



**March 24, 1925.**

**1,530,898**

**A. A. KLEIN**

FLUID PRESSURE DEVICE

Filed Aug. 13. 1920

3 Sheets-Sheet 2

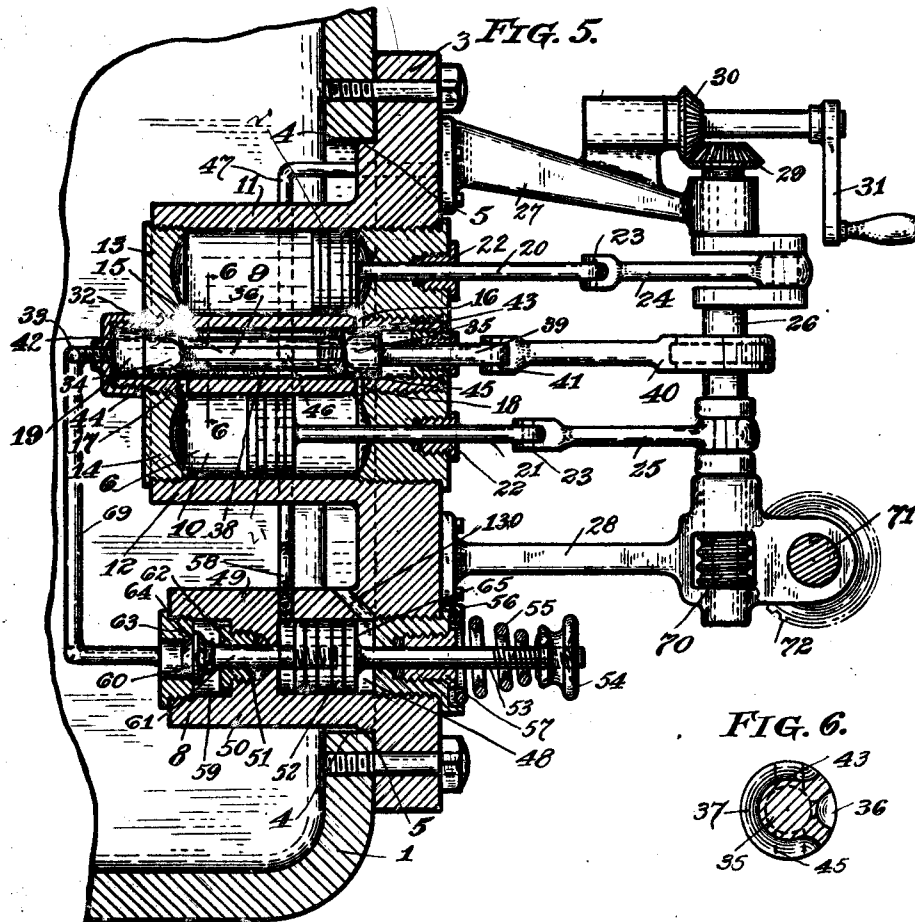


**FIG. 6.**

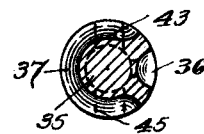
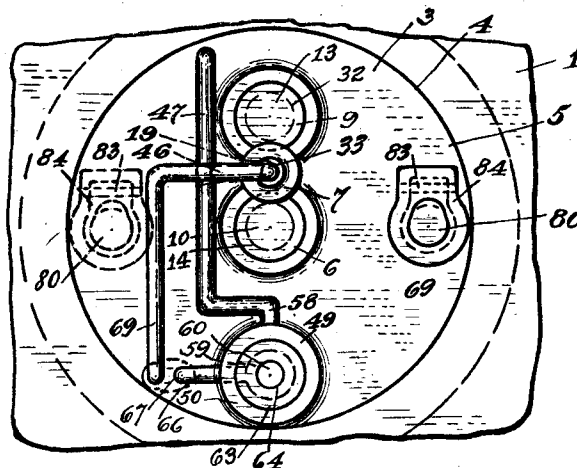


**FIG. 7.**



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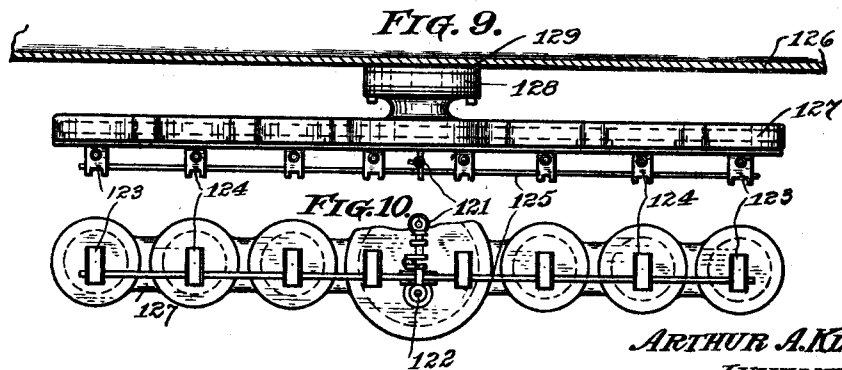
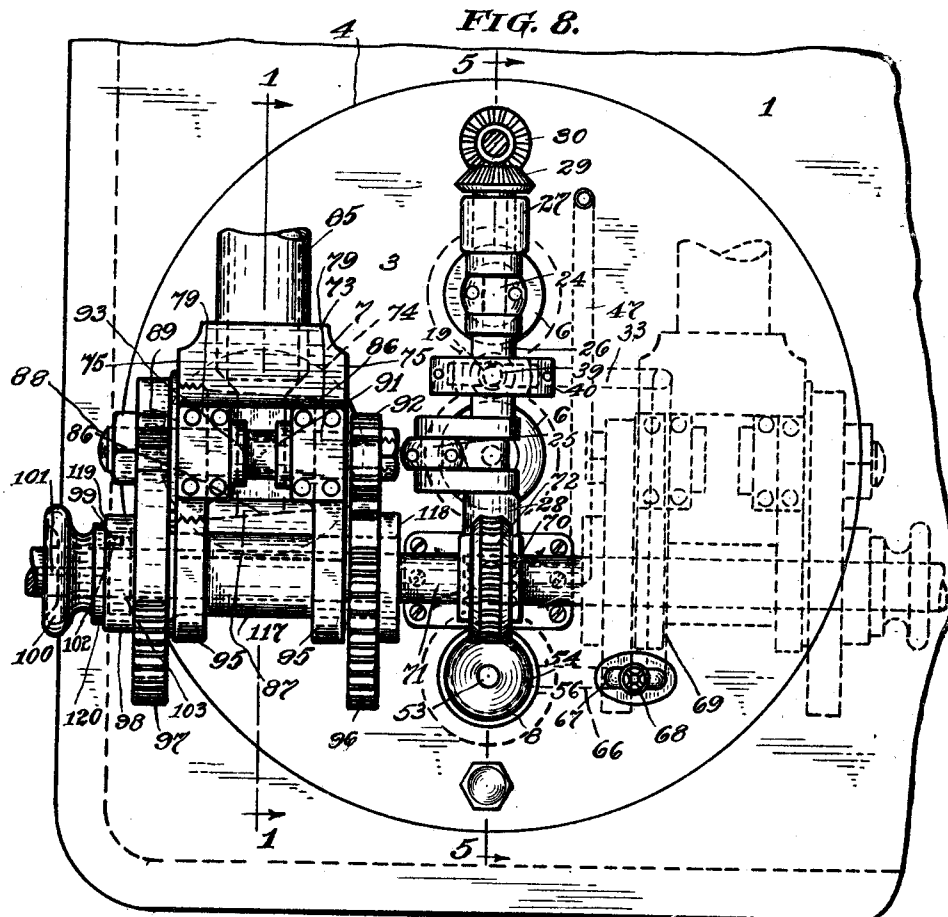
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Patented Mar. 24, 1925.

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# UNITED STATES PATENT OFFICE.

ARTHUR A. KLEIN, OF NEW YORK, N. Y.

## FLUID-PRESSURE DEVICE.

Application filed August 13, 1920. Serial No. 403,399.

*To all whom it may concern:*

Be it known that I, ARTHUR A. KLEIN, a citizen of the State of Hungary residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Fluid-Pressure Devices, of which the following is a specification.

The present invention relates to fluid pressure devices and has for its object the provision of a combination of devices which will automatically maintain a predetermined fluid or gas pressure within an accumulator or tank, so that such fluid under pressure may be used as desired for power purposes. To accomplish this end I have provided a fluid pressure engine, a combustion casing and an automatic control valve which cooperate to maintain the fluid pressure within the accumulator at a certain point of pressure as will be more fully explained hereinafter on this specification.

In the drawings forming part of this specification I have illustrated a complete example of the physical embodiment of my invention constructed according to the best mode I have so far devised for the practical application of the principles of my invention.

In the drawings, Figure 1 is a vertical section on line 1—1 of Figure 8 showing the combustion casing used with my invention.

Figure 2 is a partial side elevation of said combustion casing taken from the left as seen in Figure 8.

Figure 3 is a transverse view of a part of the combustion casing taken on line 3—3 of Figure 1.

Figure 4 is a transverse vertical section on line 4—4 of Figure 1.

Figure 5 is a vertical section through the pressure engine and control valve of my invention taken on line 5—5 of Figure 8 of the drawings.

Figure 6 is a transverse section of a piston, taken on line 6—6 of Figure 5.

Figure 7 is a rear elevation of my invention taken from the left as seen in Figure 5.

Figure 8 is a front elevation of my device taken from the right as seen in Figure 5.

Figure 9 is a diagrammatic plan view of a series of combustion casings as operated by a single fluid pressure engine mounted on an accumulator tank.

Figure 10 is a front elevation of Figure 9.

In the drawings the numeral 1 indicates an accumulator tank adapted to receive any fluid under pressure and having means such as the exit valve 2, for controlling the out flow of the fluid contained therein. 3 indicates a metal disc suitably mounted on the face of the accumulator 1, an aperture being formed in the tank at 4 to receive the flange 5 of said disc.

Mounted on this disc or plate 3 are a fluid pressure engine 6, a combustion casing 7, and a control valve 8, all of which cooperate to maintain a predetermined amount of fluid or gas pressure within the accumulator 1, as will be described below.

The fluid pressure engine 6 is composed of preferably a pair of piston chambers 9, 10, the walls 11, 12 of which are formed integral with the disc 3, and said chambers have the usual piston heads 13, 14 as shown. Inlet passages 15, 16, 17, 18 admit fluid under pressure from the central piston chamber 19; into chambers 9, 10. 20, 21 are pistons which pass through the usual stuffing boxes 22 and are pivotally attached at 23 to the connecting rods 24; and 25 respectively. 26 indicates a crank shaft mounted on the face of the disc 3 preferably by means of the bearing supports 27, 28. It is noted that the connecting rods 24, 25 are attached to the shaft 26 in position at "right angles" to each other as seen in Figures 5 and 8 of the drawings. A bevel gear 29, a meshing bevel gear 30 carried by the support 27, and a manually operated crank 31 provide a means of starting the rotation of crank shaft 26 as will be explained below.

The piston valve chamber 19 has therein a piston valve 32 of special construction which upon receiving fluid under pressure through pipe 33 operates the pistons 20 and 21. Said piston valve 32 is of a cross-sectional shape shown in Figure 6, with a pair of concave or cup-shaped ends 34, 35, joined by the longitudinal connecting passage 36. The central portion of the piston valve 32 is cut away as shown in Figure 6, at 37 in a circumferential direction forming thereby a chamber 38 within the piston valve chamber 19 as seen in Figure 5. 39 indicates the valve rod which is pivotally secured to the end of the eccentric 40, at 41; and the eccentric is suitably mounted on the crank shaft 26 as illustrated in Figure 5. It is at once seen from an inspection of Figures 5 and 6 that when fluid pressure is admitted to chamber 19 that

the pistons 20 and 21 are at once operated by means of the feed passages 42, 43, 44, 45, pipe 36 in the piston 32, and the inlet passages 15 to 18 inclusive in the walls 11, 12 of the piston chambers 9 and 10. The exhaust gases pass by means of chamber 38 to the exhaust pipes 46, 47 and through the disc plate 3 to the exterior of the accumulator 1, as seen from an inspection of Figures 5 and 7 of the drawings. The operation of these pistons 20, 21, it is thought will be readily understood without further detailed description.

The control valve mechanism consists of a piston chamber 48 having its walls 49, 50 preferably integral with the disc plate 3, and pierced by a passage 51, which connects the chamber 48 with the interior of the accumulator 1. Within chamber 48 operates the piston 52 having the stem 53 on which is screw-threaded the cap-nut 54. Surrounding the stem 53 is the spring 55, which at one end engages within the cap-nut 54 and at the other end engages within the cup-shaped piston chamber head 56. The spring 55 is made of any desired tension according to the fluid pressure desired within the accumulator 1. A stuffing box 57 is provided as is usual, to prevent leakage around the piston stem 53. Leading from chamber 48 is the pipe 58 which connects with exhaust pipe 47 as shown. 59 indicates a valve chamber, having a valve 60, with stem 61, and stuffing box 62. A valve seat is formed in the open-ended cap 63 at 64. It is at once evident that when the fluid or gas pressure within the accumulator 1 drops to a point below the strength of the spring 55 that the pressure exerted by said gas, at 65 behind said piston 52, will no longer be able to retain the valve 60 on its seat 64, and consequently fluid pressure will be admitted to valve chamber 59, and thus to pipe 66 connected thereto; and leading to and through the disc plate 1 at 67, thence through the emergency control valve 68 to pipe 69, and thence to pipe 33, the latter connecting to the central piston chamber 19 as shown in Figure 7. In this way as soon as the fluid pressure within the accumulator drops to a predetermined point depending upon the strength of spring 55, gas is at once admitted to the central piston chamber 19 and the fluid pressure engine 6 will begin to operate the crank shaft 26, and worm 70 mounted thereon, within the support casting 28 before mentioned. The casting 28 also carries a longitudinal revoluble shaft 71, on which is mounted the worm gear 72.

The combustion or explosive casing 7, forming one element of my invention consists of the following parts: On the face of disc plate 3 preferably integral therewith is the casting 73, cylindrical in shape about the body portion 74 and flattened on its sides at

75, 75 toward the free end 76 as illustrated clearly in Figure 4 of the drawings. The casting 73 is pierced by a passage or explosion chamber 77, and a compression piston chamber 78, and a pair of jaws 79, 79 are formed on the extremity 76. The inner end of explosion chamber 77 is connected to a trap-valve 80, by means of a nut-like casting 81, having a series of very small passages 82, 82, etc., passing therethrough, as shown in Figures 1 and 3. The valve 80 is pivoted at 83 in the valve casting 84. It is evident that as long as the pressure within the accumulator 1 is greater than that within the explosion chamber 77, the valve 80 will remain in a closed position as in Figure 1, but upon an explosion taking place within chamber 77 the trap valve 80 will open (provided the outer end of chamber 77 is closed) and admit the explosive gas into the accumulator. On the casting 73 is mounted the fuel supply pipe 85, which is connected to the source of fuel supply (not shown). Also within the casting 73 is the beveled charging plug 86, having a passage 87 therethrough, and a stem 88. Said plug it is seen is revolubly mounted and may be operated by means of the gear 89 mounted on the stem 88. The passage 87 is made of equal diameter with the chambers 77, and 78, and the compression piston 90, so that when the plug 86 is revolved the piston 90 can pass through passage 87 and enter chamber 77, and thereby compress a "charge" of fuel which has been previously deposited by gravity from pipe 85 into said chamber 77. Mounted in jaws 79, 79 is the crank shaft 91, carrying on its outer end the gear 92, and the short connecting rod 93 is pivotally attached thereto at point 94. The connecting rod 93 is pivotally connected at its inner end to the compression piston 90, so that when shaft 91 is operated by means of gear 92 the piston 90 will pass through passage 87 (if in proper aligned position) and into chamber 77.

The revoluble shaft 71 passes through a pair of downwardly projecting jaws 95, 95 formed integral with casting 73 and carries a spool 117 which extends from 118 to 119, said spool being freely mounted on the shaft 71. The spool 117 has rigidly mounted on its periphery the two gears 96 and 97 and a collar 98 integral therewith. A clutch pin socket 99 is formed in the side wall of the collar 98 as shown. 100 is a clutch head which is slidable longitudinally along shaft 71 but "keyed" thereon by key 101, so that said head rotates with shaft 71. Said clutch head 101 has a pin 102 which is adapted to engage into the complementary socket 99 of the collar 98 before described. From which it is seen that when shaft 71 is operated and the clutch pin 102 is in engagement, that gears 97, 89, 96, 92 are operated, as is also the charging plug 86 above de-

scribed. The gears 96, 92, 97 and 89 are intermittent gears and will be further described below. On the collar 98 is a short section of electrically conductive metal 103 insulated from said collar, and on the side of the casting 73 is attached a bracket 104, for holding the electrical "brushes" 105, 106, which are insulated from bracket 104, and the ends of which depend upon the collar or "timer" 98. Wires 107, 108 lead from these brushes as shown in Figure 2.

Within the casting 73 are two plugs 109, 110 from which wires lead to an electrical battery 111. The wires 112, 113 lead from the battery to the plugs, while wires 114, 115 lead from the latter and join to form a connection with wire 107 leading to the "timer" before described; while a wire which leads from the storage battery 111 joins to wire 108 before mentioned. The upper end of the double wires which are in each plug 109, 110 are joined by a resistance 116, and as these "hot wires" lie just beneath the inner circumference of explosive chamber 77, it is seen that if a "charge" of explosive fuel is within said chamber and properly compressed that such charge will be exploded and the explosive gases will pass through casting 81 through valve 80 and into the accumulator 1. The "timing" of the heating of the "hot wires" 116 is controlled by means of the contact brushes 105, 106 and the part 103 before described.

When shaft 71 is operated and gears 96 and 97 are also by means of the spool 117 and clutch 120, the gears 92 and 89 are intermittently operated as before mentioned. It is seen that as gear 96 revolves a complete revolution that the gear 92 makes two complete revolutions with two "stop periods" between such revolutions, and consequently the piston 90 reciprocates twice during a full revolution of gear 96. Also it is evident that when gear 97 makes a full revolution that gear 89 also makes a full revolution with two "stop periods". These gears 96, 92, 97, 89 are arranged so that when the stop period of gear 89 occurs that the passage 87 in the plug 86, is in a horizontal position, and while in this position (which of course occurs twice in every revolution of gear 89) the "period of action" of gear 92 takes place and the compression piston 90 is actuated and passes through the passage 87 to compress a "charge" of explosive fuel which has been previously deposited by gravity from fuel supply pipe 85. The explosive chamber 77 is made of proper length so that two "charges" of explosive fuel from passage 87 are compressed as much as desired according to the character of fuel used. As the operation of intermittent gears is well understood further description is believed unnecessary in this connection. The plugs 109 and 110 are arranged to be heated by

means of the electrical system before described, after a full "charge" has been deposited in chamber 77, and properly rammed, and while the revoluble charging plug 86 is in the position shown in Figure 1 of the drawing, with the outer end of chamber 77 closed, so that the gaseous result of the explosion passes through the casting holes 82, and opening the valve 80, enters the accumulator 1.

Operation: When the fluid pressure in the accumulator 1 drops below a certain predetermined amount, depending upon the strength of spring 55 used, as before described in this specification, the automatic control mechanism 8 begins to operate and actuate the fluid pressure engine 6, and in turn crank shaft 26 and worm 70 revolve. Worm 70 operates in turn the worm gear 72, shaft 71 and thereby the combustion casing 7 re-charges fluid pressure into the accumulator 1. In this way the fluid pressure is maintained at a constant amount and such pressure may be used for power purposes by withdrawing same through the valve 2 before mentioned. In case of repairs the emergency valve 68 can be used to shut off the pressure supply to the pressure engine 6, and thus prevent the combustion casing from further accumulation of pressure in the accumulator. When the accumulator 1 is empty the crank 31 is used to operate the crank shaft 26 and combustion casing 7 until a sufficient pressure is accumulated to operate the fluid pressure engine, so that the combustion casing will be operated by the latter.

In the case of using fluid or gas under pressure in large quantities, an arrangement of a single fluid pressure engine (as indicated by 121 in the diagrammatic views of Figures 9 and 10 of the drawings) and a single automatic control valve 122 for operating a series of combustion casings 123, 124, etc., from a single line shaft 125 is used.

In this way a whole series of combustion casings similar to casing 7 before described will accumulate fluid mixture of gas under pressure in the accumulator 126 in large quantities. It may be desirable to have a hollow casting 127 which terminates in a preferably gate valve 128, so that only a single connection need be made to the accumulator 126 at 129.

Any suitable fuel which will meet the explosive conditions required in chamber 77 of the combustion casing 7, may be used to produce the fluid under pressure required for the accumulator 1 and I do not limit myself to any particular form of fuel among those which will meet the conditions required to operate the various parts of my invention.

It is also noted that the wires 112, 113 and 114, 115 are moulded in the plugs 109, 110 in a wave-form as shown in Figure 1 of the

drawings, so that said wires will not be blown out of the plugs by the blasts in the combustion chamber 77.

I claim:—

- 5 1. In a fluid pressure device, a casting having an explosion chamber and a charging orifice, a charging plug having a passage therethrough adapted for alinement with the explosion chamber, and the said charging orifice when said plug is properly operated, a compression piston adapted to enter the charging plug passage for the purpose of moving a charge of fuel from the latter into the explosion chamber and means for aligning the charging plug passage with the explosion chamber and said compression piston.
2. In a fluid pressure device, an explosion chamber, a charging orifice, a revolvable charging plug having a passage therethrough adapted to be alined with the explosion chamber and the charging orifice when properly operated, a reciprocating compression piston adapted to enter the plug passage, and means for alternately actuating the charging plug and the compression piston to move a charge of fuel from the charging orifice to the explosion chamber of said casting.
3. In a fluid pressure device a casting provided with a horizontally disposed explosion chamber and a fuel charging orifice, a transverse revolvable charging plug closing the outer end of the explosion chamber, a diametrical passage in the plug adapted to align itself with the explosion chamber and with the charging orifice when said plug is properly revolved, a compression piston adapted to enter both the explosion chamber and charging plug passage, and means for exploding a charge of fuel in said explosion chamber when the end of said chamber is closed by the charging plug.
4. In a fluid pressure device, a main casting provided with a combustion chamber, and a fuel charging opening, a revolvable charging plug closing the outer end of the combustion chamber, a plug passage adapted to be alined with the combustion chamber, and with the charging opening when said plug is properly revolved, a compression piston adapted to reciprocate through the plug passage and into the combustion chamber, means for exploding a charge of fuel in the combustion chamber when the charging plug wall is in proper position closing the end of the combustion chamber, a crank shaft carried in the end of the main casting and having means connecting the crank shaft and piston, an intermittent gear on the crank shaft, an intermittent gear on the end of the charging plug, means for actuating the intermittent gears to alternately operate the compression piston and charging plug before described.

5. In a fluid pressure device, a fluid pressure accumulator, a main casting mounted thereon and having a fuel charging opening therein, a combustion chamber in said casting, a finely perforated casting closing the inner end of the combustion chamber, a compression piston in the casting, a revolvable charging plug closing the outer end of the combustion chamber, a fuel carrying passage passing through the charging plug, and adapted to be alined with the piston and combustion chamber, intermittent means for alternately operating the charging plug and reciprocating the compression piston, a plurality of heating plugs adjacent to the combustion chamber, and means for energizing said plugs when the aforesaid charging plug is in position closing the outer end of the combustion chamber.

6. In a fluid pressure device, a fluid pressure accumulator, a casting mounted thereon having a fuel charging opening therein, a combustion chamber, a compression piston, a revolvable charging plug closing the end of the combustion chamber, a fuel bearing passage through the charging plug adapted to be alined with said piston and combustion chamber, intermittent means for alternately operating the charging plug and compression piston, and means for exploding a charge of fuel deposited in the explosion chamber, when the charging plug is in position closing the end of the explosion chamber.

7. In a fluid pressure device an accumulator, a combustion casing for supplying fuel to said accumulator, comprising a main casting mounted on the accumulator having a combustion chamber and a fuel charging opening therein, a revolvable charging plug in the main casting having a fuel carrying passage passing therethrough, a finely perforated casting between the combustion chamber and the interior of the accumulator, a non-return valve adjacent to the perforated casting, a compression piston in the main casting, means for igniting a charge of fuel in the combustion chamber when the charging plug is in position closing the combustion chamber; an automatic valve control mechanism comprising a piston having a head and stem, a piston chamber, a valve chamber having a valve seat therein, a control valve head having a stem mounted in the piston head, and normally engaging the said valve seat, resilient means on the piston stem tending to raise the valve head from its seat, a passage for admitting fluid pressure from the interior of the accumulator into the piston chamber and tending to keep the aforesaid control valve head on its seat; a fluid pressure engine having means for intermittently and alternately operating the charging plug and reciprocating the compression piston of the combustion engine; 130

and means for conveying fluid under pressure from the valve chamber of the control valve mechanism to the fluid pressure engine.

5 8. In a fluid pressure device, an accumulator, a combustion casing comprising a casting having a combustion chamber and a fuel charging orifice, a revoluble charging plug having a passage therethrough adapted to be alined with the combustion chamber and the charging orifice when properly operated, a compression piston adapted to reciprocate within the charging plug passage; a fluid pressure engine having means for alternately operating the charging plug and compression piston of the combustion engine; and an automatic control mechanism, having means for starting and stopping the fluid pressure engine when the pressure in the accumulator reaches a predetermined point.

9. In a fluid pressure device, an accumulator, a combustion casing comprising a casting having an explosion chamber and a fuel charging orifice, a revoluble charging plug having a passage therethrough adapted to be alined with the combustion chamber and the charging orifice when properly operated, a compression piston adapted to reciprocate within the plug passage, a crank shaft carried in the end of the main casting having means connecting the crank shaft and piston, an intermittent gear on the crank shaft, an intermittent gear on the end of the charging plug; a fluid pressure engine having means for actuating the intermittent gears so that the compression piston and charging plug are alternately operated; an automatic control valve mechanism having means for starting and stopping the fluid pressure engine when the pressure in the accumulator reaches a predetermined point.

10. In a fluid pressure device, an accumulator, a combustion casing comprising a casting having an explosion chamber and a charging orifice, a revoluble charging plug having a passage therethrough adapted for alinement with the explosion chamber and the charging orifice when properly operated, a piston adapted to reciprocate within the charging plug passage, and means for alternately actuating the charging plug and compression piston; in combination with an automatic control valve mechanism comprising a piston having a head and stem, a piston chamber, a valve chamber having a valve seat therein, a control valve head having a stem mounted in the piston head and normally engaging the said valve seat, resilient means on the piston tending to raise the valve from its seat, a passage for admitting fluid under pressure from the interior of the accumulator into the piston chamber and tending to keep the aforesaid control valve on its seat.

11. In a fluid pressure device, an accumu-

lator, a combustion casing comprising a main casting having an explosion chamber and a fuel charging orifice, a revoluble charging plug in the main casting having a fuel carrying passage therethrough, a finely perforated casting between the combustion chamber and the interior of the accumulator, a non-return valve adjacent to the perforated casting, a compression piston in the main casting adapted to reciprocate within the plug passage, and means for aligning the charging plug passage with the explosion chamber and the compression piston, a fluid pressure engine having a central piston chamber, a piston having a concave piston head on each end of same, a longitudinal passage connecting the cavities in the piston heads, a circumferential recess partially surrounding the piston between the opposed piston heads, a pair of piston chambers each having a piston therein, positioned adjacent to the central piston chamber, and means connecting the pistons of the fluid pressure engine with the charging plug and compression piston of the combustion casing for alternately operating said plug and compression piston.

12. In a fluid pressure device, a combustion casing comprising a casting having a combustion chamber and a fuel charging orifice, a revoluble charging plug having a diametrical passage therethrough, adapted to be alined with the combustion chamber and the charging orifice when the charging plug is properly operated, a compression piston adapted to enter the plug passage, means for actuating the charging plug and compression piston, and an electrical heating plug having a pair of wave-shaped wires secured in the heating plug body, and an electrical resistance joining the upper ends of said wires in operating proximity with the explosion chamber of the combustion casing.

13. In a fluid pressure device, a casting having an explosion chamber and a charging orifice, a revoluble charging plug mounted in the casting, means for measuring a charge of fuel in the said plug, a compression piston adapted to move said charge of fuel from the charging plug into the explosion chamber, a crank shaft carried in the end of the main casting, means connecting the crank shaft and compression piston, an intermittent gear on the crank shaft, an intermittent gear on the end of the charging plug, and means for actuating the intermittent gears to alternately operate the compression piston and charging plug before described.

14. In a fluid pressure device, a casting having an explosion chamber and a charging orifice, a charging plug mounted in the casting, means passing diametrically through the plug for measuring a charge of

fuel therein, a compression piston positioned without the plug when a charge of fuel is being loaded, and adapted to move a charge of fuel from the measuring means into the said explosion chamber and means for align- 5 ing said measuring means with said piston and explosion chamber to permit said piston to pass through the measuring means.

15 15. In a fluid pressure device, a combustion casing comprising a casting, having an explosion chamber and a fuel charging orifice, a charging plug mounted in the casting, means for measuring a charge of fuel within the charging plug, a compression 20 plug in the casting, a non-return valve adjacent to the explosion chamber, a crank

shaft on the end of the casting, provided with means connecting the crank shaft and the compression piston, complementary intermittent gears on the crank shaft and the 20 end of the charging plug, and means for actuating said gears to alternately operate the charging plug and the compression piston for the purpose of transferring a charge of 25 fuel from the charging orifice to the explosion chamber aforesaid.

In testimony whereof I affix my signature.

ARTHUR A. KLEIN.

Witnesses:

WILLIAM A. HITTLE,  
WALDO P. BREEDEN.