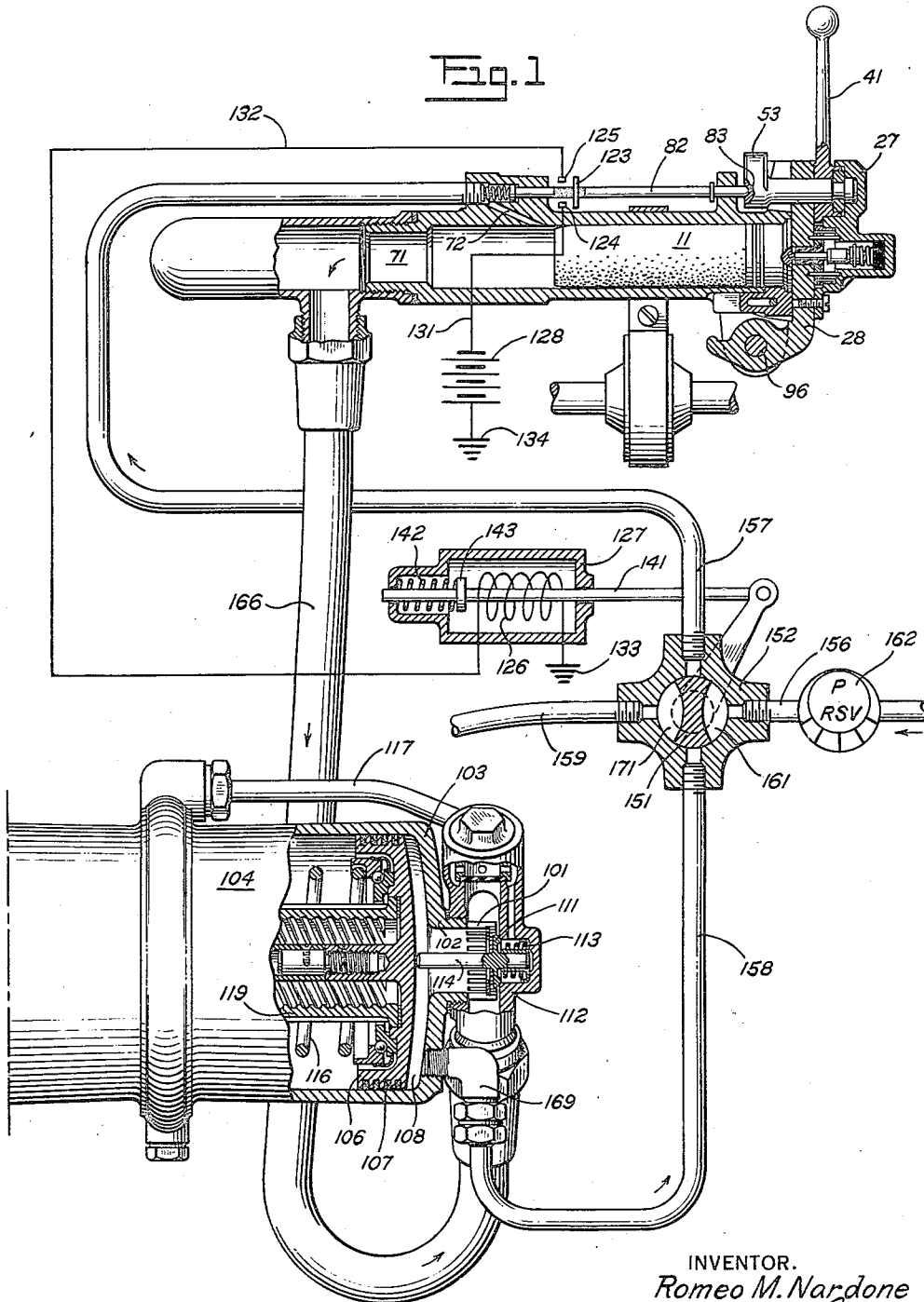


Oct. 24, 1939.

R. M. NARDONE
FLUID PRESSURE SYSTEM
Filed Oct. 30, 1937

2,177,044

2 Sheets-Sheet 1



INVENTOR.
Romeo M. Nardone
BY *Mattias J. Finnegan*
ATTORNEY.

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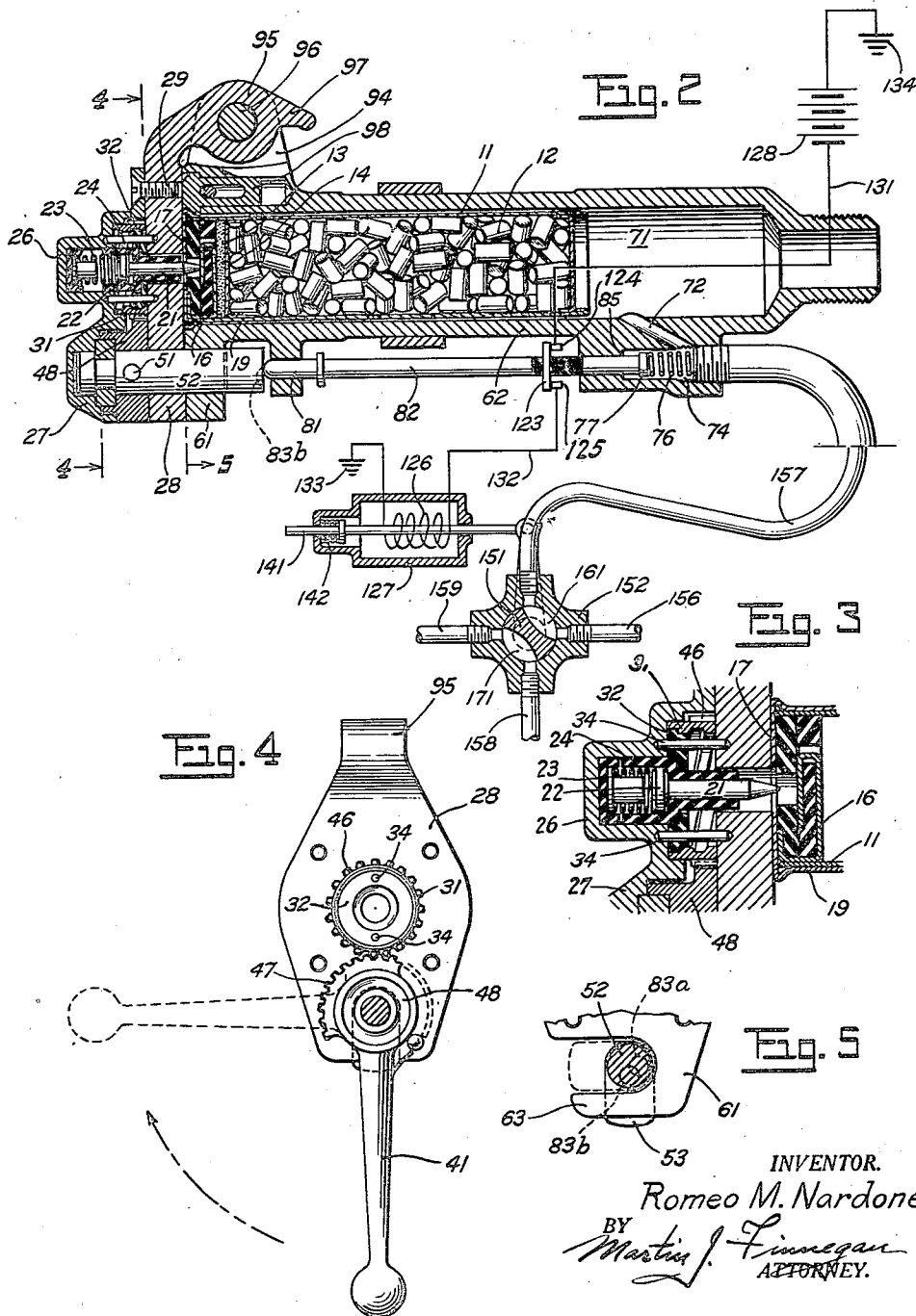
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2 Sheets-Sheet 2



INVENTOR.

Romeo M. Nardone

BY

Martin J. Linnegan

ATTORNEY.

UNITED STATES PATENT OFFICE

2,177,044

FLUID PRESSURE SYSTEM

Romeo M. Nardone, East Orange, N. J., assignor
to Eclipse Aviation Corporation, East Orange,
N. J., a corporation of New Jersey

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7 Claims. (Cl. 60-44)

This invention relates to fluid pressure systems, and particularly to systems utilizing pressure fluid generated by the ignition of explosive material confined in a suitable container such as is commonly termed a cartridge.

An object of the invention is to provide a novel cartridge housing and breech mechanism, including a novel valve mechanism controlling admission of a scavenging supply of fluid to the parts with which the outlet conduit of the breech mechanism has communication.

Another object is to provide an interrelationship between such valve mechanism and certain movable elements of the breech assembly, whereby the scavenging action is caused to occur at a predetermined stage in the cycle of operation.

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 the invention is shown as applied to the operation of a servo-motor (engine starter, for example, of the type shown in Patent No. 2,117,225 of Fred A. Stein, granted May 10, 1938) symbolizing any part to be served by the breech and valve mechanisms above described.

Referring to said drawings:

Fig. 1 is a view of the complete system, including a sectional showing of the breech mechanism, engine starter, and valve mechanism, the breech being shown with the cartridge in position and the igniting mechanism also in operative position, and the valve being shown as shifted from the position it occupies during the "scavenging" action, and the electromagnetic shifting means being shown diagrammatically;

Fig. 2 is a second view of the breech and valve mechanisms, the parts being shown in the positions they occupy during scavenging;

Fig. 3 is a longitudinal sectional view of the igniting mechanism shown in Fig. 1, but on a larger scale, and with the igniting plunger in the position which it occupies whenever the breech is in the unlocked position of Fig. 2;

Fig. 4 is a transverse view of certain of the parts as seen along the line 4-4 of Fig. 2; and

Fig. 5 is a transverse view along the line 5-5

of Fig. 2 showing details of the locking and exhaust valve operating mechanism.

The cartridge 11 is shown in Figs. 1 and 2 as containing a relatively slow burning powder 12 occupying a major portion of the space within 5 the cartridge and separated from a layer 13 of a highly combustible primer charge by an intervening partition 14 of suitable material such as cellulose. 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 portion thereof 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, 16 where it firmly grips the non-metallic portion of the cartridge casing. Another portion of strip 16 lies in the path of the conical end of a plunger 21 of current conducting material, said plunger having a head 22 adapted to be urged forward 20 by a 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 25 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 adapted to be threaded axially along guide pins 34 to cause a corresponding axial movement of 35 the nonconducting sleeve 24 and thereby to move the head of the plunger 21 from the position indicated in Fig. 1 in response to the turning of the sleeve 31 which results whenever the breech handle 41 is swung, such swinging of the handle 40 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 48 respectively, the latter being the central hub portion of the handle 41.

A pin 51 secures hub 48 of the handle 41 to 45 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. This leg 61, together 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.

A transverse passage 72 serves to connect the

chamber 71 with a smaller chamber 74 wherein is located a coiled spring 76 pressing upon the end 77 of rod 82 to yieldably hold said rod 82 in the position shown in Fig. 1, in which position the other end of said rod fits into the depression 83 in the forward surface of the flag 53; but after the firing of the cartridge and the swinging of the handle 41 to the breech unlocking position the corresponding movement of the flag 53 shifts the position of the depression 83 from that indicated at 83a (see Fig. 5) to that indicated at 83b and thereby creates a cam action which presses the rod 82 forward to the position indicated in Fig. 2, in which position contacts 124 and 125 are bridged by member 123.

After the handle 41 has thus been moved to the lock releasing position the sectional breech cover 27 and 28 may be swung to the breech opening position about the supporting trunnion 94 in which the hinged 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 by reason of the intervening parts 97 and 98, the former being a toe piece on the hinge 95 engageable with the ejector 98 in response to the swinging of the cover plate, and the ejector 98 being in turn provided with a flange engaging the forward flange on the cartridge to eject the latter.

Upon ignition of the priming charge 13, the rapid combustion of the said priming charge creates sufficient additional heat to ignite the main charge 12, which thereupon proceeds to burn at a relatively slow rate, to cause a gradual building up of pressure in the chamber 71 and the conduit 166 leading to the point of application of the pressure thus generated.

While the resulting pressure may cause a forward movement, to a limited degree, of a few particles of the powder 12, combustion of virtually the complete charge occurs in the breech chamber; the conduit 166 serving mainly for the transmission of the pressure fluid resulting from such combustion, together with those few particles of the powder not consumed. Any of such particles which collect upon or pass through the slotted cylindrical cage or grid 101 in starter 104 will subsequently be blown out of the engine starting mechanism, along with any residual gases, by the scavenging action, hereinabove referred to and to be described presently in greater detail.

As shown in Fig. 1, the cylindrical slotted cage 101 is an integral extension of the externally threaded boss 102 in which the head end 103 of the engine starter housing 104 terminates. Within said housing 104 is a piston 106 provided with sealing rings 107 for fluid tightness as the piston moves along the inner cylindrical surface of the housing 104 in response to the passage of the pressure fluid through the slotted cage 101 on its way to the working chamber 108 of the starting unit. In its normal position—that is, the position indicated in Fig. 1—the piston 106 operates to hold valve 111 firmly seated on the valve seat formed in the cover plate 112, such seating being effected against the opposition of the coiled compression spring 113 and by reason of the fact that piston 106 engages the end of the valve stem 114 as the piston is returned to the position shown; the return of the piston to said position being due to the expanding action of the coiled compression spring 116, which expanding action occurs following the release of the pressure fluid to the exhaust con-

nection 117 in any suitable manner as, for example, that more fully illustrated and described in the Stein patent above identified.

When such return stroke of the piston 106 has been completed (the engine having meanwhile been started as a result of the initial rotation imparted thereto through the motion translating connections between the piston 106 and the engine crankshaft, which connections are only partially shown at 119 in Fig. 1 but are more fully illustrated and described in the above identified Stein patent) the operator will proceed to release the lock of the breech mechanism preparatory to swinging the cover plate to the open position to allow removal of the remains of the cartridge. As a result of this unlocking movement the rod 82 is shifted to the left of the position shown in Fig. 1, the shifting being produced by reason of the cam action of the flag 53 upon the rounded end of the rod as it moves the latter out of depression hereinbefore described.

This longitudinal movement of the rod 82 is sufficient to carry the contact plate 123 into engagement with the stationary contacts 124 and 125, whereupon a circuit is completed to energize the winding 126 of the solenoid 127; the circuit passing from the source 128 to said winding 126 by way of conductors 131, 124, 123, 125 and 132, and returning by way of the ground connections indicated at 133 and 134.

The effect of the energization of the solenoid 127 in the manner thus described is to cause the solenoid plunger 141 to be shifted to the left from the position indicated in Fig. 1—in which position it is normally held by the action of coiled compression spring 142 upon the collar 143 of the plunger—into the position indicated in Fig. 2, in which position the valve 151 within the valve housing 152 occupies a position wherein free communication is allowed between conduits 156 and 157 on the one hand and conduits 158 and 159 on the other.

Of these conduits, the first-named serves to connect the valve chamber 161 with the air pump 162 or other source of compressed air or equivalent scavenging fluid, while the conduit 157 serves to establish communication between said valve chamber 161 and the passage 72 leading into the forward chamber 71 of the breech mechanism. Free communication is thus established with the conduit 166 leading to the chamber 108 of the engine starter, and between said chamber 108 and the atmosphere by way of outlet 169, conduit 158, valve chamber 171 and exhaust pipe 159.

The free path for the scavenging fluid which is thus provided permits a blowing and scavenging action all along said path, and any solid particles remaining in said path after the engine starting operation, together with the unexhausted gaseous residue are thus carried away and ejected to the atmosphere at the terminal of the exhaust pipe 159.

After completion of this scavenging step, the operator will proceed to swing open the now unlocked cover plate, in order to effect removal of the spent cartridge. As he does so, the flag is withdrawn from the path of the rod, whereupon spring 76 snaps said rod lengthwise sufficiently to reopen the solenoid circuit at the switch 123. Solenoid spring 142 then acts to return the valve to the fluid cut-off position of Fig. 1, thus completing the cycle.

What is claimed is:

1. The combination with a cylinder, having a

piston therein, of a cartridge firing breech mechanism, means for firing a cartridge in said breech mechanism, means for conducting the resulting gases to said cylinder to move said piston, and means for scavenging said cylinder to remove any gases that may remain after completion of the piston stroke, said last-named means being operative in response to the unlocking of said breech mechanism following firing of the cartridge.

2. The combination with a servo-motor of actuating means including a breech mechanism having a cover plate and means for unlocking said cover plate with respect to the breech body, means for introducing a scavenging fluid into said breech mechanism, said introducing means including a valve for connecting the breech chamber with a source of pressure fluid, and means responsive to unlocking of said cover plate for operating said valve.

3. The combination with a servo-motor of actuating means including a breech mechanism having a cover plate and means for unlocking said cover plate, means for introducing a scavenging fluid into said breech mechanism, said introducing means including a valve for connecting the breech chamber and servo-motor with a source of pressure fluid, and means responsive to unlocking of said cover plate for operating said valve, said valve further serving to vent said servo-motor whereby the scavenging fluid may be evacuated therefrom.

4. The combination with a servo-motor of actuating means including a breech mechanism, means for introducing a scavenging fluid into said breech mechanism, and means for conveying said scavenging fluid to said servo-motor, said introducing means including a valve for connecting the breech chamber with a source of pressure fluid, means normally holding said valve

in source disconnecting position, and electromagnetic means for shifting said valve to the connecting position.

5. The combination with a servo-motor of actuating means including a breech mechanism having a cover plate and locking means for said cover plate, of means for introducing a scavenging fluid into said breech mechanism and servo-motor, said introducing means including a valve for connecting the breech chamber with a source of pressure fluid, means normally holding said valve in source disconnecting position, electromagnetic means for shifting said valve to the connecting position, a circuit from a current source to said electromagnetic means, and means including said cover plate locking means for operating said circuit.

6. The combination with a servo-motor of actuating means including a breech mechanism, means for introducing a scavenging fluid into said breech mechanism and servo-motor, said introducing means including a valve for connecting the breech chamber with a source of pressure fluid, means normally holding said valve in source disconnecting position, electromagnetic means for shifting said valve to the connecting position, a circuit from a current source to said electromagnetic means, and means for operating said circuit.

7. The combination with a servo-motor of actuating means including a breech mechanism having a firing pin, a cover plate, and a lock for fastening said cover plate to the breech body, means including a lock engaging rod for controlling introduction of a scavenging fluid into said breech mechanism and servo-motor, and common operating means for said firing pin, lock, and lock engaging rod.

ROMEO M. NARDONE.