May 25, 1948. W. FERRIS 2,442,164

POWER OPERATED MEANS AND CONTROL MECHANISM THEREFOR

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Fig. 1.

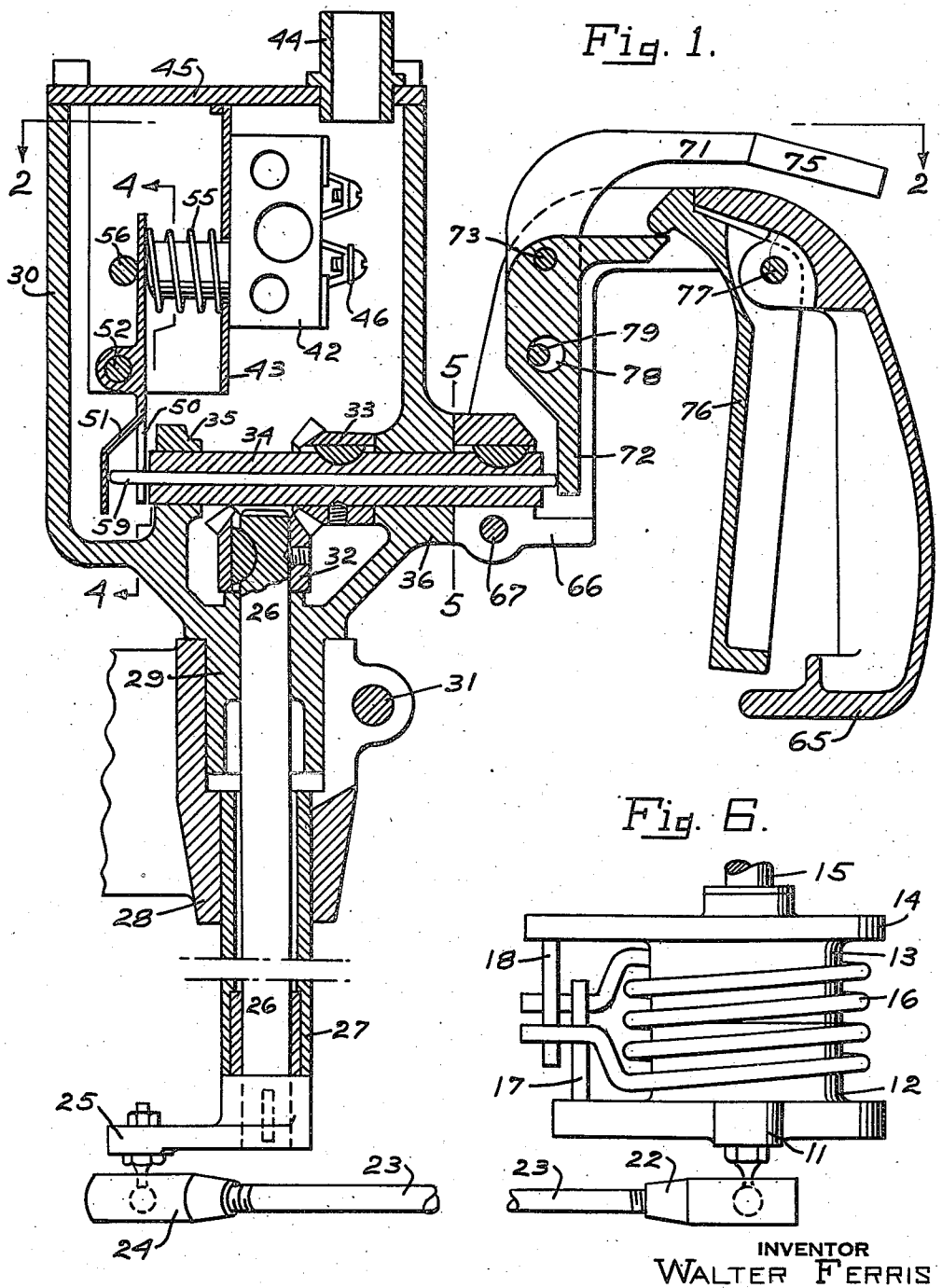


Fig. 6.

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Fig. 2.

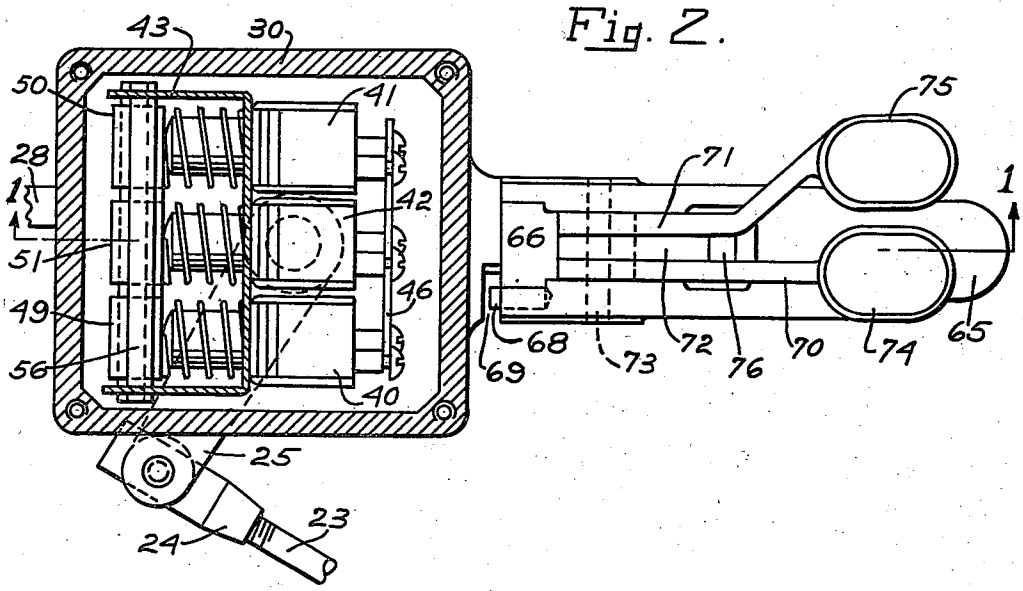


Fig. 3.

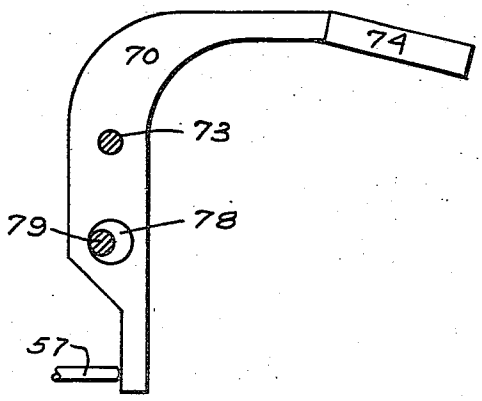


Fig 4.

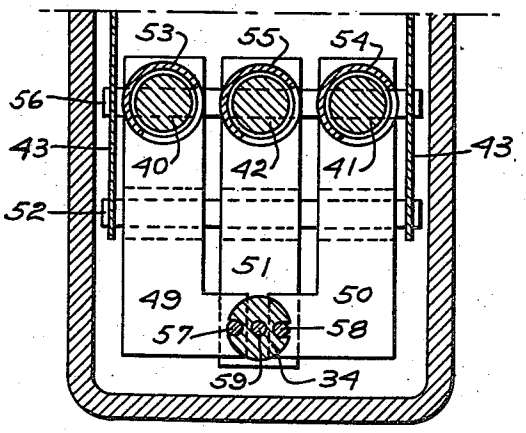
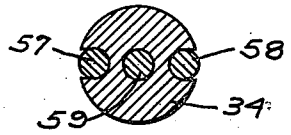


Fig. 5.



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Fig. 8.

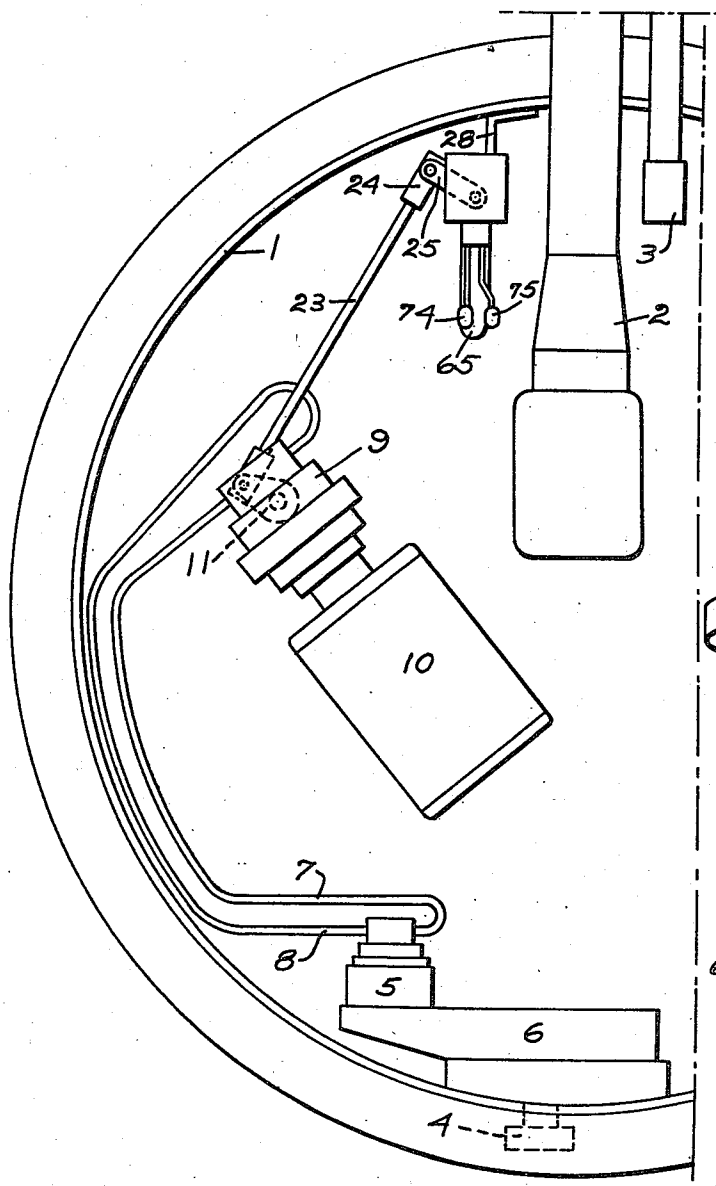


Fig. 7.

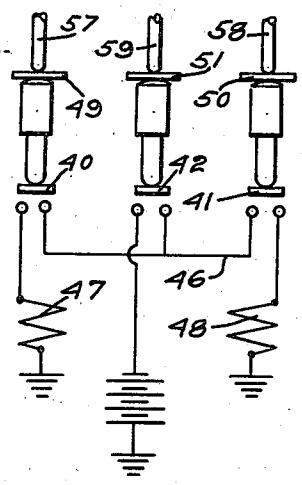
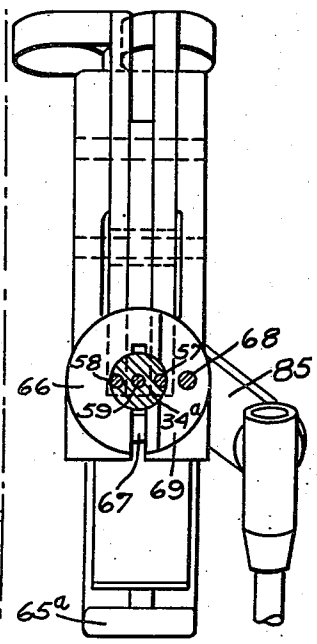


Fig. 11.



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Fig. 10.

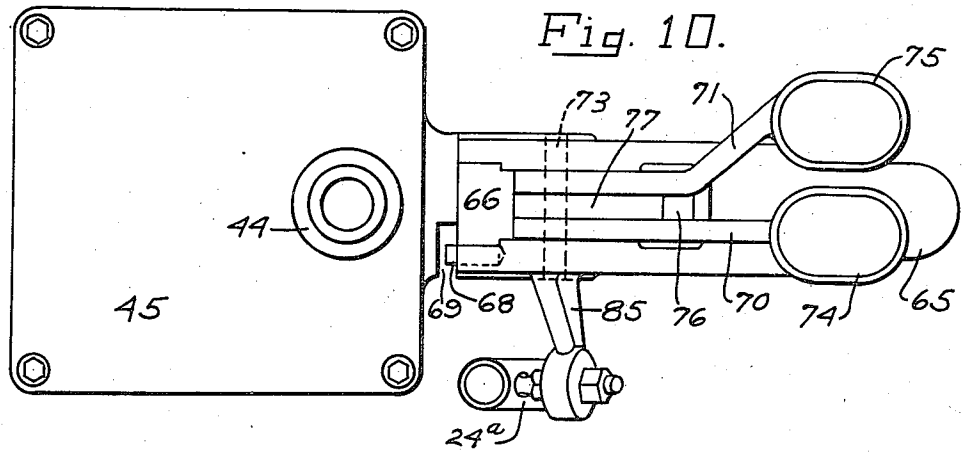
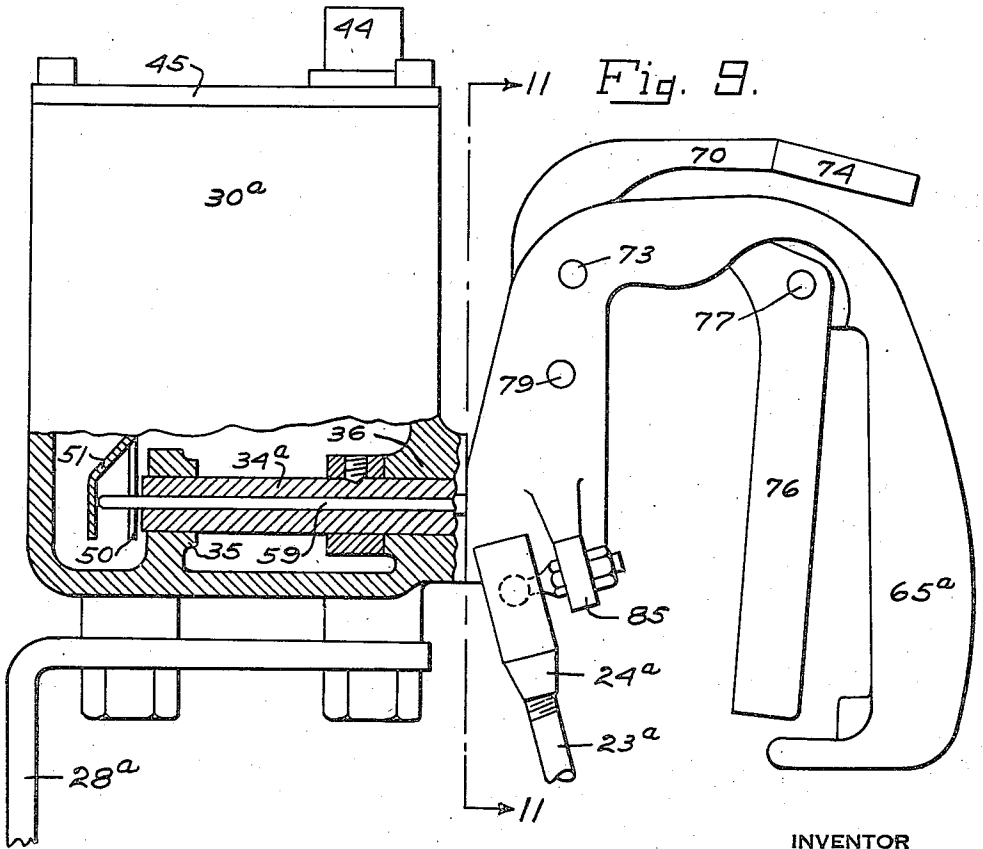


Fig. 9.



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Patented May 25, 1948

2,442,164

UNITED STATES PATENT OFFICE

2,442,164

POWER-OPERATED MEANS AND CONTROL MECHANISM THEREFOR

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Application September 18, 1942, Serial No. 458,889

10 Claims. (Cl. 89—41)

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This invention relates to control mechanisms of the type in which a single device is employed to control a plurality of mechanisms.

For the purpose of illustration, the invention will be explained as employed to control the turret traverse mechanism and the firing mechanisms of an army tank but the invention is not limited to such use as it may readily be employed for controlling other mechanisms.

In a tank to which the invention is applied, the turret is rotated by a traverse mechanism to aim the guns carried by the turret, the guns are fired by electro-magnetic mechanisms and the traverse and firing mechanisms are controlled by a single control device.

The invention has among its objects the provision in a control device of the above character movable elements for effecting operation of at least one mechanism, stationary switch means for effecting operation of at least one electromagnetic mechanism, and instrumentalities movable with the movable elements for operating the stationary switch means so that the use of flexible cables or sliding electrical contacts is avoided. Other and more specific objects and advantages of the invention will appear from the description hereinafter given of the control mechanisms shown in part schematically in the accompanying drawings in which the views are as follows:

Fig. 1 is a vertical central sectional view of a control device constructed according to the invention and adapted to be employed for controlling the traverse and firing mechanisms of an army tank, the view being taken on the line 1—1 of Fig. 2.

Fig. 2 is a sectional plan view thereof as indicated by the line 2—2 of Fig. 1.

Fig. 3 is a detailed view of one of the levers or triggers shown in Figs. 1 and 2.

Fig. 4 is a sectional view taken on the irregular line 4—4 of Fig. 1 and showing the actuators for operating the switches which control the firing mechanisms of the guns carried by the turret of the tank.

Fig. 5 is a cross-sectional view showing the push rods for operating the switches of the fire control mechanisms arranged within a shaft which forms a part of the turret traverse control mechanism, the view being taken on the line 5—5 of Fig. 1 but drawn to a larger scale.

Fig. 6 is a side view of a mechanism for effecting operation of the turret traverse drive.

Fig. 7 is a diagram of the electric circuit of the firing mechanisms for the guns shown in Fig. 8.

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Fig. 8 is a schematic plan view showing the invention applied to the turret of a tank.

Fig. 9 is an elevation partly in section showing a modification of the device shown in Fig. 1.

Fig. 10 is a top plan view of the device shown in Fig. 9.

Fig. 11 is a view taken on the line 11—11 of Fig. 9.

For the purpose of illustration, the invention has been shown applied to a tank turret in Fig. 8 from which all devices not associated with the invention, such as the oil reservoir, gun stabilizer and stabilizer pump have been omitted to avoid complicating the view. The turret 1 has a plurality of guns such as a cannon 2 and a machine gun 3 suitably mounted therein and adapted to be aimed at a target by rotating turret 1 by means of a pinion 4 driven by hydraulic motor 5 through a reduction gear 6. Motor 5 is energized by liquid supplied thereto through two pipes 7 and 8 from a reversible variable delivery pump 9 which is continuously driven by an electric motor 10.

Pump 9 may be similar to the pump shown in Patent No. 2,406,138 to which reference may be had as to the construction and operating characteristics thereof. It is deemed sufficient to state herein that pump 9 will deliver liquid in a direction and at a rate dependent upon the direction and distance its control lever 11 is moved from its neutral position and that, when lever 11 is in its neutral position, pump 9 will be at zero stroke and no liquid will be delivered thereby.

Figs. 1–7

As shown in Fig. 6, lever 11 has a hub 12 formed thereon with its face in engagement with the face of a hub 13 formed upon a flange 14 which is fixed in a stationary position as by being fastened to the casing of pump 9. Hub 12 is fixed upon the outer end of a shaft 15 which extends through hub 13 into pump 9 to operate the stroke changing mechanism thereof as fully shown and described in Patent No. 2,406,138.

Hubs 12 and 13 are encircled by a torsion spring 16 the opposite ends of which are arranged upon opposite sides of two pins 17 and 18 fixed, respectively, in lever 11 and in flange 14 so that spring 16 tends to hold pins 17 and 18 in radial alinement with shaft 15 in which position of pins 17 and 18 the pump control mechanism is in neutral and no liquid will be delivered by pump 9. When lever 11 is rotated in one direction or the other from its neutral position, shaft 15 will op-

erate the pump control mechanism and cause pump 9 to deliver liquid in one direction or the other and pin 17 will move one end or the other of spring 16 away from pin 18 and thereby increase the torsion of spring 16 so that, when lever 11 is released, spring 16 will return the pump control mechanism to neutral.

Lever 11 is connected by means of a ball and socket joint 22 to one end of a rod 23 the other end of which is connected by ball and socket joint 24 to a lever 25 fixed to the lower end of a shaft 26 as shown in Fig. 1. Shaft 25 is journaled near its lower end in the lower end of a tube 27 fixed to or formed integral with a bracket 28 which is attached to a wall of turret 1 as indicated in Fig. 8. Shaft 26 is journaled near its upper end in an annular projection 29 formed upon the lower end of a housing 30 and fitted within bracket 28 which is bifurcated along one side thereof and provided with a bolt 31 for clamping housing 30 in an adjusted position. The upper end of shaft 26 has a bevel gear 32 fixed thereon and arranged within housing 30 in mesh with a bevel gear 33 fixed upon a horizontal control shaft 34 which has one end journaled in a bearing 35 and its other end journaled in and extending through a bearing 36 formed upon a wall of housing 30.

For the purpose of illustration, shaft 26 has been shown in a vertical position in order to simplify the views but in practice shaft 26, projection 29, bracket 28 and tube 27 extend downward and laterally at an angle from the axis of horizontal shaft 34 in order that the control mechanism and the turret traverse drive may be suitably arranged within the limited space available within turret 1.

Three normally open electric switches 40, 41 and 42 are supported, as by means of a bracket 43, within housing 30 and connected into an electric circuit by conductors (not shown) extending through a thimble 44 arranged in the cover 45 of housing 30, the three switches having one terminal of each connected together by a bus bar 46. As shown in Fig. 7, switches 40 and 41 control two solenoids 47 and 48 respectively, and switch 42 functions to cut switches 40 and 41 into and out of the electric circuit. Energizing one or the other of solenoids 47 and 48 effects operation of the firing mechanism of one or the other of guns 2 and 3.

Switches 40, 41 and 42 are adapted to be closed, respectively, by three actuators 49, 50 and 51 journaled upon a shaft 52 carried by bracket 43. The upper ends of actuators 49, 50 and 51 are urged, respectively, by springs 53, 54 and 55 against a stop bar 56 carried by bracket 43. The lower ends of actuators 49, 50 and 51 engage, respectively, three push rods 57, 58 and 59 which are slidable in horizontal shaft 34. Push rods 57 and 58 extend through suitable longitudinal slots formed in the peripheral surface of shaft 34 diametrically opposite each other and push rod 59 extends through a suitable bore formed upon the axis of shaft 34 as shown in Fig. 5.

Shaft 34 is adapted to be rotated by a control handle 65 having the front or inner part thereof bifurcated and provided with a bifurcated hub 66 which is fixed for rotation therewith as by means of a suitable key and is clamped thereon by means of a bolt 67. A pin 68 is fixed in hub 66 and extends into a recess 69 formed in the outer face of bearing 36 so that rotation of handle 65 and shaft 34 in either direction is limited by pin 68 engaging one end or the other of recess 69.

Push rods 57, 58 and 59 are adapted to be operated, respectively, by three bell crank levers or triggers 70, 71 and 72 arranged within the bifurcated part of handle 65 and pivoted upon a pin 73 fixed in the side walls thereof. Levers 70 and 71 extend over the top of handle 65 and are provided, respectively, with thumb pads 74 and 75, the two levers being substantially identical except that pad 75 is offset from the axis of lever 71 while pad 74 is arranged approximately upon the axis of lever 70 as shown in Fig. 2. The lower portion of lever 72 is substantially identical to the lower portions of levers 70 and 71 but the upper part thereof extends rearward within the bifurcated part of handle 65 and is engaged by a lever 76 pivoted upon a pin 77 and extending downward along the inside of the grip portion of handle 65 as shown in Fig. 1. In order to limit the movement of levers 70, 71 and 72, a hole 78 is formed in all three levers and a pin 79 of smaller diameter extends through hole 78 and is fixed in the side walls of the bifurcated part of handle 65.

Operation

Handle 65 (Figs. 1 and 2) is normally held in its central or neutral position by the action of spring 16 (Fig. 6). When handle 65 is swung in one direction or the other through a certain angular distance in a vertical plane, it will rotate shaft 34, gears 32 and 33 will rotate shaft 26, and lever 25 on shaft 26 will cause rod 23 to swing pump control lever 11 in a direction and through a distance corresponding to the direction and distance handle 65 is moved from its neutral position. Moving lever 11 will cause pump 9 (Fig. 8) to discharge liquid in a direction and at a rate determined by the direction and distance lever 11 is moved from its neutral position. The liquid discharged by pump 9 will flow to motor 5 and cause it to rotate turret 1 through reduction gear 6 and pinion 4. Turret 1 is thus rotated in a direction and at a rate determined by the direction and distance handle 65 is moved from its neutral position.

As the turret approaches the position in which the guns are directed toward the target, the operator gradually returns handle 65 toward its neutral position, thereby reducing the speed of the turret until the guns are aimed directly at the target at which time the speed of the turret can be regulated to the speed of the target and/or the speed of the tank, or the turret can be stopped if the target is stationary or is moving directly toward or from the tank or if the tank is moving directly toward or from the target.

The operator, by squeezing the grip portion of handle 65, may swing lever 76 upon pivot 77 and cause it to swing lever 72 upon pin 73 and move rod 59 axially of shaft 34. Rod 59 will swing actuator 51 upon shaft 52 and cause it to close switch 42 to thereby connect switches 40 and 41 into the electric circuit.

Then when the guns are aimed at the target, the operator may place his thumb upon and depress either or both of pads 74 and 75 to swing either or both of levers 70 and 71 upon pin 73 and move either or both of rods 57 and 58 axially of shaft 34 so that either or both of actuators 49 and 50 are swung upon shaft 52 and close either or both of switches 40 and 41 to energize either or both of solenoids 47 and 48 and thereby cause

either or both of guns 2 and 3 to be fired at the target.

Figs. 9 to 11

The device shown in these figures differs from the device shown in Figs. 1 to 5 only in the means for transmitting motion from the control handle to the pump control lever. Consequently like parts have been indicated by like reference numerals and further description thereof is deemed unnecessary while corresponding parts have been indicated by corresponding reference numerals with the exponent "a" added to the numerals applied to such corresponding parts in Figs. 9 to 11.

The firing and safety switches are arranged within a housing 30a which differs from housing 30 in that it is connected at its bottom to a bracket 28a by means of which it may be attached to the turret. Housing 30a has journaled therein a shaft 34a which differs from shaft 34 in that gear 33 is omitted therefrom and which has the control handle 65a fixed to its outer end.

Handle 65a has a lug 85 extending from one side thereof and connected by means of a ball and socket joint 24a to one end of a rod 23a the other end of which is connected by a ball and socket joint to the pump control lever in the same manner that rod 23 is connected to pump control lever 11. The control shown in these figures is employed in a tank of a type different from the type in which the control shown in Figs. 1 to 5 is employed, it being understood that pump 9 is so located that rod 23a may be readily attached to and operate the control lever 11 thereof.

The control operates in exactly the same manner as the control shown in Figs. 1 to 5 except for the manner in which motion is transmitted from the control handle to the pump control lever.

The invention herein set forth is susceptible of various other modifications and adaptations without departing from the scope of the invention which is hereby claimed as follows.

I claim:

1. In a machine having a member adapted when operated to perform a given function, a drive for moving said member, a control for said drive and electric means for effecting operation of said member, the combination of a controller movable from a neutral position to operate said control and thereby cause said drive to move said member, yielding means for returning said controller to and normally retaining it in neutral position, switch means supported independently of said controller for effecting operation of said electric means, and means carried by said controller for operating said switch means.

2. In a machine having a member adapted when operated to perform a given function, a drive for moving said member, a control for said drive and electric means for effecting operation of said member, the combination of a controller rotatable in opposite directions selectively from a neutral position to operate said control and thereby cause said drive to move said member, a stationary abutment, a second abutment movable with said controller, a torsion spring having the ends thereof engaging opposite sides of both of said abutments to enable said spring to return said controller to and normally retain it in neutral position, switch means supported independently of said controller for effecting operation of said electric means, and means carried by said controller for operating said switch means.

3. In a machine having a member adapted when operated to perform a given function, a drive for moving said member, a control for said

drive and electric means for effecting operation of said member, the combination of a controller manually movable from a neutral position to operate said control and thereby cause said drive to move said member, said controller including a rotary shaft, yielding means for returning said controller to and normally retaining it in neutral position, stationary switch means for effecting operation of said electric means, means slidable in said shaft for actuating said switch means, and means carried by said controller for operating said switch actuating means.

4. In a machine having a member adapted when operated to perform a given function, a drive for moving said member, a control for said drive and electric means for effecting operation of said member, the combination of a controller manually rotatable from a neutral position to operate said control and thereby cause said drive to move said member, said controller including a rotary shaft having a handle fixed thereto, a torsion spring for returning said controller to and normally retaining it in neutral position, rods slidable in said shaft for operating said switch means, and manual means carried by said handle for operating said rods.

5. In a device having a plurality of independently operable mechanisms, power means for operating one of said mechanisms, electric means for effecting operation of other of said mechanisms, and a control for said power means, the combination of stationary switch means for controlling said electric means, a rotary device for effecting operation of said control and including a rotary shaft, and switch operating means carried by and slidable in said shaft.

6. In a device having a plurality of independently operable mechanisms, power means for operating one of said mechanisms, electric means for effecting operation of other of said mechanisms, and a control for said power means, the combination of stationary switch means for controlling said electric means, a rotary device for effecting operation of said control and including a rotary shaft having a control handle fixed thereto, rods slidable in said shaft for operating said switch means, and manual means carried by said handle for operating said rods.

7. A control device comprising a stationary support, a plurality of stationary electric switches carried by said support, a rotatable element carried by said support, a plurality of rods slidable in said element for operating said switches selectively during rotation of said element, and means carried by said element for actuating said rods selectively.

8. A control device comprising a stationary support, a plurality of stationary electric switches carried by said support, a shaft journaled in said support, means for rotating said shaft, a plurality of rods arranged in said shaft to operate said switches selectively during rotation of said shaft, and means for actuating said rods selectively.

9. A control device comprising a stationary support, a shaft journaled in said support, means for rotating said shaft, a plurality of stationary electric switches carried by said support and each provided with an actuator so arranged that it overlaps at least a part of the end of said shaft, a plurality of rods arranged in said shaft and each adapted to operate one of said actuators, and means associated with said shaft rotating means for actuating said rods selectively.

10. A control unit for two devices one of which

is controlled by electric means and the other of which is a pump having a member rotatable in one direction or the other from a neutral position to cause said pump to deliver liquid in one direction or the other, said control unit comprising a housing arranged in a stationary position remote from said devices, a shaft journaled in said housing and having a handle attached thereto, means for transmitting motion between said shaft and said member so that rotation of said shaft in one direction or the other by said handle will cause said member to be rotated in one direction or the other from its neutral position, a torsion spring for returning said handle and said member to their initial positions upon release of said handle, two switches adapted to be connected in series with said electric means and a source of electrical energy so that both switches must be closed to effect operation of said electric means, and means carried by said handle for operating each of said switches so that said pump may be adjusted and said electric means may be energized simultaneously, one of said switch operating means being operable in response to the operator grasping said handle and the other switch operating means being independently operable.

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