any breakdown or impairment of function. Another cause may be the fact that the power operated trap has unsatisfactory throwing characteristics, or other characteristics which render it inferior to standard types of manually operated traps.

In view of these circumstances, it is a general object of my invention to provide an automatic cocking mechanism for a target trap, which is adapted to operate without supervision by an attendant.

It is also a primary object of my invention to provide an automatic loading mechanism for a target trap, which is adapted to keep the trap properly loaded at all times without supervision by an attendant.

It is also an object of my invention to provide automatic loading and cocking mechanisms for target traps which are adapted to be added to or used in connection with target traps of known design that have been found in actual operation to have satisfactory operating characteristics, and to provide such mechanisms as do not undesirably alter the normal characteristics of the traps.

It is a further object of my invention to provide loading and cocking mechanisms of the type referred to above which are relatively simple in

2

design so that they may be manufactured and installed at a relatively low cost, and yet which are fully reliable in operation so that they perform continuously without supervision and without requiring a prohibitive amount of maintenance.

My invention is herein shown and described as being applied to a particular kind of target trap disclosed in Patent 1,663,780 issued March 27, 1928, to William Spangler on "Target-Throwing Trap." This particular target trap may be described briefly as comprising a spring-operated target throwing member which includes a swinging arm and a rotatable shaft upon which the arm is mounted, and a manually operable cocking mechanism which is adapted to set the operating spring. Upon release, the spring swings the throwing member in one direction to throw a target. After the target leaves the throwing arm, the spring snubs the throwing arm and stores within itself force which is utilized to restore the arm to the loading position. During such restoration, the spring swings the throwing member in the opposite direction to the throwing swing to move it toward and past the target loading position, the travel beyond the loading position being utilized to permit resetting the locking element which holds the arm in loading position. Then when the arm initially swings forwardly in the direction of throwing, it moves into the loading position where it is held until released.

It is a characteristic of this particular trap that the throwing arm has but a single rest position. The operating spring produces a rapid return of the arm to this fixed rest position, which is the position in which the target is loaded onto the throwing arm. The operating spring has some tension in it, so that the parts are then in a half-cocked position; and the spring is subsequently fully tensioned or set by the cocking mechanism in order to prepare the trap for the next cycle of operation.

These characteristics of operation make this trap particularly suitable for conversion to automatic operation. Furthermore, this type of trap has gone into wide commercial use showing that it is satisfactory in its throwing and operating characteristics. For these reasons, I have developed my invention with the particular view in mind of adapting it to traps embodying the principles of operation shown and described in the Spangler patent referred to above, and as a result my invention has many details which are determined by the construction of the Spangler trap. However, it will be understood that my invention is not necessarily limited to this particular type of trap, for in their broader aspects the improved loading and cocking mechanisms disclosed herein can be adapted to other types of traps with appropriate modifications.

In general, the above objects and advantages of my invention have been attained by providing an automatic cocking mechanism which includes a source of power, such as an electric motor, a drive means operatively connecting the power source to a manually operable cocking mechanism, and means responsive to the movement of the target throwing member causing the drive means to actuate the cocking mechanism. The drive means may take the form of a rotatable shaft with a crank arm which is connected by a suitable connecting rod to a convenient portion of the manually operable cocking mechanism, preferably a lever which in the ordinary trap is operated to reset the main operating spring. The drive means is caused to periodically actuate the cocking mechanism for a limited time, since this operation is required only after each time that a target is thrown. To accomplish this, I preferably include a single-revolution clutch between the power source and the drive means, the clutch being operated by movement of the target throwing member to be engaged for one revolution of a drive shaft after movement of the target throwing member to operate the cocking mechanism and reset the spring.

In order that the trap may be fully automatic, automatic feeding and loading mechanism is also provided. This mechanism includes a magazine holding a stack of targets in such a position that one end of the stack is adjacent a loading platform. Means are provided to advance the stack in successive steps to drop the targets one at a time onto the loading platform from which they are loaded onto the throwing arm by a reciprocating ram. Means for advancing the stack of targets and for operating the reciprocating ram are driven from the power source by the same drive means referred to above. Thus the target feeding and loading mechanisms are also operatively connected to the drive means but are operated intermittently after each throwing cycle of the target throwing member by means responsive to the movement of the target throwing member.

How the above objects and advantages of my invention, as well as others not specifically mentioned herein, are attained will be more readily understood by reference to the following description and to the annexed drawings, in which:

Fig. 1 is a plan view of a target throwing trap showing the application thereto of my invention, the trap being loaded ready to throw a target;

Fig. 2 is a combined vertical section and side elevation on line **2—2** of Fig. 1;

Fig. 3 is a combined vertical section and side elevation on line **3—3** of Fig. 1, looking at the opposite side of the trap from Fig. 2;

Fig. 4 is a median vertical section of the target magazine and a front elevation of the loading platform, showing also the single-revolution clutch connecting the drive shaft to the power source, taken on line **4—4** of Figs. 1 and 3;

Fig. 5 is a vertical end elevation of the target magazine and stack advancing means taken on line **5—5** of Fig. 4;

Fig. 6 is a fragmentary horizontal section on line **6—6** of Fig. 4;

Fig. 7 is an enlarged fragmentary horizontal section and plan, similar to Fig. 6, showing a modified form of indexing rack for controlling the advancement of a stack of targets;

Fig. 8 is a vertical transverse section through the variational indexing rack on line **8—8** of Fig. 7;

Fig. 9 is a fragmentary horizontal section and plan view on line **9—9** of Fig. 2 showing the main operating spring and the cocking lever in half-cocked position, and also showing the drive means and the means for engaging the single-revolution clutch by movement of the target throwing member;

Fig. 10 is a fragmentary view like Fig. 9 but showing the position of certain of the parts at the end of the overtravel of the throwing arm;

Fig. 11 is a fragmentary, semi-diagrammatic side elevation corresponding generally to Fig. 2 but with certain parts positioned as in Fig. 9;

Fig. 12 is a fragmentary section through the single-revolution clutch taken on line **12—12** of Fig. 11;

Fig. 13 is a combined elevation and section similar to Fig. 3, but with certain parts omitted and others in the positions occupied during the operations of cocking and loading a target onto the throwing arm;

Fig. 14 is a fragmentary plan view of the loading platform and throwing arm only, showing a target being loaded as in Fig. 13 and taken on line **14—14** of that figure;

Figs. 15 and 16 are fragmentary plan views of the latch mechanism for holding and releasing the target throwing arm, taken on line **15—15** in Fig. 13, in different positions;

Fig. 17 is a fragmentary section and plan similar to Fig. 9 but showing a variational form of clutch actuating mechanism; and

Fig. 18 is a fragmentary, semi-diagrammatic side elevation, similar to Fig. 11, showing the variational form of clutch actuating mechanism of Fig. 17.

Referring now to the drawings, I shall describe the application of my invention to a target throwing trap of conventional design. In order that the disclosure may be clarified, I shall first describe a conventional target trap of the type disclosed in the Spangler Patent 1,663,780. The trap illustrated herein differs in certain minor details of construction from that disclosed in the patent, but the principle of operation is the same; and the patent may be referred to for a more detailed discussion thereof.

The target trap itself is most comprehensively shown in Figs. 2 and 3, and in general comprises base plate **10**, a frame **11** mounted upon the base, a throwing member **12** pivotally mounted on frame **11**, and spring **14** for operating the throwing member. Base plate **10** is here shown as being attached to the foundation framework **15** which supports the other mechanisms of my invention in a fixed relationship to the trap.

Base plate **10** is preferably formed with an upstanding web **16**. Frame **11** has a similar depending web **17** by which the frame is mounted upon the base. The two webs are pivotally interconnected by a bolt or cap screw **18**, and also by a clamping bolt or cap screw at **19**. By this arrangement, frame **11** can be adjusted to a limited extent about a transverse horizontal axis at **18** in order to change the vertical angle at which the target is thrown into the air. The parts are held clamped in adjusted position by tightening cap screw **19**.

It is ordinarily unnecessary to provide the trap with means for adjusting it about a vertical axis since it is satisfactory to maintain it in a fixed position. However, should it be desirable to obtain horizontal orientation of the trap, it is within the scope of my invention to mount the trap and its cooperating mechanisms upon a pivoted base permitting adjustment about a vertical axis.

Frame 11 is in the form of an open rectangle and comprises upper and lower parallel frame bars 20 and 21 respectively which are joined at their ends by two upwardly extending end members 22. The target throwing member 12 is rotatably mounted upon frame 11. The target throwing member comprises upwardly extending shaft 24 which is journaled in frame bars 20 and 21, a swinging arm 25 which is fastened to the upper end of shaft 24 to turn therewith, and other attached parts as described later. As may be seen in Figs. 13 and 14, arm 25 has a flat upper surface, and is provided along one side with guide rail 26 spaced slightly above the surface of the arm. Rail 26 preferably has a resilient facing 26*a*.

In the following description, the end of the trap toward which shaft 24 is located is referred to as the forward end because the target is thrown away from that side. Such relative directions as forward or backward thus refer to directions toward or away from the right-hand side of the trap as viewed in Fig. 3.

Immediately underneath upper frame bar 20, there is located on shaft 24 arm 30 which is rigidly attached to shaft 24 by a pin or other similar means. At the outer end of arm 30, is crank pin 31 to which the main operating spring 14 is connected by means of I-bolt 34. The other end of spring 14 is connected by a short link 35 to pin 36 carried on the outer end of arm 37, as seen in Fig. 9. Arm 37 is pivotally mounted to lower frame bar 21 by pivot pin 40.

Also pivotally mounted on pin 40 is a second lever arm 41 which is disposed immediately beneath arm 37 and extends outwardly beyond pin 36 on the end of arm 37, as shown in Fig. 9 particularly. Arm 41 is the cocking lever and a part of the cocking mechanism. Lever 41 is adapted upon rearward movement to move arm 37 in the same direction to extend or set spring 14. To effect this movement of spring arm 37, the arm carries a downwardly extending fixed abutment 38, which is preferably provided with a set screw in order to obtain adjustment of the stroke. As may be seen clearly from Figs. 3 and 9, rearward movement of lever 41 engages abutment 38, or the set screw carried thereby, to push spring arm 37 rearwardly with it. However spring arm 37 is free to move rearwardly independently of arm 41 just as lever 41 is free to move forwardly independently of spring arm 37. Thus the connection between these two arms afforded by abutment 38 may be described as a one-way connection.

The remainder of the cocking mechanism attached to cocking lever 41 comprises a forwardly extending connecting rod 42 which is fastened to the outer end of arm 41 and also to the upper end of lever 43. Lever 43 is mounted on one end of horizontally extending rock-shaft 44 which is rotatably mounted in a pedestal bearing on base plate 10. On the other end of shaft 44 is a handle 45, a portion of which is shown in Fig. 1, by means of which shaft 44 can be manually rocked. Tension spring 46 attached to base 10 and arm 43 normally keeps the cocking mechanism in the position shown. Handle 45 is preferably relatively long in order to afford the operator sufficient leverage to set the operating spring.

When the cocking lever 41 moves rearwardly in unison with spring arm 37, the spring arm moves to the dot-dash position shown in Fig. 9 stretching spring 14 as the forward end is stationary; and it is necessary that the spring arm be held in this rearward position in order to hold spring 14 under the desired degree of tension. Spring arm 37 is maintained in this rearward position by latch bar 47 which is attached at its rearward end to spring arm 37 by means of pin 47*a*. The forward end of bar 47 passes through a slot in guide 22*a* projecting from one side of the forward frame member 22. The top of the slot is closed by plate 22*b*. As shown in Fig. 2, the guide is provided with a ball 48 which is pressed upwardly by spring 49 against the under side of bar 47 so that the top surface of the bar normally rides against plate 22*b* at the top of the slot in the guide. The forward end of latch 47 is notched so that when the rod is viewed in profile, as in Fig. 2, there is seen a forwardly facing shoulder 50. When the latch rod is retracted by the rearward movement of spring arm 37, the pressure of spring 49 and ball 48 against the under side of the rod moves shoulder 50 into engagement with the rear face of guide plate 22*b*, thus retaining the spring arm in the rearward position with spring 14 under full tension.

Latch bar 47 is depressed against spring 49 to disengage shoulder 50 from guide 22*a* by a short pin 52 on one end of shaft 53 passing horizontally through frame 11. At the other end, shaft 53 is bent to form arm 54, see Fig. 3 or 13, which is in a position to be engaged by cam 30*a* which is an extension of arm 30 (see Fig. 9). As shaft 24 rotates clockwise when viewed from above, cam 30*a* engages arm 54 and rotates shaft 53 to press pin 52 against latch bar 47. The reverse movement of cam 30*a* merely lifts pin 52 off the latch bar. The effect of this action is described later.

When spring 14 is under tension, it will be seen from Fig. 9 that the pull of the spring on pin 31 and arm 30 tends to rotate shaft 24 in a counterclockwise direction, viewed from above. This tendency to rotate the target throwing member is restrained until the proper time by means of a latch mechanism carried on frame bar 20 which engages pin 56 carried on the under side of throwing arm 25. When the latch mechanism engages and holds pin 56, arm 25 is held stationary in the loading position shown in Figs. 1 and 2 against the torque imparted by spring 14. This latch mechanism consists of a latch plate 57 rotatably mounted upon the upper surface of frame bar 20, as shown particularly in Figs. 15 and 16, and provided with a notch 57*a* in its periphery to receive pin 56. Free rotation of latch 57 is limited by pin 55. Pin 56 is held in one position by latch plate 57 when the latter is locked against rotation, and this is effected by keeper bar 59 which is pivotally mounted at 60 on one side of upper frame bar 20, as shown in Fig. 3. Keeper 59 has a forwardly facing shoulder 61 which, when raised to the position of Fig. 3, engages latch plate 57 and holds the latter against rotation in response to the force applied by pin 56. Keeper 59 is moved to this raised position by spring 58 which yields to the force applied to shoulder 61 by latch plate 57 and pin 56, unless firing pin 62, which is slidably mounted in frame 11 and which is spring-urged to a forward position in which the pin projects beyond the side face of frame bar 20, is advanced to hold the rearward end of keeper 59 in the raised position of Fig. 3.

Pin 62 can be retracted manually, or by any suitable mechanical means, as by solenoid 63. When pin 62 is retracted beyond the side face of frame bar 20, the rear end of keeper 59 is free to move down, disengaging shoulder 61 from latch plate 57. The force exerted by pin 58 against latch plate 57 normally is sufficient to rotate the plate and depress keeper 59, thus releasing arm 25.

As mentioned previously, pin 62 is spring-urged toward a normally advanced position. When it is retracted to release keeper 59 and spring 14, it is held in this retracted position by engagement with vertically extending bar 64 which is pivotally mounted on the frame at its upper end and pulled rearwardly by spring 65. The lower end of bar 64 engages the side face of spring arm 37 so that at the proper time in the operation cycle of the device, the lower end of bar 64 is moved forwardly by the final part of the forward rotation of arm 37 to disengage and release firing pin 62 which then is free to move toward the advanced position, a movement which is completed as soon as the end of keeper 59 is raised clear of pin 62.

All of the mechanism which has been described so far, and which I refer to as the basic trap, is conventional and well known in its construction. Being conventional, this mechanism does not per se constitute any part of my invention but is rather the basic mechanism to which I have added other mechanisms which result in an entirely automatic target trap. It also follows that my invention is not necessarily limited to the particular details of the trap already described for the elements of my invention may be modified as necessary to adapt them to other target traps without departing from the spirit and scope of my invention; but the type of trap which I have already described constitutes the basic construction upon which I prefer to add my invention, and is described herein to make a full disclosure of my invention.

In order to operate the trap automatically, there is provided a suitable power source. As typical of such sources, I show herein an electric motor 70 connected to the input shaft of the speed reducer 71 which delivers power to output shaft 72. A belt drive may be used, with suitable speed reduction, in place of the gear-type reducer 71, or another prime mover may be used in place of motor 70. This power source is operatively connected through drive means to the target feeding and loading means and to the cocking mechanism in the manner which will be described later; but the drive means is operated only intermittently at the will of the operator and only for a sufficient length of time to move the various parts through one complete cycle of operation. In order to cause the drive means to actuate the other mechanisms in this manner, I provide means which is responsive to movement of the target throwing member for causing the drive means to operate intermittently for the necessary short periods of time. This latter means preferably takes the form of a single-revolution clutch indicated generally at 74 and shown in detail in Fig.12, and its operating member. I prefer to use a single-revolution clutch as this permits motor 70 and shaft 72 to revolve constantly, making full power instantly available for cocking and loading the trap and simplifying control of the position of the parts. However, it is considered as coming within the scope of my invention to eliminate the clutch and use an intermittently active power source in which case the drive means is actuated by suitable switches closing a circuit to the motor-starter.

Clutch 74 comprises a collar 75 keyed or otherwise attached to the end of drive shaft 72 and provided with an internal bearing 76 into which extends the end of driven shaft 78 so that drive shaft 72 and driven shaft 78 are axially aligned. A driving dog 79 is slidably mounted in keyway 80 in shaft 78. Dog 79 is normally urged toward the right, as viewed in Fig. 12, by spring 81; and in this right-hand position dog 79 enters notch *75a* in collar 75 to effect a driving relationship between shafts 72 and 78.

Cam 82 is pivotally mounted at its lower end at 83 on frame 15; and when the upper end is moved forwardly toward shaft 78 as in Fig. 12, cam 82 engages dog 79 to move it toward the left, against the action of spring 81, to the inoperative or non-driving position illustrated in Fig. 12. When driving dog 79 is retracted as shown, shaft 78 remains stationary while shaft 72 and collar 75 are free to revolve continuously.

Cam 82 is movable toward and away from shaft 78, but is otherwise stationary. When the cam is retracted or swung away from the shaft, dog 79 moves into driving position; when cam 82 is advanced toward the shaft 78, it engages dog 79 and withdraws it to the non-driving position. Engagement of the driving dog for only a single revolution of shaft 78 is insured by providing means to move the cam to the dog-engaging position shortly after each disengagement from the driving dog incorporated as a part of the clutch operating mechanism. As shown in Figs. 4 and 11, cam 82 is pivotally mounted at 83 to frame 15 and is connected intermediate its ends to clutch operating rod 84. Tension spring 85 is attached to the bent end of operating rod 84 and also to a pin on frame 15 so that the force exerted by this spring normally tends to pull cam 82 forwardly into engagement with driving dog 79. Thus, the normal position of the parts is the one in which the clutch is disengaged.

In order to provide further assurance that cam 82 is moved to the forward position after each retraction to release driving dog 79, the rearward end of operating rod 84 is connected by horizontally extending link 87 to rocker arm 88 which is pivoted at its lower end at 89 to frame 15, as shown in Figs. 2 and 11. Rocker arm 88 carries a horizontally extending pin 90 which is in a position to be engaged by semi-circular cam 91 on the outside of a collar *91a* surrounding the end of driven shaft 78 and rotating therewith. The shape of cam 91 is shown in Figs. 4 and 11, and its relationship to pin 90 in Fig. 12. In operation, after cam 82 is retracted to allow shaft 78 to turn, the rotation of cam 91 with the shaft brings the cam into engagement with pin 90, moving the latter away from shaft 78 and, through arm 88 and link 87 positively returning cam 82 to a position in which the cam engages the driving dog on the next revolution. This engagement again retracts dog 79 and disengages clutch 74 so that the clutch is operative to drive shaft 78 for only a single revolution of the shaft and the clutch must be reactuated at the end of each revolution in order to re-engage the clutch. Arm 88 also serves as a handle by which clutch 74 can be manually operated to initially set or to operate the trap, as may be desired.

The forward end of cam 82 preferably carries stop pin 92 in a position to engage a projecting portion of driving dog 79 and arrest the rotation of shaft 78 at the end of the revolution. Since the momentum of the driven parts usually carries driving dog 79 into engagement with stop pin 92 at the end of each revolution, the motion of the parts driven by clutch 74 starts and stops at, or close to, the same point in the cycle.

Clutch operating rod 84 extends forwardly along one side of frame 11, and its forward end slides freely in an opening in bracket 93 which is bolted to guide portion 22*a* of frame 11. Bracket 93 guides the forward end of the clutch operating rod, yet allows the rod to move freely longitudinally.

Toward its forward end, rod 84 carries a fixed arm 95 which extends at approximately right angles to the rod and is so disposed as to be engaged by arm 30 (Figs. 9–11) during the final movement of the arm after the throwing member has been returned to and past the loading position. Swinging arm 30, as will be more fully described, acts as a cam which contacts and moves fixed arm 95, thus moving the clutch operating rod longitudinally forward. This movement of the rod in response to movement of the target throwing member 12 of which arm 30 is a part, retracts cam 82 and causes clutch 74 to become engaged for one rotation of drive shaft 78.

Drive shaft 78 is journaled in bearing 96 mounted in post 97 which comprises a part of the general framework 15. Shaft 78 carries crank 98 which is provided at its outer end with crank pin 99. Pivotally connected to crank pin 99, are two connecting rods, one of which is articulated and the other rigid.

The articulated connecting rod comprises bar 100 which is connected by pin 101 to a pair of links 102 that are connected at their other ends to pin 103. Pin 103 also interconnects the ends of crank arm 43 and connecting rod 42, thus forming a common pivotal interconnection for all three parts. As shown in Figs. 3 and 13, links 102 are preferably provided with slots through which pin 101 passes in order that links 102 may move longitudinally rearwardly with respect to bar 100 as is the case when the trap is manually operated by means of handle 45. Lever 43 rotates counterclockwise as viewed in Fig. 3, and links 102 move with respect to bar 100 because pin 101 remains stationary and slides within the slots in the links, thus allowing manual operation of the trap at any time without requiring disconnection or any alteration in the power drive means.

Section 100 of the connecting rod is preferably made with a threaded section and a lock nut in order that it may be properly adjusted as to length between pins 99 and 101, thus accommodating the connecting rod to any differences in the spacing between the center line of shaft 78 and pin 103. This feature is of particular assistance where this mechanism for operating the cocking lever is added to a trap which is already installed, but may be eliminated in the event the trap is originally made as a power driven unit. Crank 98 and the connecting rod provided by links 100 and 102 provide a part of the means for operatively connecting the power source to the cocking mechanism, which includes particularly cocking lever 41. For mechanical reasons I prefer to make the power connection to the end of lever 43 and the forward end of connecting rod 42; but it is entirely feasible to make the connection directly to the outer end of cocking lever 41 by replacing the connecting pin between lever 41 and rod 42 with a suitable type of connector to which rod 100 can be fastened.

Also attached to crank pin 99 is a forwardly extending push rod 104 which is pivotally connected at its forward end to lever 105 pivotally mounted at 106 to an arm projecting upwardly from base 15. Lever 105 has connected to its upper end operating rod 108 which at its rear end is attached to ram or carriage 110. Carriage 110 is slidably mounted upon straight bar 111 which provides a track for the carriage to slide upon. Track 111 is mounted upon bracket plate 112 which is bolted to the upper end of post 97. Bracket plate 112 also carries platform 114 upon which a clay target rests before it is loaded onto throwing arm 25. Platform 114 is preferably provided with one or more guards 115 to hold the target in place on the platform. Carriage 110 is provided with a laterally extending plate 116 which operates as a rear guard, and with a rubber roller 118 which engages the target. The carriage with its roller acts as a ram to push the target from platform 114 onto swinging arm 25 as carriage 110 is advanced along track 111.

Targets are fed onto platform 114 to the position T_1 by gravity and it has been found preferable to cover the top of the platform with a layer 114*a* of sponge rubber or similar material. Whatever the surface is upon which the targets rest, this surface is arranged substantially as a continuation of, but preferably slightly above, the surface of arm 25, as may be seen in Fig. 3. Throwing arm 25 ordinarily is inclined slightly to the horizontal, and consequently the top surface of platform 114 is given the same inclination. Track 111 is arranged parallel to but below the top surfaces of platform 114 and arm 25 so that it moves carriage 110 parallel to these surfaces and at a slight distance above them as may be found to best engage and move the target.

At the rear of the stroke, carriage 110 is to the rear of platform 114, as in Fig. 1. The length of its forward stroke can be easily regulated by varying the proportions of lever 105; and it is preferable to provide a plurality of openings in the upper end of lever 105 so that operating rod 108 can be connected to the lever at various points to obtain minor variations in the length of stroke of ram 110. Roller 118 is mounted on carriage 110 by bracket 117 on the side away from rail 26, the roller being spaced preferably above platform 114 sufficiently to engage the target at a point above its rim. If desired, roller 118 may be lowered to engage the rim of the target T_1. The action of roller 118 is to push the target against rail 26 as the target is moved forwardly at T_2 (Fig. 14) onto arm 25, and thus aids in properly positioning the target. Another important aid is bracket 120 mounted on the inner end of arm 25 in a manner to permit limited swinging movement of the bracket with respect to the arm to adjust to targets of different diameters. As shown in Figs. 1 and 14, the rearward free end of bracket 120 is provided with a flat bow spring 121 which is so positioned that at the extreme forward movement of the target onto arm 25, the target is held lightly between spring 121 and rail 26. Spring 121 holds the target at T_3 in place against rail 26 even though a considerable period of time elapses between loading and firing, and any vibration from motor 70 or other moving parts does not dislodge the target from its proper position. Spring 121 operates to eliminate breakage of the targets at the beginning of the throwing stroke, because arm 25 has such a high rate of acceleration that, unless the target is virtually resting against rail 26 at the beginning of the throwing stroke, the impact of the rail against the target is sufficient to break the target. Consequently, it is important that the target be against rail 26 at the time that the throwing stroke commences.

Targets are fed to loading platform 114 from a substantially horizontally extending magazine indicated generally at 125. The magazine is adapted to hold a plurality of targets in a generally horizontal stack 124 with the forward end of the stack, in the direction of advancement, adjacent and slightly above the loading platform 114, as shown in Figs. 1 and 4. Thus, as the stack is advanced within the magazine, the targets fall from the forward end of the stack, one at a time by gravity, onto the loading platform to a position such as shown in Figs. 1 and 4.

Magazine 125 is supported in the position shown by suitable arrangement of structural members, including bracket 122, resting upon the structural frame 15. The magazine itself comprises a pair of parallel, horizontally extending angles 126 and 127 which each have one leg horizontal and the other leg extending upwardly to form a channel-shaped trough into which the targets are loaded. One of the angles, in this case angle 126, is rigidly held at both ends; while the other angle, in this instance angle 127, is pivotally held at its rear end, the end more remote from the discharge end. At its forward end, angle 127 is slidably mounted with respect to its supporting framework by a bolt which passes through a slotted hole indicated at 127*a* (Fig. 5); and tension spring 123 which has one end attached to each of angles 126 and 127 pulls the forward ends of the two angles together. The purpose of this construction is two-fold. In the first place it adapts the magazine readily to minor differences in diameters of targets loaded into the magazine by providing a resilient or expansible means for detering the spacing between the magazine sides; and it also insures a firm contact between the targets and the magazine sides at the forward discharge end of the magazine without building up undue friction between the stack of targets and the sides of the magazine throughout their length. The minimum of frictional engagement with the stack as a whole is desirable in order to reduce the pressure upon the stack required to cause it to advance, since the frangible nature of the targets limits the pressure which can be applied.

While for various reasons given, I prefer to use a magazine as shown and just described, it is also possible to use a magazine that is other than channel-shaped, as for example semi-cylindrical or cylindrical. Also, I may slightly incline the magazine downwardly toward the discharge end to diminish the frictional drag of stack 124.

Means is provided for advancing the stack lengthwise thereof in the magazine by successive steps, each step being equal to the average thickness of a target in the stack. This stack advancing apparatus includes a bar 128 extending horizontally and parallel to the magazine in a position just underneath it. The bar is mounted for longitudinal sliding motion in any suitable manner, but is here shown as being mounted upon axial pins 129 located in one at each end of the bar. As shown in Fig. 6, spring 130 is placed in the central bore of bar 128 to bear against the forward pin 129 in order to urge bar 128 towards a normal rearward position. This rearward position is indicated at 128*a* in Fig. 4.

Bar 128 is shifted longitudinally by lever 133 which is pivotally mounted on bracket 122 at 134 to swing about a horizontal axis. The upper end of lever 133 is bifurcated to provide a fork which engages pin 135 carried by a collar 137 on the forward end of bar 128. Collar 137 is held against rotation by tension spring 147 connected to pin 135 on the collar and a pin on lever 133, as shown in Figs. 4 and 5. The lower end of lever 133 has a curved cam surface 132 which is engaged by the rounded head of crank pin 99, as may be seen in Fig. 4. Engagement of crank pin 99 with end 132 of lever 133 causes the lever to move in a clockwise direction and advance bar 128 longitudinally. After the crank pin has disengaged the lever, spring 130 moves bar 128 in the opposite direction to the position 128*a* indicated in Fig. 4 by the dot-dash line.

This longitudinal movement of bar 128 is utilized to advance the stack of targets, and for this purpose the top face of bar 128 is provided with a series of slots forming equally spaced teeth 136 in the form of a longitudinally extending rack on the bar. A follower 138 is slidably mounted on the horizontal flanges of angles 126 and 127 to be guided thereby, and comprises a ring 139 which presses against the rearmost target of the stack. Follower 138 has on its under side pawl 140 which is pivotally mounted on the follower and is normally urged downward by spring 141 so that the pawl engages teeth 136 on the top of bar 128. It is obvious that if bar 128 is hollow teeth 136 can be formed by notching the side wall of the bar.

By this arrangement, the forward movement of bar 128 brings a tooth 136 into engagement with the rear end of pawl 140 and follower 138 is thereby caused to advance with bar 128. When the reverse movement of the rack bar takes place, pawl 140 swings upwardly, compressing spring 141, so that the pawl passes over the next forwardly disposed tooth and drops into the space ahead of it. Thus, upon subsequent forward movement of the rack bar, follower 138 is again advanced because the pawl engages the tooth 136 next ahead of the tooth previously engaged. Pawl 140 and the toothed rack 136 comprise a one-way connection between reciprocating bar 128 and follower 138, so that continued axial reciprocation of the bar moves the follower only in a forward direction, and this movement is by successive steps. The distance or spacing between working faces of successive teeth 136 is made equal to the thickness of an individual target occupied in the stack, so that the advance of the stack for each forward movement of the bar is equal to the thickness of one target and each forward step operates to push one target off the forward end of the magazine so that the target falls by gravity downward onto the loading platform 114.

The clay targets are of a well known and conventional design with a relatively heavy rim and a thinner web or central portion which is dished or offset axially toward one side of the rim. It is actually the thickness of this rim portion that is referred to immediately above as being the thickness of the target or the space occupied by an individual target in the stack, because the targets nest together. In manufacturing these targets, their size is held within fairly close tolerance, but it has been found in actual experience that targets differ somewhat slightly in the thickness of the rim portion. Although this difference in dimension is not of any consequence for most considerations, it is sometimes of importance in the present invention. Magazine 125 is typically designed to hold a stack of one hundred targets. If a particular batch of targets happen to run uniformly oversize in their rim dimension by .005'', then the stack as a whole would be oversize by some .5'', assuming one hundred targets in the stack. The amount of this oversize is more than the thickness of a single target. It is equally possible that a particular shipment of targets might run undersize by a similar amount. If the spacing of teeth 136 is fixed, based upon the average thickness of a target, such a single fixed spacing could bring about a condition in which the stack of targets would not feed properly from the end onto the loading platform. Assume a condition in which the leading target is at the forward end of the magazine ready to be fed to platform 114 on the next step advance of bar 128. If the targets were undersize, the step of advancement would be too great, and there could be eventually a step at which two targets would fall from the end, and then a blank step at which no target would be fed. If the targets were oversize, a similar situation could occur but the blank step would precede the step feeding two targets.

In order to better adapt the rack bar to handle targets of varying sizes, it is preferably constructed as shown in Figs. 7 and 8. In these figures bar 128 is provided with four separate racks of teeth, one on each of four sides of the bar. Thus if teeth 136 have the minimum desired spacing *a* as shown in Fig. 7 between the forward or working faces, then the set of teeth 136*b* may have a slightly greater spacing shown as *b* in Fig. 7. Similarly, the third set of teeth 136*c* may have a still greater spacing *c*, and a fourth set of teeth 136*d*, a still larger spacing which corresponds to the maximum size of step which may be desired. The racks or rows of teeth 136, 136*b*, 136*c*, 136*d*, are disposed at successive positions spaced 90° apart about the axis of bar 128, so that by rotating the bar through 90° or multiples thereof, the uppermost rack 136 can be replaced by another rack of different tooth spacing. I find it is satisfactory in practice to provide four different tooth spacings representing increments of .005'' providing for maximum and minimum target thicknesses differing by .020''. This covers adequately the normal size variations.

To permit changing the rack, the forward end of bar 128 and collar 137 are provided with spring detent means comprising ball 143 and spring 144 in the stationary collar to which pin 135 is attached. The end of bar 128 has a plurality of indentations 145 spaced 90° apart, and each aligned with one of the rows of teeth on the bar. Bar 128 being rotatable about pins 129, the spring detent holds the bar in any one of four adjusted positions with the rack of chosen spacing uppermost to be engaged by pawl 140. In this way the steps by which the stack of targets are advanced can be adjusted so that they represent a proper fraction of the entire length of any given stack to very closely approximate the thickness of a single target, or at least the average thickness of a target within that stack. The forward face of the flange on the end of bar 128 may carry a series of identifying numbers or the like, as seen in Fig. 8, to aid in identifying the rows of teeth.

Bearing in mind the foregoing description of the construction of my improved target trap, I shall now summarize briefly its operation, starting with the operation of the basic trap which is conventional in its design and construction. This sequence of description is chosen because the operation of the apparatus for feeding and loading the targets and recocking the main operating spring are dependent upon the operation of the basic trap and are timed to operate in response to certain motions of the throwing member.

Assuming a target to be forward on throwing arm 25 in a position T_3 where it is held between spring 121 and rail 26 (Fig. 1), and the main operating spring 14 to be set under full tension, the trap is ready to be fired. Target throwing member 12 is now held against rotation by engagement of pin 56 in notch 57*a* of latch plate 57, as shown in Fig. 15. Firing is accomplished by retracting firing pin 62. This retraction is ordinarily done by a solenoid 63 so that the trap can be released from a position remote from the trap; but pin 62 can likewise be released manually. Retraction of pin 62 starts a series of movements which combine to form a complete cycle of operation.

When pin 62 no longer holds up the rear end of lever 59, the pressure of latch plate 57 on shoulder 61 moves the rear end downwardly, as viewed in Figs. 3 and 13, and removes shoulder 61 from holding engagement with latch plate 57 so that the latch plate is free to rotate clockwise, viewed from above, under the force applied by pin 56. Rotation of the latch plate to the full line position of Fig. 16 releases pin 56 and throwing member 12 rotates forwardly under the pull of spring 14 to throw the target. Arm 25 moves from the loading position shown in full lines in Fig. 1 through more than a half-circle to a position in the vicinity of the dot-dash line position 25*a* of Fig. 1. The location of the arm at the end of the forward stroke is not critical and its exact position depends upon the strength of spring 14.

During the forward swing of the throwing arm, shaft 24 and arm 30 rotate counterclockwise as viewed in Fig. 9, and about half way through the stroke pin 31 reaches a position on a line extending between the centers of shaft 24 and pin 36, which pin connects the rear end of the operating spring to arm 37. At this position, the tension in spring 14 is at a minimum, and closely approximates a zero value, although it may not actually reach zero. As a result of this condition, the accelerating period of the stroke is ended and the arm moves through the latter portion of its stroke under its own momentum. The continued rotation of arm 30 again places the operating spring 14 under tension, and the operating spring operates to snub or decelerate the target throwing member and bring these rotating parts to a smooth stop. Thus the operating spring not only operates to impart a high acceleration to the target throwing member to launch the target, but it also operates to decelerate the target throwing member.

In the process of deceleration, spring 14 is placed in tension and stores energy which is utilized to restore the target throwing member to its initial rest position. Full restoration could not be done if it were necessary to extend the operating spring to the same amount as when the spring was originally fully cocked and ready for release. But it can be done by allowing the rear end of the operating spring to move forward. This is accomplished on the return stroke of arm 25 as it moves in a clockwise direction. Shortly after the throwing arm starts its return stroke, extension 30a (Figs. 9 and 10) on arm 30 engages arm 54 and moves the free lower end of the arm upwardly in a clockwise direction as viewed in Fig. 3. This causes pin 52 to depress the forward end of latch bar 47 (Fig. 2), disengaging shoulder 50 from plate 22b. Spring 14, now being under considerable tension, pulls spring arm 37 forwardly from the dot-dash position 37a of Fig. 9 to the full line position, at the same time moving latch bar 47 forwardly to the position shown.

The energy stored in spring 14 is sufficient to move throwing arm 25 on the return stroke not only to, but past, the full line loading position illustrated in Fig. 1. The momentum of the parts is sufficient to carry the arm to approximately the position 25b shown in dot-dash lines in Fig. 10. The exact postion at the end of the return stroke depends upon the characteristics of spring 14, as well as the energy required to move the parts. During this return stroke, pin 31 on arm 30 has again reached and passed a position on a straight line connecting the centers of rotating shaft 24 and the rear spring pin 36. As arm 30 swings in a clockwise direction past the point, spring 14 is again placed in tension to decelerate the arm on its return stroke and again bring it to a smooth stop.

As was the case with the arm at the end of the advance stroke at 25a, the arm immediately reverses its direction of movement under the pull of the operating spring, so that the arm does not stop for any appreciable length of time at either position 25a or 25b.

It is necessary that the throwing arm be returned beyond its loading position in order that the latch mechanism holding the arm in said position can be reset. During this final portion of the return swing beyond the loading position, which is termed the over-travel, pin 56 travels along the arc indicated at 146 in Fig. 16 and again engages latch plate 57. Plate 57 is rotated counterclockwise to the dotted position to release lever 59, allowing the lever to move upwardly under the influence of spring 58 and bring shoulder 61 into the raised position where it can be again engaged by latch plate 57 as it moves back to the position of Fig. 15.

As the rear end of lever 59 clears firing pin 62, the latter is released and allowed to move forwardly to its advanced position by the action of bar 64. The lower end of bar 64 is moved forwardly by its engagement with the side face of spring arm 37 as it moves into position 37 from position 37a, as described above, to cam outwardly the lower end of bar 64 so that firing pin 62 is free to advance as soon as the rear end of lever 59 has cleared it.

The latch mechanism is thus reset during the over-travel portion of the return stroke of the target throwing member. The final portion of the restoration of the throwing arm to loading position occurs as arm 25 again moves in a counterclockwise direction under the pull of spring 14, and advances from the position 25b shown in Fig. 10 to the loading position of Fig. 1 in which the arm extends generally parallel to frame bar 20. In so moving, arm 25 rotates latch 57 until it engages shoulder 61, at which time the pin 56 and arm 25 are held against further rotation. The throwing arm has now come to rest again in the loading position, ready to receive another target.

At the end of the restoration of the throwing member to its rest position as just described, the parts occupy what is termed the "half-cocked" position. This means that the operating spring is under some tension, but is not capable of moving the parts through the operating cycle just described. Spring arm 37 is in the forward position as is latch bar 47. In the conventional type of trap, the parts are cocked and the spring moved to a fully set position by pulling on handle 45 so as to move lever 43 in a counterclockwise position, as viewed in Fig. 3, moving connecting rod 42 rearwardly and likewise moving cocking lever 41 to the rear. During this rearward movement, lever 41 engages the set screw in the depending lug 38 on spring arm 37 so that the spring arm is carried rearwardly from the full line position of Fig. 9 to the dot-dash line position 37a in which spring 14 is fully tensioned. The spring is then held in this extended position by latch bar 47 which has moved rearwardly along with spring arm 37 until shoulder 50 clears the back edge of frame guide 22a and comes into engagement with plate 22b. This engagement is maintained by the upward push of ball 48 and spring 49 on the under side of latch bar 47. When handle 45 is released, parts 41, 42 and 43 are restored to the position shown in Figs. 2 and 3 by the pull of spring 46 on arm 43.

This actuation of the cocking mechanism is accomplished mechanically according to my invention, instead of manually. Drive shaft 78 and crank 98 normally come to rest in approximately the position shown in Fig. 3. As they turn during the cycle of operation, crank 98 pulls connecting rod 100 and 102 moving connecting rod 42 and lever 41 rearwardly to cock the spring in the manner just described. A full cycle of operation of the drive means including shaft 78 and crank 98 results in one complete revolution of these elements; and during the first 180° of this revolution they operate to pull on connecting rod 100 and 102 to operate the cocking mechanism, including cocking lever 41, to fully tension or set spring 14 in the manner described above, while during the second 180° of revolution, connecting rod 100 and the attached linkage are restored to the position of Fig. 3, aided by the normal pull of tension spring 46.

This cycle of operation of the cocking mechanism is initiated by engaging clutch 74 in response to movement of the throwing member during its cycle of operation. At the end of the over-travel period of the return stroke of throwing arm 25, the arm with its attached shaft 24 and arm 30 are in substantially the position shown in Fig. 10. During this over-travel the outer end of arm 30 engages arm 95 fixed on clutch-operating rod 84, moving arm 95 forwardly from the position of Fig. 9 to the position of Fig. 10. This movement of arm 95 causes a corresponding motion of clutch-operating rod 84 which retracts cam 82 and allows driving dog 79 to move into the driving position in which it engages slot 75a in collar 75 on driving shaft 72. Engagement of clutch 74 immediately starts shaft 78 turning to operate the cocking mechanism as a result of its operative connection to the power source represented by motor 70.

The engagement between swinging arm 30 and fixed arm 95 is of short duration, so that arm 95 and rod 84 are quickly returned from the position of Figs. 10 and 11 to the position of Fig. 9 under the action of spring 85. Should spring 85 fail to operate in this fashion, the parts are positively returned by engagement of rotating cam 91 with pin 90 which is moved outwardly away from the axis of drive shaft 78. The movement of pin 90 is transmitted through lever 88 and link 87 to rod 84 and cam 82 (Fig. 11). As a consequence, cam 82 is again in position, before one revolution of shaft 78 has been completed, to engage driving dog 79 and move it to the non-engaging position of Fig. 12. A lug on driving dog 79 engages pin 92 to stop shaft 78 in the proper position and prevent over-travel of the shaft, thus insuring that the cycle of operation starts and stops at the same position or close thereto.

Clutch 74 is engaged to render the driving means operative after the throwing member has been returned past the loading position, or is in that portion of its movement referred to as the over-travel. This insures that the cocking mechanism will not be operated until after spring arm 37 has been released and moved forward, placing operating spring 14 under reduced tension. Thus when throwing arm 25 returns to the loading position from its extreme over-travel, spring 14 is only partially tensioned or "half-cocked." The rapidity of action of the throwing member is such that it has returned to the loading position before any appreciable movement of drive shaft 78 has occurred, and consequently the moving parts of the trap involved in the throwing operation have come to rest before the cocking mechanism is actuated by the mechanical drive means.

This same drive means including shaft 78 and crank 98 serves to actuate the target loading means and the means for feeding another target onto the loading platform. The former is done by operating rod 104. As crank 98 revolves, it moves rod 104 rearwardly, as shown in Fig. 13, causing lever 105 to be rotated in a clockwise direction. The forward movement of the upper end of the lever is transmitted by rod 108 to carriage 110 which slides forwardly on rail 111, as illustrated in Fig. 13. As the carriage moves forward, roller 118 is first brought into contact with the rear side of the target at T_1 on platform 114, and the target is then pushed forwardly off the loading platform onto the free end of arm 25. The position of guide 118 is such as also to push the target over against rail 26, as may best be seen in Fig. 14 when the target at T_2 is being advanced over the flat top surface of arm 25 by ram 110.

The stroke of ram 110 is sufficient to advance the target toward the pivoted end of the throwing arm to position T_1 in which the target is held snugly between leaf spring 121 and rail 26, which is the position shown in Fig. 1. In this position, the target begins to move simultaneously with the throwing arm, and there is no impact of the rail on the throwing arm against the rim of the target which breaks the target frequently, as is the case when the target is loaded to a position in which it is slightly spaced from rail 26. The stroke of ram 110 can be varied by changing the length and points of interconnection of the various links actuating the ram. A fine adjustment of the end of the stroke is provided by a slotted connection at 153 between the carriage slide and bracket 117. The slot permits roller 118 to be moved relative to the carriage slide to determine exactly the position of the target when fully loaded onto arm 25.

This loading action takse place during the first 180° of revolution of crank 98 which is the same time that the crank actuates the cocking mechanism. During the second one-half revolution of the crank, the motions of the linkage are reversed and ram 110 is moved rearwardly on rail 111 to a position at the back of the loading platform where it is again ready to load a target from the platform onto the throwing arm.

Plate 116 extends across platform 114 and arm 25. As carriage 110 reciprocates, plate 116 clears off any fragments of broken targets or, on the back stroke, any target that has prematurely fallen onto platform 114.

The means for advancing the stack of targets in the magazine is also operated by rotation of crank 98; but in order to obtain the proper timed relation between the advance of the stack and the target loading carriage 110, the stack is advanced during the second 180° of rotation of crank 98. At the end of each rotation of shaft 78, crank pin 99 stops in engagement with the curved cam surface 132 on the lever 133, the parts being positioned as shown in Fig. 4. The lower end of lever 133 being depressed, bar 128 is advanced. As shaft 78 commences its single revolution, crank pin 99 moves downwardly out of engagement with lever 133 allowing bar 128 to move to the left at Fig. 4 under the force exerted by the spring 139. As the rack bar moves, pawl 140 lifts and rides over one tooth, coming down into the next space. Movement of the rack bar also lifts the lower end of lever 133 so that it is in a position to be engaged by the rounded end of crank pin 99 toward the end of the revolution of shaft 78 and crank 98.

As the crank pin engages the lower curved end of lever 133, it depresses the lower end 132 and rotates lever 133 in a clockwise direction as viewed in Fig. 4 to advance rack bar 128. The bar moves until a tooth engages the end of pawl 140, when further movement of the bar also moves follower 138 for the remainder of the rack bar movement. Since the forward motion of the rack bar terminates at the same point each time, the net advance motion of follower 138 equals the spacing between teeth 136 for each successive actuation of lever 133.

In this manner, follower 138 advances by successive steps, one step for each revolution of crank pin 99. Each step is the equivalent of the net thickness of the target in the stack so that each step advances the entire stack to the end of magazine 127 a sufficient distance that the end target is pushed off the end of the magazine and falls by gravity onto platform 114.

By arranging the stack of targets in a horizontally extending direction, the problem of removing the end target from the advancing end of the stack is considerably simplified. It is unnecessary to use any mechanical member to separate the end target and remove it from the stack, this being done by gravity. Also it is not necessary to support the entire weight of the stack upon the target at the end or next to the end of the stack as would be the case if the stack were vertical. With a horizontally extending stack, each target rests individually upon angles 126 and 127 so that the weight of the stack is supported throughout its length. The pressure applied by follower 138 is sufficient to move the stack horizontally over angles 126 and 127, and the amount of this pressure is regulated by the friction developed between the targets and the angles. This can be kept sufficiently low that the pressure applied to a stack of targets, numbering one hundred for example, is well within the pressure permitted by the relatively fragile nature of the targets. Another advantage of my form of magazine is that it does not clog or jam if one of the targets is broken in the stack. The fragments are cleared out of the machine and the operational cycle made without throwing a target, but without any adverse effect in subsequent operation.

When the target at the end of the stack falls from the magazine onto the loading platform to position T_1, it rotates through 90° and falls with its greater dimensions parallel to the top surface of platform **114**. The pad of sponge rubber **114***a* is preferably provided to eliminate any chipping of the rim of the target as a result of the fall from the magazine, also to dampen any rebound from the platform.

After the stack of targets has all been discharged onto the loading platform, the magazine may be simply reloaded by lifting pawl **140** clear of rack **136** and manually pulling follower **138** back to the outer end of the magazine. The given number of the targets is then stacked in the magazine, this number being for purposes of illustration one hundred. The length of this stack is then determined and, if bar **128** is adjustable, the bar is rotated to bring uppermost the series of teeth of which the spacing *a*, *b*, *c*, or *d*, is closest to .01 of the overall length of the stack. In order to ready the magazine for action, the stack is advanced over angles **126** and **127** until the end target is at the end of the magazine, as shown in Fig. 4.

Figs. 17 and 18 show a modified form of my invention employing a variational means for operating clutch **74**. The clutch operating rod **84** is eliminated and the clutch is operated instead by solenoid **148** and plunger **149** which bears against handle **88**. When the solenoid is energized to move plunger **149** toward the left as viewed in Figs. 17 and 18, handle **88** is moved counterclockwise by engagement with the plunger. This motion is transmitted through link **87** to cam **82** which withdraws the cam and causes the clutch to engage, in the manner previously described.

Solenoid **148** is actuated by micro-switch **150** which is mounted on a bracket fastened to upper frame bar **20** by bolt **60**. The micro-switch carries a horizontally extending, flexible reed **151** which is so located as to be engaged by arm **25** during the period of over-travel. When arm **25** is in the arc of over-travel, as shown in Fig. 17, the arm depresses reed **151** and closes the contacts of the micro-switch. This action closes circuit **152** and energizes the solenoid, as just described. The length of time during which switch **150** is closed, can be regulated if desired by changing the position of the switch and the length of reed **151**; but a very short period of contact is sufficient to release plunger **149** and cause clutch **74** to engage.

After solenoid **148** is de-energized, plunger **149** is restored to its retracted position by engagement of cam **91** with pin **90** carried by handle **88**, cam **82** also being thereby returned to the non-operating position as previously described.

In Figs. 17 and 18 the mechanism has been simplified by removing spring **85**.

Except for the changes in the construction of the clutch actuating mechanism just described, the construction and operation of the modified form of my invention is the same in all respects as previously set forth.

Having described a preferred embodiment of my invention and certain modifications thereof, it will be apparent that changes therein may be made by persons skilled in the art without departing from the spirit and scope of my invention; and therefore I wish it understood that the foregoing description is considered as being illustrative of, rather than limitative upon, the appended claims.

I claim:

1. In a target throwing trap having a spring-operated target throwing member comprising a swinging arm and a rotatable shaft to which the arm is attached, and a cocking mechanism movable independently of the throwing member to set a spring which upon release swings the throwing member in one direction and subsequently swings the throwing member in the other direction to return it to a target loading position, the combination comprising: a power source; a continuously driven member operatively connected to the power source; and means engaged by the target throwing member during its swinging movement for causing the driven member to actuate the cocking mechanism.

2. In a target throwing trap having a spring-operated target throwing member comprising a swinging arm and a rotatable shaft to which the arm is attached, and a cocking mechanism movable independently of the throwing member to set a spring which upon release swings the throwing member in one direction and subsequently swings the throwing member in the other direction to return it to a target loading position, the combination comprising: a power source; a driven member operatively connected to the power source; and means responsive to return movement of the target throwing member for causing the driven member to actuate the cocking mechanism, including a member engaged by the throwing member near the end of its swing in said other direction.

3. In a target throwing trap having a spring-operated target throwing member comprising a swinging arm and a rotatable shaft to which the arm is attached, and a cocking mechanism movable independently of the throwing member to set a spring which upon release swings the throwing member in one direction and subsequently swings the throwing member in the other direction to return it to and past a target loading position, the combination comprising: a power source; drive means operatively connecting the power source to the cocking mechanism; and means for rendering the drive means operative to actuate the cocking mechanism after the throwing member has been returned past the loading position, including a member engaged by the throwing member after being returned past the target loading position.

4. In a target throwing trap having a spring-operated target throwing member comprising a swinging arm and a rotatable shaft to which the arm is attached, and a cocking mechanism movable independently of the throwing member to set a spring which upon release swings the throwing member in one direction and subsequently swings the throwing member in the other direction to return it to a target loading position, the combination comprising: a power source; drive means operatively connected to the cocking mechanism; clutch means normally disen-

gaged for drivingly connecting the power source to the drive means; and means for engaging the clutch in response to movement of the target throwing member to actuate the cocking mechanism.

5. A target throwing trap as in claim 4 in which the means for engaging the clutch is operative after the throwing member has been returned past the loading position.

6. A target throwing trap as in claim 4 in which the means for engaging the clutch includes a cam on the rotatable shaft carrying the swinging arm and a rod extending between the cam and clutch, the cam being shaped to actuate the rod only when the swinging arm has been returned past the loading position.

7. In a target throwing trap having a spring-operated target throwing member comprising a swinging arm and a rotatable shaft to which the arm is attached, and a cocking mechanism movable independently of the throwing member to set a spring which upon release swings the throwing member in one direction and subsequently swings the throwing member in the other direction to return it to a target loading position, the combination comprising: a motor; a drive shaft operatively connecting the motor to the cocking mechanism; clutch means for drivingly connecting the motor to the shaft; and means for actuating the clutch in response to movement of the target throwing member.

8. In a target throwing trap having a spring-operated target throwing member comprising a swinging arm and a rotatable shaft to which the arm is attached, and a cocking lever adapted to set a spring which upon release swings the throwing member in one direction and subsequently swings the throwing member in the other direction to return it to a target loading position, the combination comprising: a motor; a drive shaft having crank means; a connecting rod operatively connecting the crank means to the cocking lever; single-revolution clutch means for drivingly connecting the motor to the drive shaft; clutch engaging means for engaging said single revolution clutch; and a member connected to the clutch engaging means and engaged by the target throwing member upon rotation of the target throwing member to actuate the clutch engaging means.

9. In a target throwing trap having a spring-operated target throwing member comprising a swinging arm and a rotatable shaft to which the arm is attached, and a spring which upon release swings the throwing member in one direction and subsequently swings the throwing member in the other direction to return it to and past a target loading position, the combination comprising: a loading platform adjacent the free end of the swinging arm when the arm is in loading position from which platform targets are placed onto the throwing arm; a substantially horizontally extending magazine adapted to hold a plurality of targets in a horizontal stack with one end adjacent the platform; means for advancing the stack lengthwise by steps substantially equal to the thickness of a single target; a power source; drive means operatively connecting the power source to the stack advancing means; and means for rendering the drive means operative including an actuating member engaged by the throwing member after the throwing member has been returned past the loading position to actuate the stack advancing means.

10. In a target throwing trap having a spring-operated target throwing member comprising a swinging arm and a rotatable shaft to which the arm is attached, and a cocking mechanism adapted to set a spring connected to the throwing member and which upon release swings the throwing member in one direction and subsequently swings the throwing member in the other direction to return it to and past a target loading position, the combination comprising: a loading platform adjacent the free end of the swinging arm when the arm is in loading position; reciprocating means for loading a target onto the arm from the platform; a power source; drive means operatively connecting the power source to the reciprocating means and to the cocking mechanism; and a member engaged by the target throwing member during said swinging movement of the target throwing member for causing the drive means to actuate the reciprocating means and the cocking mechanism.

11. In a target throwing trap having a spring-operated target throwing member comprising a swinging arm and a rotatable shaft to which the arm is attached, and a cocking mechanism adapted to set a spring connected to the throwing member and which upon release swings the throwing member in one direction and subsequently swings the throwing member in the other direction to return it to and past a target loading position, the combination comprising: a magazine adapted to hold a plurality of targets in a substantially horizontally extending stack; means for advancing the stack by successive steps to eject targets one at a time from the magazine; a power source, drive means operatively connecting the power source to the stack advancing means and to the cocking mechanism; and a member engaged by the target throwing member during said swinging movement of the target throwing member for causing the drive means to actuate the stack advancing means and the cocking mechanism.

12. In a target throwing trap having a spring-operated target throwing member comprising a swinging arm and a rotatable shaft to which the arm is attached, and a cocking mechanism adapted to set a spring connected to the throwing member and which upon release swings the throwing member in one direction and subsequently swings the throwing member in the other direction to return it to and past a target loading position, the combination comprising: a loading platform adjacent the free end of the swinging arm when the arm is in loading position; reciprocating means for loading a target onto the arm from the platform; a magazine adapted to hold a plurality of targets in a substantially horizontally extending stack; means for advancing the stack by successive steps to deposit targets one at a time on the loading platform; a power source; drive means operatively connecting the power source to the stack advancing means, to the reciprocating means, and to the cocking mechanism; and a member engaged by the target throwing member during said swinging movement of the target throwing member for causing the drive means to actuate the stack advancing means, the reciprocating means, and the cocking mechanism.

13. In a target throwing trap having a spring-operated target throwing member comprising a swinging arm and a rotatable shaft to which the arm is attached, and a spring which upon release swings the throwing member in one direction and

subsequently swings the throwing member in the other direction to return it to and past a target loading position, the combination comprising: a loading platform adjacent the free end of the swinging arm when the arm is in loading position from which platform targets are placed onto the throwing arm; a substantially horizontally extending magazine adapted to hold a plurality of targets in a horizontal stack with one end adjacent the platform; means for advancing the stack lengthwise by steps substantially equal to the thickness of a single target; a power source; drive means operatively connecting the power source to the stack advancing means; and means for rendering the drive means operative after the throwing member has been returned past the loading position to actuate the stack advancing means; said stack advancing means including a longitudinally and rotationally movable bar having a plurality of separate, longitudinally extending racks of different tooth spacing selectively engageable by a stack advancing member to regulate the size of the step by which the stack is advanced.

14. In a target throwing trap having a spring-operated target throwing member comprising a swinging arm and a rotatable shaft to which the arm is attached, and a cocking mechanism adapted to set a spring connected to the throwing member and which upon release swings the throwing member in one direction and subsequently swings the throwing member in the other direction to return it to and past a target loading position, the combination comprising: a loading platform adjacent the free end of the swinging arm when the arm is in loading position; reciprocating means for loading a target onto the arm from the platform; a magazine adapted to hold a plurality of targets in a substantially horizontally extending stack; means for advancing the stack by successive steps to deposit targets one at a time on the loading platform; a power source; drive means operatively connecting the power source to the stack advancing means, to the reciprocating means, and to the cocking mechanism, said drive means including a rotating element that simultaneously actuates the cocking mechanism and the reciprocating means and subsequently advances the stack of targets; and means responsive to movement of the target throwing member for causing the drive means to actuate the stack advancing means, the reciprocating means, and the cocking mechanism.

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