

July 16, 1940.

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2,207,936

FLUID PRESSURE GENERATION

Filed Aug. 17, 1939

2 Sheets-Sheet 1

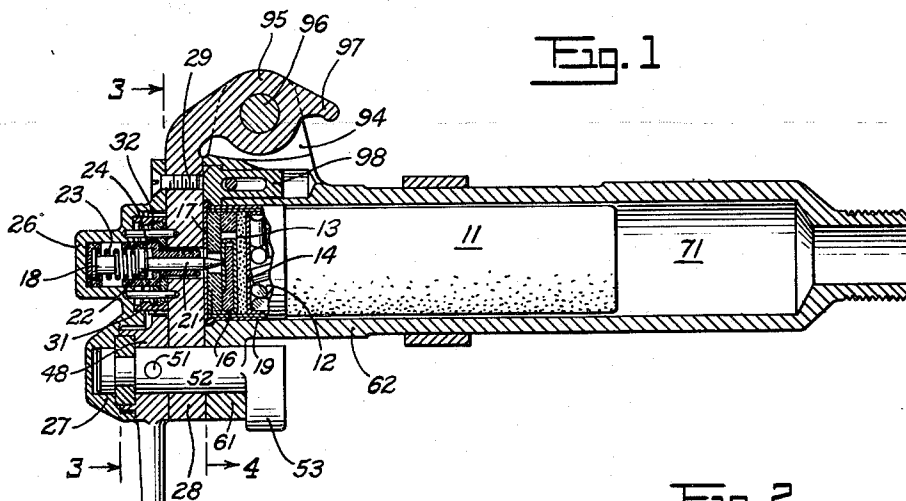


Fig. 1

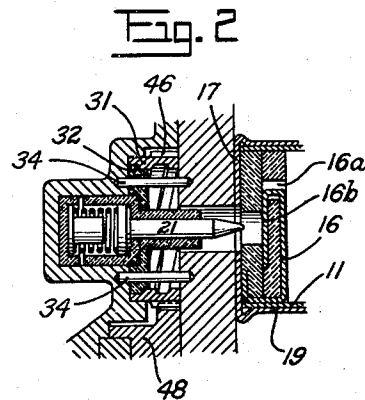


Fig. 2

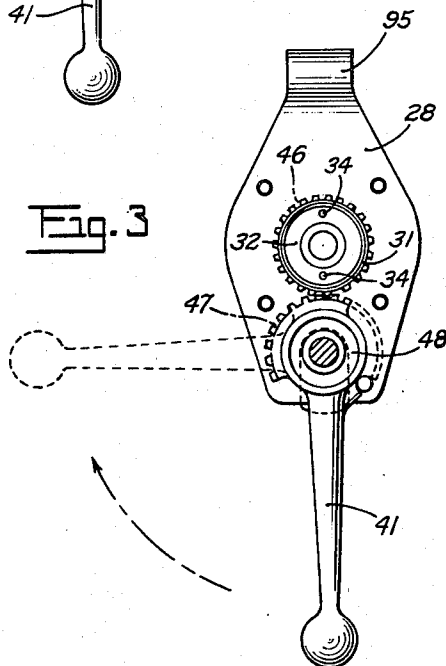


Fig. 3

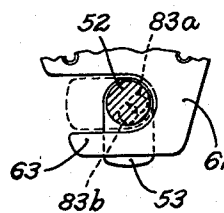


Fig. 4

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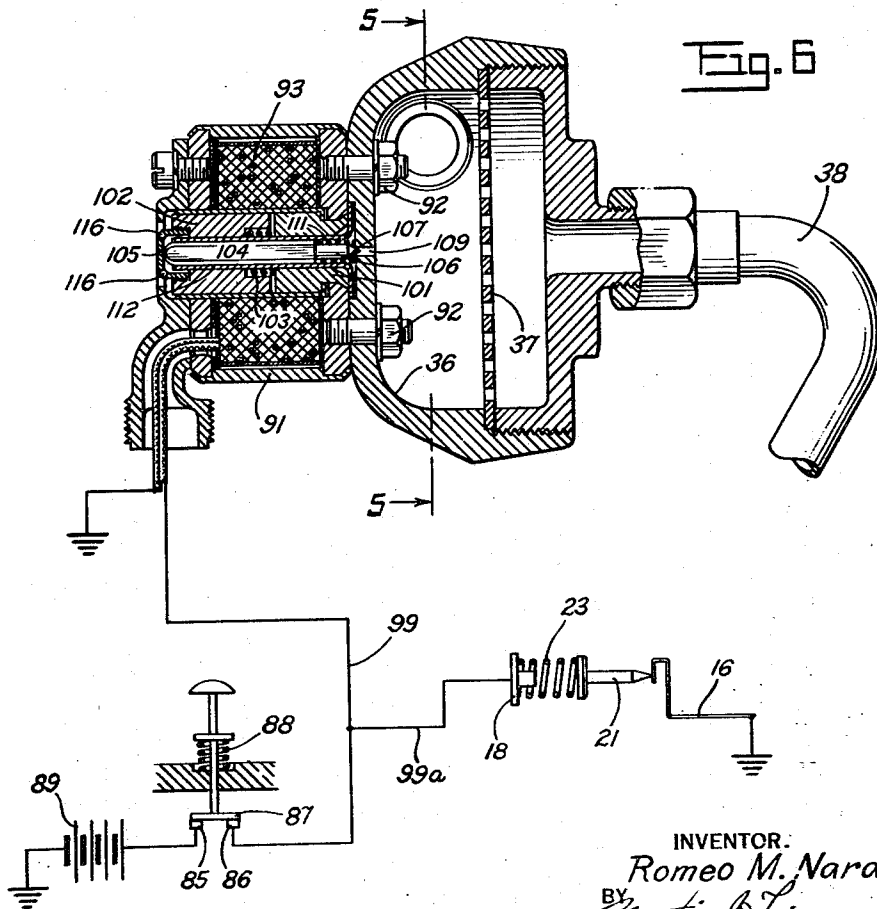
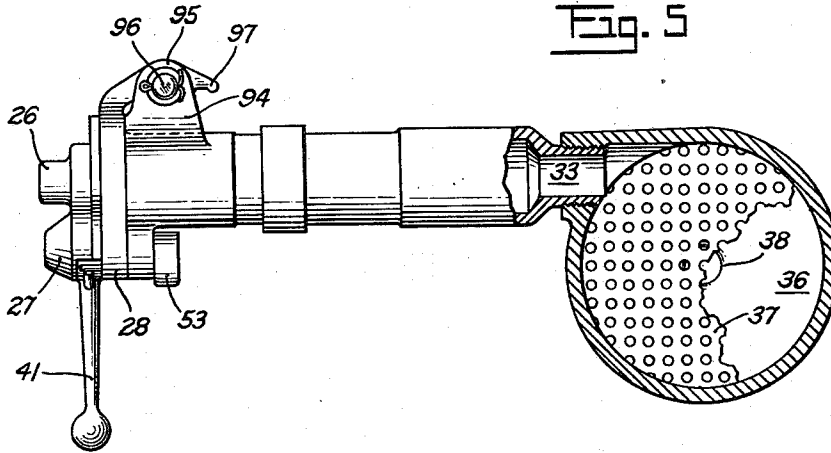
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2 Sheets-Sheet 2



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FLUID PRESSURE GENERATION

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Application August 17, 1939, Serial No. 290,714

15 Claims: (Cl. 123—183)

This invention relates to fluid pressure generation, particularly to the generation of pressure fluid by the ignition of explosive material confined in a suitable container or cartridge, which pressure fluid may, upon generation, be applied to an engine starting mechanism to produce energization thereof.

An object of the invention is to provide a novel cartridge housing or breech mechanism including a novel control of the opening, closing and locking of the breech mechanism and a novel interlocking arrangement whereby ignition of the combustible material is rendered impossible in advance of a secured locking of the breech mechanism.

A further object is to provide means for exhausting the chamber of the breech mechanism in advance of the combustible charge and for automatically insuring the closing of such an exhaust vent prior to the firing of the combustible charge, also for insuring complete evacuation of the chamber in advance of opening the breech mechanism, following the firing of the charge.

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 the breech mechanism with the cartridge in position and the igniting mechanism also in operative position;

Fig. 2 is a longitudinal sectional view of the igniting mechanism shown in Fig. 1 but on a larger scale and with the igniting plunger in a position which it occupies whenever the breech is in the unlocked position;

Fig. 3 is a transverse view of certain of the parts as seen along the line 3—3 of Fig. 1;

Fig. 4 is a transverse view along the line 4—4 of Fig. 1 showing a detail of the locking mechanism;

Fig. 5 is a view in elevation of the mechanism shown in Fig. 1 in its relationship to the powder burning and pressure generating chamber, the latter being shown as it appears when viewed along line 5—5 of Fig. 6; and

Fig. 6 is a sectional view of the breech mechanism in its relationship to the electromagnetic

vent valve mechanism constituting one embodiment of a part of the means for automatically insuring the closing of the exhaust vent prior to the firing of the combustible charge, which means constitutes an important feature of the invention as hereinabove noted.

The combustible charge is shown in Fig. 1 in the form of a relatively slow burning powder 12 occupying a major portion of the space within a cartridge 11, and separated from a layer 13 of a highly combustible primer charge by an intervening partition 14 of "Cellophane" or equivalent material, which not only serves as a dividing wall between the priming charge 13 and the slow burning powder charge 12 but additionally serves as a retainer for particles of fast burning powder of the character constituting the primer charge 13. Such particles may be affixed to the "Cellophane" surface by any suitable means as by first applying a liquid or plastic adhesive such as glue to the "Cellophane" surface and then depositing the particles upon the surface so treated. If desired both sides of the dividing wall 14 can be treated in this manner; but in any event, it is desirable that the side which is adjacent the slow burning powder 12 be so treated, in order to accelerate the process of heat transfer from the priming charge 13 to the slow burning powder 12 and thus insure ignition of the latter. The primer charge 13 is in turn confined in advance of a strip 16 of current conducting metallic material bent into the shape indicated so that one surface lies along the outer metal cap 17 which extends over the end of the cartridge and along its cylindrical side for a certain distance as indicated at 19 where it firmly grips the non-metallic portion of the cartridge casing. The strip of metal is bent to pass through the slotted partition 16a (shown best in Fig. 2) and is again bent so that it will have an extending portion 16b in the path of the conical end of a plunger 21 of current conducting material having a head 22 adapted to be urged forward by coiled spring 23, the plunger being slidable within a sleeve 24 of non-conducting material which in turn slides within the boss 26 of the breech cover plate 27, the said cover plate being in two sections, 27 and 28, secured together as indicated at 29.

The means for normally holding the plunger 21 out of position for transmission of current to the igniting disc 18, and thereby preventing premature ignition—that is, ignition prior to the locking of the breech mechanism—is shown as including an internally threaded sleeve 31 operating upon an externally threaded screw 32 adapt-

ed to be threaded axially along guide pins 34 (best shown in Fig. 2) to cause a corresponding axial movement of the non-conducting sleeve 24 and thereby move the head of the plunger 21 from the position indicated in Fig. 1, to the position indicated in Fig. 2 in response to the turning of the sleeve 31 which results whenever the breech handle 41 is moved from the position shown in full lines in Fig. 3 to the position shown in dash lines, such swinging of the handle being effective to turn the threaded sleeve 31 by reason of the inter-engagement of the teeth or splines 46 and 47 of the members 31 and 43 respectively, the latter being the central hub portion of the handle 41. A pin 51 secures said hub 48 of the handle to the stem 52 of the flag or latch 53 which thereby swings with the handle 41 so as to move from a locked to an unlocked position with respect to the dependent leg 61 of the breech casing 62, which leg 61 with the toe 63 constitutes the keeper for the latch or flag 53 and prevents opening of the breech cover prior to the swinging of the handle to the unlocked position, which swinging moves the flag 53 from the full line position indicated in Fig. 4 to the dash line position.

Upon ignition of its priming charge, the cartridge 11 releases a quantity of solid fuel particles, or pellets, the combustion of the priming charge being sufficiently explosive in character to cause propulsion of all of said pellets through the breech outlet passage 33 and thence in a continuous, whirling movement around the burning chamber 36 which, as shown in Figs. 5 and 6, has an outlet through the flat perforated disc 37. With this construction it will be evident that the chamber 36 will receive the entire charge of solid fuel (in the form of pellets too large to pass through the grid) and hold it in close contact with the hot flame of the initially ignited priming charge, so that there is thus afforded maximum opportunity for complete combustion before any of the fuel becomes sufficiently reduced in size to permit its passing through the grid 37 and being carried along the conduit 38 by the pressure of gases generated and superheated in the chamber 36 by the burning of the fuel therein. Thus there is assured the development of sufficient heat and pressure to offset whatever losses occur during passage through conduit 38, and at the same time there is provided a hotter and more efficient burning chamber than can otherwise be obtained, with the result that a higher percentage of the fuel is completely consumed before entering the conduit 38.

The means for automatically venting the chambers 71 and 36, after completion of fuel consumption, preferably includes an electromagnetic valve unit enclosed in a substantially cylindrical housing 91 attachable to the housing 36 by suitable means 92, and including a coil or winding 93 adapted to receive current by way of a conductor 99 leading thereto from one terminal post 86 of a switch which includes a second terminal post 85 and a current conducting member 87 manually movable into bridgeable relationship to the contacts 85 and 86 but normally held separated therefrom by the pressure of a coiled spring 88, which pressure is overcome by the hand of the operator when it is desired to produce energization of the winding 93. The same manual action completes a circuit from the source 89 to the firing pin 21 by way of the said contacts 85, 86, conducting member 87, and a

conductor 99a connecting by suitable means with the contact member shown at 18 in Fig. 1. Included in the electromagnetic unit are a pair of magnetic elements 101 and 102, the former constituting a fixed or stationary pole piece and the latter a movable pole piece normally separated from the pole piece 101 by the action of the interposed spring 103, but movable toward engagement therewith by the magnetic effect created upon passage of current through the winding 93. Movable with the pole piece 102 through the instrumentality of cup 105, is a rod or plunger 104, terminating in a reduced portion 106 having a conical end 107 constituting a valve for closure of the opening 109 provided centrally of the wall of chamber 36, the said opening constituting a normally open vent for the chambers 71 and 36 by reason of the free communication from said opening to the atmosphere by way of the annular space between valve spring 111 and plunger guide sleeve 112, and the longitudinally extending spaces along the flattened sides of the plunger 104, which spaces extend to the openings 116 at the rear of the unit 91.

With the construction just described it will be apparent that the action of the operator, in pressing the switch member 87 to the circuit closing position, will immediately energize the winding 93 and therefore cause movement of the valve to the vent closing position simultaneously with the establishment of a circuit to the firing pin 21 and therefore prior to the passage through the said firing pin 21 of sufficient heat energy for substantial ignition of the primary charge 13. Thus any possibility of the vent's remaining open to permit the escape of the pressure subsequently generated in the chambers 71 and 36 by the consumption of the major charge in the cartridge is avoided.

In the intended mode of operation, the operator will wait until after the firing of the cartridge and the delivery of the fluid pressure to the conduit 38 leading from the chamber 36 (and connecting with the device to be moved) before removing the manually applied pressure from the switch element 87. Upon removal of such manually applied pressure the operator will prepare to take hold of the breech handle 41 for the purpose of swinging the latter to the breech opening position; but immediately upon such removal of pressure from the switch element 87 the latter is moved to the circuit opening position by the action of the spring 88, and the consequent stoppage of current flow to the winding 93 de-energizes the magnetic hold existing up to that time between the elements 101 and 102, whereupon the spring 111 operates to shift the parts sufficiently to withdraw the valve and allow any residual pressure in the chamber 36 to be exhausted to the atmosphere by way of the vent opening 109. Thus it will be seen that the complete evacuation of pressure fluid from the chambers 71 and 36 is brought about just as the operator removes his hand from the switch button and therefore prior to the time when the operator would naturally be expected to apply his hand to any other mechanism, as for example the breech handle 41. It follows that there is positive assurance of the release of all residual fluid pressure prior to any movement whatever of the breech handle 41 in the unlocking direction.

After the handle 41 has been moved to the breech unlocking position the sectional breech cover 27, 28 may be swung to the breech opening position about the supporting trunnion 34 in

which the hinge portion 95 of the breech cover plate is rotatably mounted as indicated at 96. This swinging of the cover plate will operate to eject or at least dislodge the cartridge, through the action of intervening parts 97 and 98, the former being a toe piece on the hinge 95 engageable with the ejector pin 98 in response to the swinging of the cover plate, and the ejector plate 98 being in turn provided with a flange engaging the forward flange on the cartridge to eject the latter.

This application contains subject matter corresponding in part to that of applicant's co-pending application No. 107,295, filed October 23, 1936, and in part to applicant's co-pending application No. 148,997, filed June 18, 1937, but also contains additional subject matter not disclosed in either of said co-pending applications. The claims herein are directed to the subject matter not claimed in either of said co-pending applications.

What I claim is:

1. In a device of the class described, a barrel provided with a vent and adapted to hold a charge which is combustible upon transfer of sufficient heat thereto, a breech block for closing one end of said barrel, means operable to lock said breech block to said barrel in closed position, and means independent of said locking means for closing the vent prior to transfer to said charge of any significant amount of heat.

2. In a device of the class described, a barrel provided with a vent and adapted to hold a charge which is combustible upon transfer of sufficient heat thereto, a breech block for closing one end of said barrel, means operable to lock said breech block to said barrel in closed position, means independent of said locking means for closing the vent prior to transfer to said charge of any significant amount of heat, and means for automatically re-opening said vent prior to any movement of said locking means in the unlocking direction.

3. In a device of the class described, a barrel provided with a vent and adapted to hold a charge which is combustible upon transfer of sufficient heat thereto, a breech block for closing one end of said barrel, means operable to lock said breech block to said barrel in closed position, means independent of said locking means for closing the vent prior to transfer to said charge of any significant amount of heat, and means for automatically re-opening said vent upon discontinuance of heat transfer to said combustible charge.

4. In a device of the class described, a barrel provided with a vent and adapted to hold a charge which is combustible upon transfer of sufficient heat thereto, a breech block for closing one end of said barrel, means operable to lock said breech block to said barrel in closed position, means independent of said locking means for closing the vent prior to transfer to said charge of any significant amount of heat, and means for automatically re-opening said vent independently of any movement of said locking means in the unlocking direction.

5. In a device of the class described, the combination with a powder burning chamber, of a powder charge therein, means for transferring heat to said powder charge to produce burning of the powder therein, means for locking the device to render the powder charge inaccessible from the exterior of the device, and means independent of said locking means for controlling

the escape of gases generated in said chamber by the burning of the powder charge.

6. In a device of the class described, the combination with a powder burning chamber of a powder charge therein, shiftable means for locking the device to render the powder charge inaccessible from the exterior thereof, and means for venting said chamber independently of the position of said shiftable means.

7. In a device of the class described, the combination with a powder burning chamber, of a powder charge therein, means including a source of current and an electric circuit for transferring heat to said powder charge to produce combustion thereof, and means electrically connected with said circuit for controlling the escape of gases generated in said chamber by the combustion of the powder charge.

8. In a device of the class described, the combination with a normally vented powder burning chamber, of a powder charge therein, means for transferring heat to said powder charge to produce burning of the powder therein, electromagnetic means for closing the vent in said chamber, and means including a source of current for energization of both said heat transferring and said vent closing means.

9. In a device of the class described, the combination with a powder burning chamber, of powder burning means therein, and means for controlling the escape from said chamber of gases generated by the operation of said powder burning means, said means comprising a valve having a passage therein through which said gases may escape, a magnetic element secured to said valve, and means for energizing said magnetic element to produce operation of said valve.

10. In a device of the class described, the combination with a chamber having an apertured wall, of means engageable therewith to prevent escape of fluid by way of said apertured wall, said means comprising a valve having a passage therein through which said fluid may normally escape, a magnetic element secured to said valve, and means for energizing said magnetic element to produce a shift of said valve to a position cutting off communication between said chamber and said valve passage.

11. In a device of the class described, the combination with a powder burning chamber, of powder burning means therein, and means for controlling the escape from said chamber of gases generated by the operation of said powder burning means, said means comprising a valve having a passage therein through which said gases may escape, a magnetic element secured to said valve, means for energizing said magnetic element to produce operation of said valve, said energizing means comprising a current receiving coil surrounding said magnetic element, and means for sending current therethrough.

12. In a device of the class described, the combination with a chamber having an apertured wall, of means engageable therewith to prevent escape of fluid by way of said apertured wall, said means comprising a valve having a passage therein through which said fluid may normally escape, a magnetic element secured to said valve, means for energizing said magnetic element to produce a shift of said valve to a position cutting off communication between said chamber and said valve passage, said energizing means comprising a current receiving coil surrounding said magnetic element, and means for sending current there-through.

13. In a device of the class described, the combination with a chamber having an apertured wall, of means engageable therewith to prevent escape of fluid by way of said apertured wall, 3 said means comprising a valve having a passage therein through which said fluid may normally escape, means for shifting said valve to cut off such escape, means including a source of electricity to facilitate generation of pressure fluid 10 in said chamber, and means for energizing said valve shifting means from said source of electricity.

14. A cartridge carrying and firing device for the generation of fluid pressure comprising a 15 movable cartridge firing pin, a breech having a cover plate surrounding said firing pin, resilient means concentric with said firing pin for moving

said firing pin into position to ignite the powder charge of the cartridge, means for locking the cover plate to the breech, and means movable by the locking means causing the expansion of said resilient means to begin as soon as said locking 5 means begins to operate, said last-named means including a screw and nut combination concentric with said resilient means and firing pin.

15. A device of the class described comprising a movable cartridge firing pin, resilient means 10 concentric with said firing pin for moving said firing pin into igniting position; and means for causing the expansion of said resilient means, said last-named means including a screw and nut combination concentric with said resilient 15 means and firing pin.

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