

July 9, 1940.

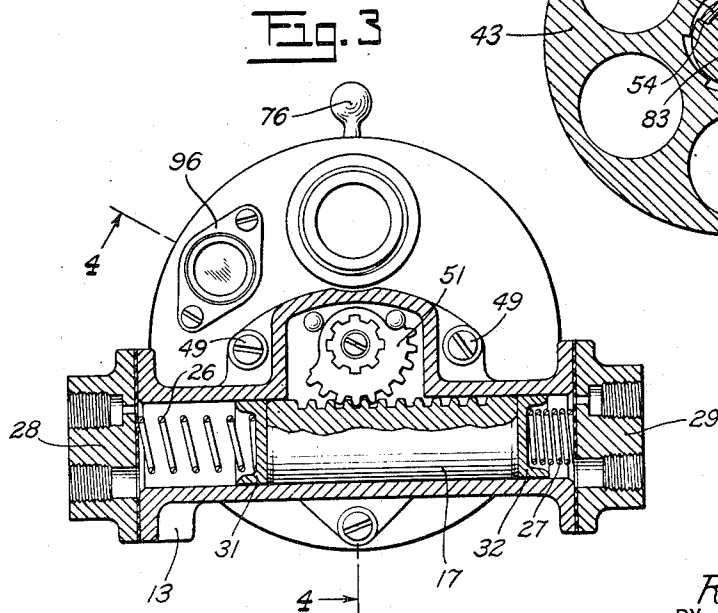
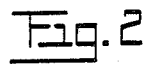
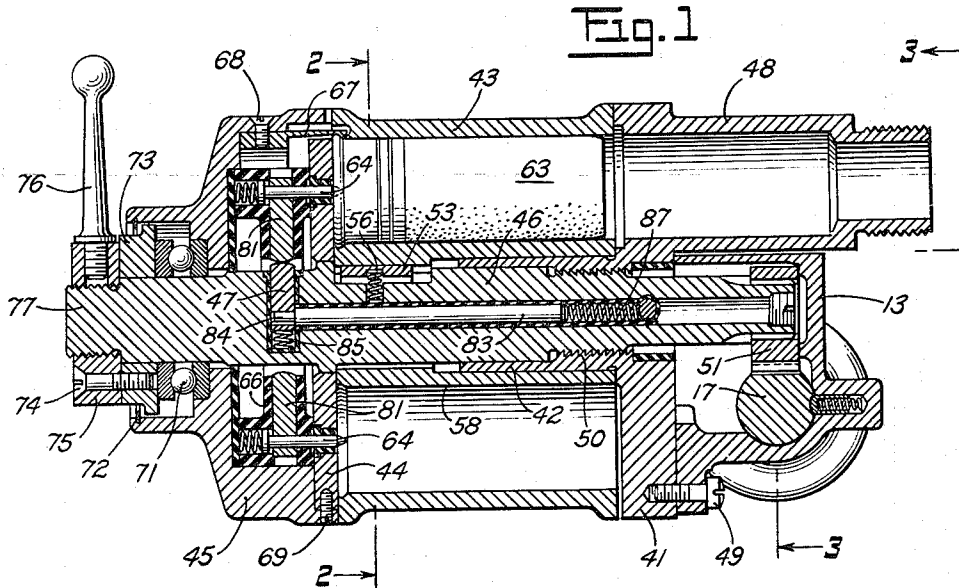
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2,207,635

LIQUID PRESSURE REMOTE CONTROL SYSTEM

Filed March 3, 1939

2 Sheets-Sheet 1



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Fig. 4

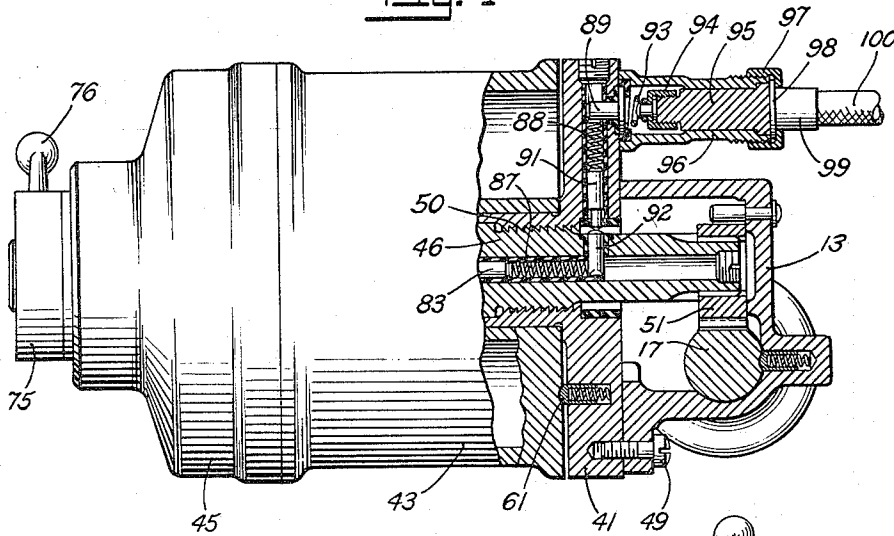


Fig. 6

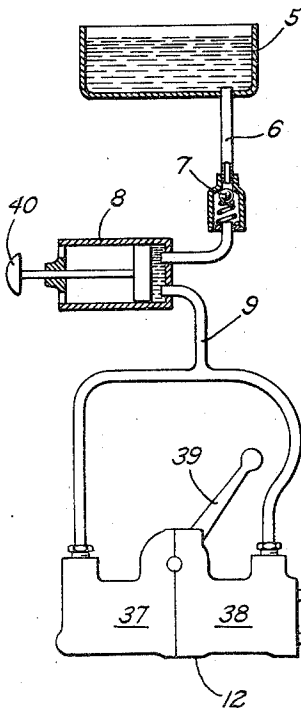
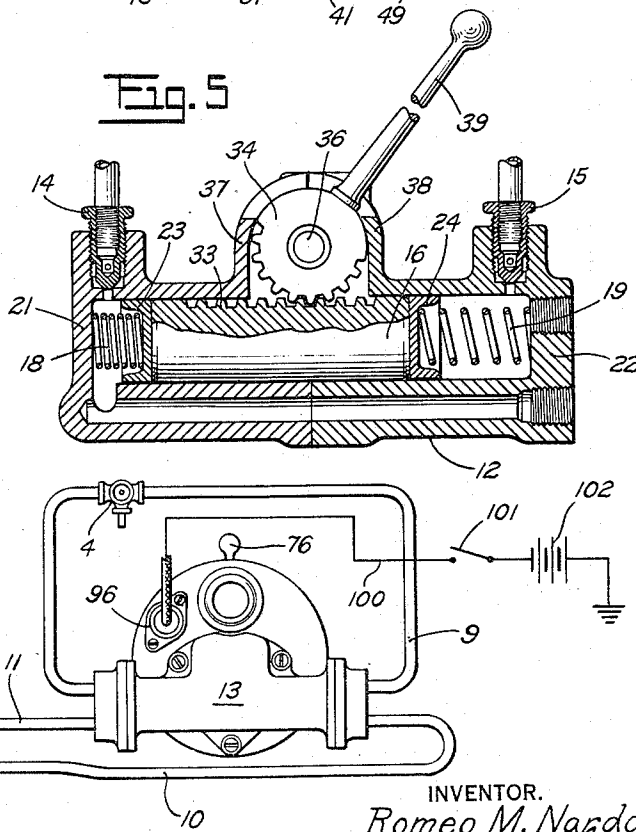


Fig. 5



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UNITED STATES PATENT OFFICE

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LIQUID PRESSURE REMOTE CONTROL SYSTEM

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Application March 3, 1939, Serial No. 259,707

9 Claims. (Cl. 89—1)

This invention relates to liquid pressure remote control systems, and has for an object the provision of an improved method and means for use in applications such as those which involve

step by step rotation of a unit located at a distance from the operator—as, for example, a rotatable breech mechanism containing a plurality of charges of powder which, upon ignition, generate gases for actuation of a servo-motor. Considered broadly, therefore, the invention provides for a liquid pressure remote control system comprising a pressure transmitting unit (located at the operator's station) and a pressure receiving unit (located adjacent or integral with the mechanism to be rotated step by step) connected together by one or more pipe lines in such manner that alternate strokes in the pressure transmitting unit produce a full step of rotary movement of the mechanism associated with the pressure receiving unit. The invention has for an additional object the provision of novel means for translating each alternate stroke in the pressure receiving unit into a rotary movement of a breech mechanism, whereby powder containing cartridges mounted in the breech are successively positioned for ignition by electric current directed thereto by novel current conducting means mounted in and operating synchronously with the breech mechanism in such manner as to select, for ignition at any one time, only the charge of powder which is at that moment in alignment with the gas discharge outlet leading to the servo-motor to be actuated thereby.

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

In the drawings:

Fig. 1 is a longitudinal sectional view of a pressure receiving unit having a rotatable breech mechanism integrated therewith;

Fig. 2 is a transverse sectional view along line 2—2 of Fig. 1;

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

Fig. 4 is a view of the unit of Fig. 1, and showing said unit partly in elevation and partly in section along line 4—4 of Fig. 3;

Fig. 5 is a longitudinal sectional view of a

pressure transmitting unit adapted to be coupled with the pressure receiving unit of Fig. 1, by pipe connections as shown in Fig. 6; and

Fig. 6 is a diagram of the electrical connections and the liquid pressure units and pipe connections above referred to.

In the system illustrated schematically in Fig. 6, reference character 10 designates a pipe line connecting one chamber of the pressure transmitting line 12 with one chamber of the pressure receiving unit 13; and character 11 designates a second pipe line connecting the second chamber of unit 12 to the second chamber of unit 13. The two chambers of unit 12 are separated by the intervening piston assembly 16, and the two chambers of unit 13 are similarly separated by the intervening piston assembly 17. Springs 18 and 19 (see Fig. 5) abutting end walls 21 and 22, respectively, of unit 12, bear against piston faces 23 and 24, respectively, of piston assembly 16 to yieldably oppose and to cushion the reciprocating movements of the piston 16; and, correspondingly, springs 25 and 27 (see Fig. 3) abut ends walls 28 and 29 of unit 13 and act similarly upon piston faces 31 and 32 of piston assembly 17.

To facilitate manual operation of piston assembly 16 there is provided a series of teeth 33 along one side of the said piston assembly, and a correspondingly toothed disc 34 in mesh therewith, and rotatable about bearings (not shown) in which the central projections 36 of the disc are journaled. The abutting enclosing sections 37 and 38 are slotted, as shown, to allow passage therethrough of operating handle 39 whose inner end is integrated with disc 34 to control movement of piston assembly 16. A second hand-grip 40 (Fig. 6) permits manual pumping of liquid from a reservoir 5, by way of conduit 6 and non-return valve 7; the pumping cylinder 8 having an outlet conduit 9 with branches leading to both chambers of pressure transmitting unit 12, the entrances to the respective chambers being by way of regulating valves 14 and 15, respectively (Fig. 5). A normally closed pet-cock 4 in bypass conduit 9 (Fig. 6) permits bleeding of air from the system, whenever necessary.

The breech mechanism is shown embodied in a unitary structure of which the major parts include a supporting plate 41 having a centrally disposed extension or spindle 42, a cartridge holding magazine or barrel 43, a cover plate 44 constituting part of the cap assembly 45, an indexing shaft 46 for step by step rotation of the barrel 43, a powder igniting current distributor or selector 47 and electrical leads running thereto by way

of the central bore in shaft 46, and a gas discharge conduit or outlet in the form of a hollow cylindrical extension 48 integral with supporting plate 41. A series of fastening members 49 (Figs. 1, 3 and 4) serve to hold pressure receiving unit 13 in such position (with respect to breech plate 41) as to produce an operative relationship between the rack portion of piston assembly 17 and a sector 51 in mesh therewith, said sector being splined to or otherwise integrated with the adjacent end portion of barrel rotating shaft 46. Shaft 46 is secured to supporting spindle 42 by fine-pitch threads 50; hence angular movement of shaft 46 (in its indexing operations) causes slight longitudinal movement of barrel assembly 43 with respect to supporting plate 41. This relieves friction therebetween.

To operatively connect shaft 46 with barrel 43 in such manner as to transmit movement from the former to the latter only upon alternate strokes of the fluid pressure actuated piston 17, there is interposed therebetween a uni-directional driving element 53 in the nature of a pawl having one end in abutment with a shoulder 54 cut in the surface of shaft 46, the opposite end of the pawl being urged by a spring 55 into position to engage, in turn, each of a series of notches 57 cut in the bore of barrel 43 at equally spaced intervals corresponding to the spacing of the cartridge receiving pockets 58—said spacing being as best illustrated in Fig. 2. This arrangement produces unitary movement of shaft 46 and barrel 43 in the clockwise direction, as viewed in Fig. 2 (forward stroke of piston 17) but in the opposite direction (corresponding to the return stroke of piston 17) the shaft 46 may rock back a corresponding distance while barrel 43 remains motionless—there being, if desired, in addition to the inertia of the loaded barrel, a spring-pressed motion resisting detent (as shown at 61 in Fig. 4) engageable, in return, with each of six equally spaced depressions in the end surface of the barrel.

From the foregoing description of the indexing mechanism it will be apparent that indexing shaft 46 moves at all times within a small angular range—first, forward sixty degrees (plus the angle X, Fig. 2, allowed for freeing barrel 43 from plate 41, by action of threads 50, as above noted) from the position indicated in Fig. 2; then back through the same angle. It follows that current distributor 47 (since it is mounted in a radially extending pocket of shaft 46) is confined to the same small angular range of oscillation; accordingly, it is necessary to devise a method and means for electrically connecting the distributor arm 47 with the current receiving igniter strip, or "match" (not shown) with which each cartridge—there being one such cartridge shown at 63 in Figs. 1 and 2—is conventionally equipped. As shown, the solution of this problem involves providing a plurality of evenly spaced firing pins 64, one for each cartridge, and mounting said pins in an annular carrier assembly 66 of non-conducting material, said carrier assembly being in turn mounted within, and rotatable with the cap assembly 45, as the latter turns with the barrel 43 from which it receives the turning impulses by way of cover plate 44, shell removing fingers 67, and the screw connections 68 and 69 therebetween. Rotation of cap assembly 45 relatively to indexing shaft 46 is facilitated by bearing assembly 71, the balls of which take the thrust reaction occasioned by firing of a cartridge. A lock ring 72 on the cap assem-

bly 45 is engageable by a flange on the inner section 73 of the four-piece cap removing assembly 73—74—75—76, the piece 75 being internally threaded for fixation upon the externally threaded end portion 77 of indexing shaft 46, whereby the cap assembly 45 is held in assembled relation to the body portion of the breech.

To provide for selective ignition of the cartridge charges in the order of their disposition about the indexing shaft 46, I propose to insert in the carrier assembly 66 a plurality of evenly spaced, radially extending current conductors 81, corresponding in number to the number of cartridges, and each apertured transversely to allow passage therethrough of the firing pin 64 for the corresponding cartridge. At its inner end each conductor 81 is rounded for better rubbing contact with the correspondingly rounded outer end of distributor arm 47, and spring-pressed into a position assuring firm engagement with each of the conductors 81 in turn, as the cap assembly is rotated step by step. A cylindrical conductor 83 has an end section 84 of reduced diameter for current transmitting contact with the sides of a slot in the distributor arm 47, the length of the slot being sufficient to allow for the yielding action of the arm 47 as it brushes along the successively engaged conductors 81, while held in good contact therewith by the spring 85. Spring 87, abutting cylinder 83 at one end, provides further assurance of good contact between parts 83 and 47, and a similar spring 88 (Fig. 4) assures good contact between conductors 91 and 92, and also serves as the circuit connection from conductor 89 to conductor 91. Another spring 93 serves to electrically connect circuit terminal 94 with the conductor 89, the said terminal 94 being secured to the conductor anchoring means 95 which is in turn secured within the housing boss 96 (Figs. 3 and 4) by a clamp nut 97 threaded to boss 96 and enclosing a flange 98 on thimble 99 of the conductor anchoring assembly. The conductor 100 includes a hand switch 101 by which flow of current from source 102 to the terminal 96 is controlled.

What I claim is:

1. In a system of the character described, the combination with a piston having a rack shiftable therewith, of a shaft geared to said rack to oscillate in response to reciprocation of said piston, an explosive charge containing barrel coaxial with said shaft, means for rotating said barrel step by step in a single direction, in response to alternate oscillations of said shaft, and means including a conductor extending through said shaft to control ignition of said explosive charge.
2. In a system of the character described, the combination with a piston having a rack shiftable therewith, of a shaft geared to said rack to oscillate in response to reciprocation of said piston, an explosive charge containing barrel adjacent said shaft, means for rotating said barrel step by step in a single direction, in response to oscillations of said shaft, means to control ignition of said explosive charge, said means comprising a current distributor movable with said shaft, and means for electrically connecting said distributor with a source of current remote from said shaft and barrel.
3. In a system of the character described, the combination with a piston having a rack integral therewith, of a shaft geared to said rack to oscillate in response to reciprocation of said piston, a cartridge containing barrel coaxial with said

shaft, means for rotating said barrel step by step in a single direction, in response to alternate oscillations of said shaft, and means including a conductor extending through said shaft to control firing of said cartridges in the order of their arrangement in said barrel.

4. In a system of the character described, the combination with a shaft and oscillating means therefor, of a cartridge containing barrel coaxial with said shaft, means for rotating said barrel step by step in a single direction, in response to alternate oscillations of said shaft, and means including a conductor extending through said shaft to control firing of said cartridges in the order of their arrangement in said barrel.

5. In a system of the character described, the combination with a piston having a rack shiftable therewith, of a shaft geared to said rack to oscillate in response to reciprocation of said piston, an explosive charge container adjacent said shaft, means including a conductor extending through said shaft to control ignition of said explosive charge, and means for electrically connecting said conductor with a source of current remote from said shaft and piston.

6. In a system of the character described, the combination with a piston having a rack integral therewith, of a shaft geared to said rack to oscillate in response to reciprocation of said piston, an explosive charge containing barrel coaxial with said shaft, means for rotating said barrel step by step in a single direction, in response to alternate oscillations of said shaft, means including a conductor extending through said shaft to control ignition of said explosive charge, said ignition controlling means comprising a current distributor movable with said shaft, means for electrically connecting said distributor with a source of current remote from said shaft and barrel, and means rotatable with said barrel for controlling the firing of said cartridges in the order of their arrangement in said barrel.

7. In a system of the character described, the combination with a piston having a rack integral therewith, of a shaft geared to said rack to oscillate in response to reciprocation of said piston, a cartridge containing barrel coaxial with said

shaft, means for rotating said barrel step by step in a single direction, in response to alternate oscillations of said shaft, and means including a conductor extending through said shaft to control firing of said cartridges in the order of their arrangement in said barrel, said last-named means also including a cartridge shell removing assembly slidable over the outer end of said shaft, and housing current conducting elements successively energized from said conductor.

8. In a system of the character described, the combination with a shaft and oscillating means therefor, of a cartridge containing barrel coaxial with said shaft, means for rotating said barrel step by step in a single direction, in response to alternate oscillations of said shaft, and means including a conductor extending through said shaft to control firing of said cartridges in the order of their arrangement in said barrel, said last-named means also including a cartridge shell removing assembly slidable over the outer end of said shaft, and housing current conducting elements successively energized from said conductor.

9. In a system of the character described, the combination with a piston having a rack integral therewith, of a shaft geared to said rack to oscillate in response to reciprocation of said piston, an explosive charge containing barrel coaxial with said shaft, means for rotating said barrel step by step in a single direction, in response to alternate oscillations of said shaft, means including a conductor extending through said shaft to control ignition of said explosive charge, said ignition controlling means also comprising a current distributor movable with said shaft, means for electrically connecting said distributor with a source of current remote from said shaft and barrel, and means rotatable with said barrel for controlling the firing of said cartridges in the order of their arrangement in said barrel, said last-named means also including a cartridge shell removing assembly slidable over the outer end of said shaft, and housing current conducting elements successively energized from said distributor.

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