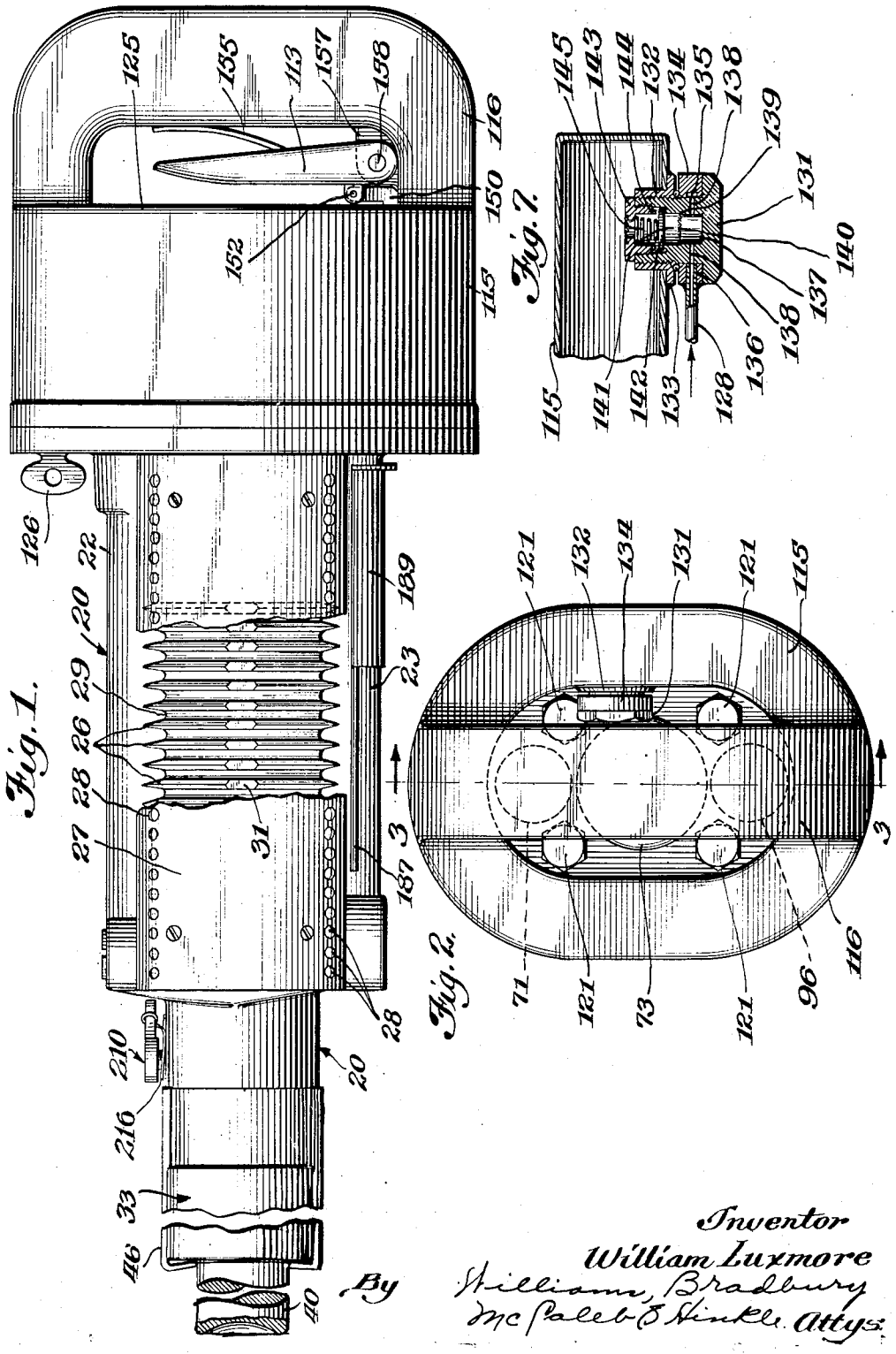
Nov. 14, 1933. W. LUXMORE 1,934,935

CARBURETOR FOR INTERNAL COMBUSTION ENGINES

Filed Sept. 10, 1930 4 Sheets-Sheet 1



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CARBURETOR FOR INTERNAL COMBUSTION ENGINES

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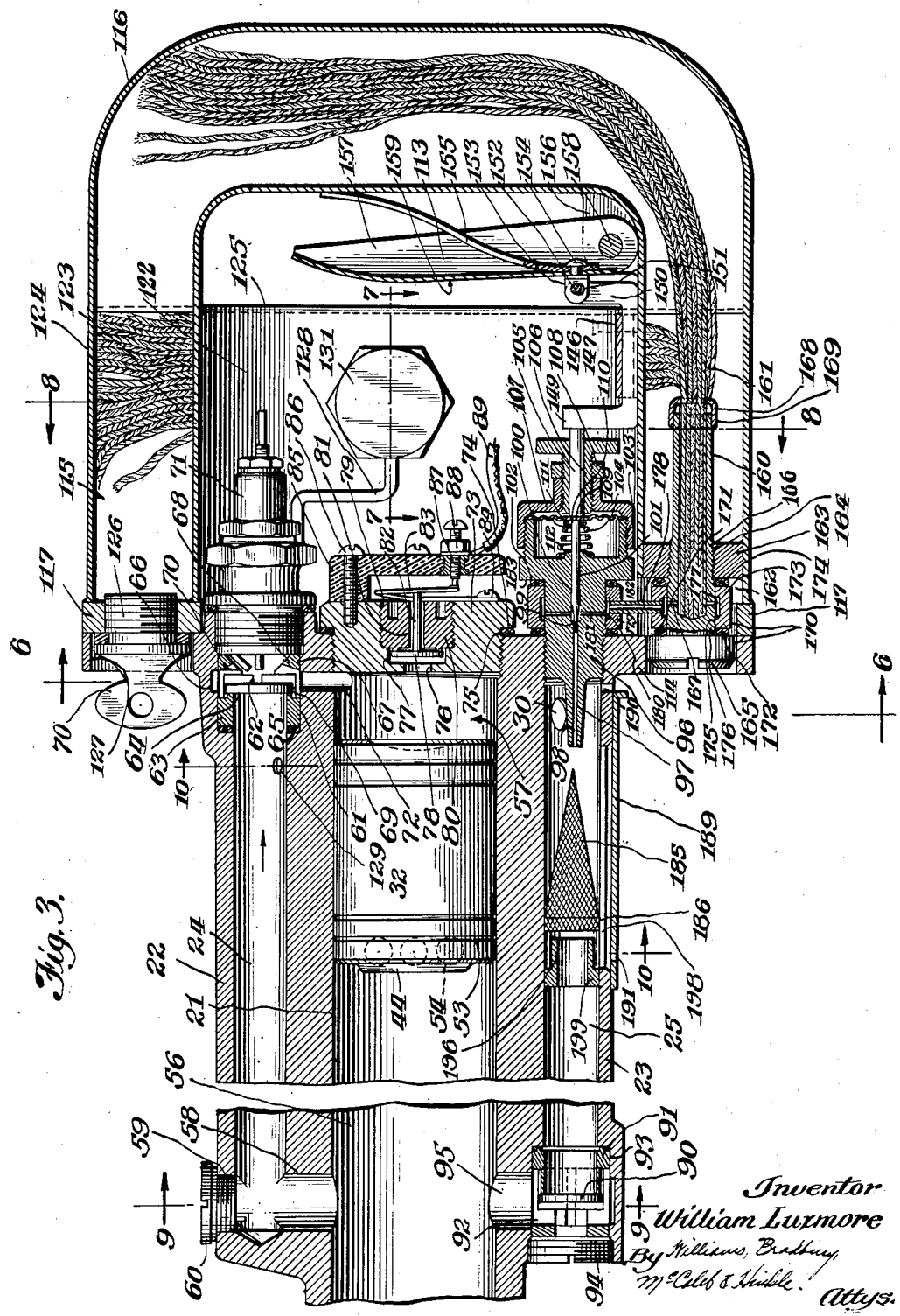


Fig. 3.

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Fig. 4.

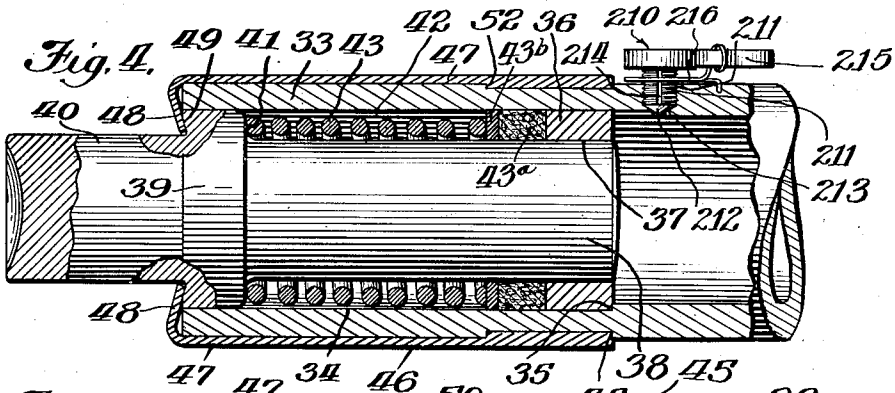


Fig. 5.

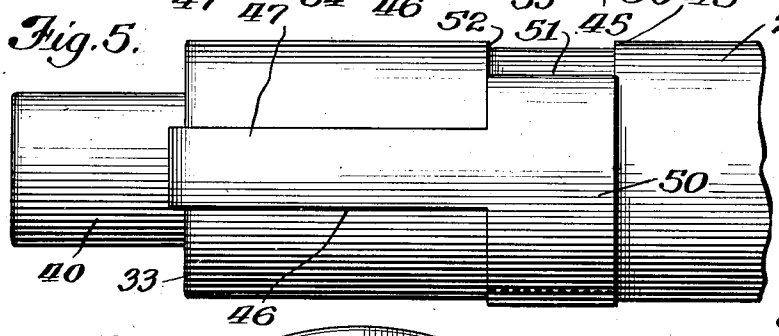


Fig. 6.

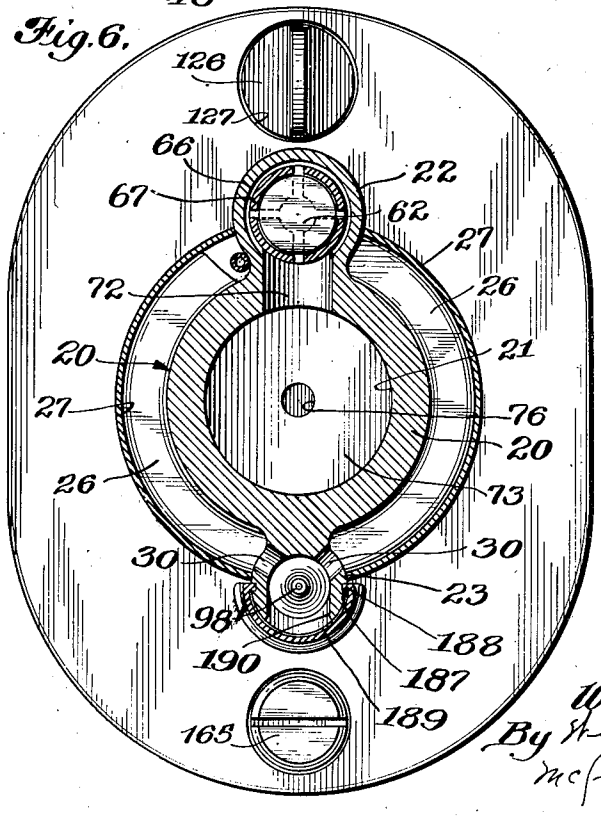
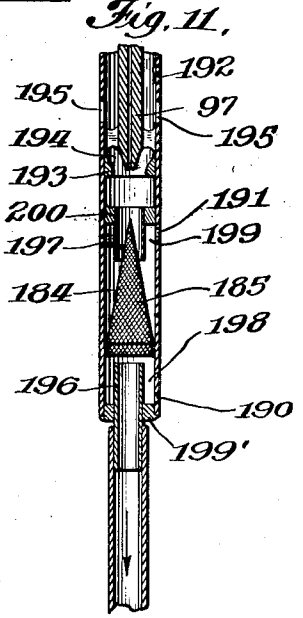


Fig. 11.



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Fig. 8.

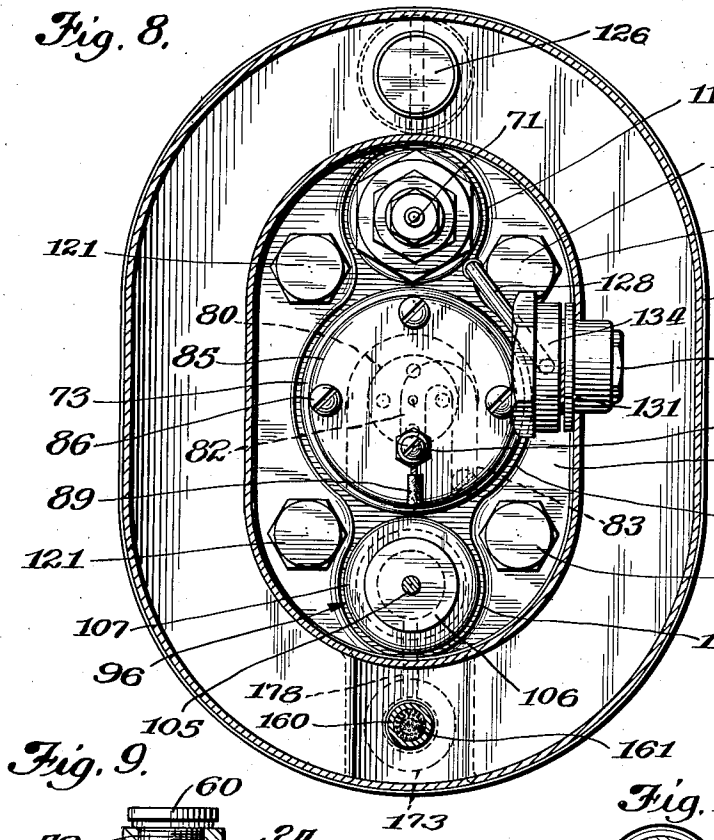


Fig. 9.

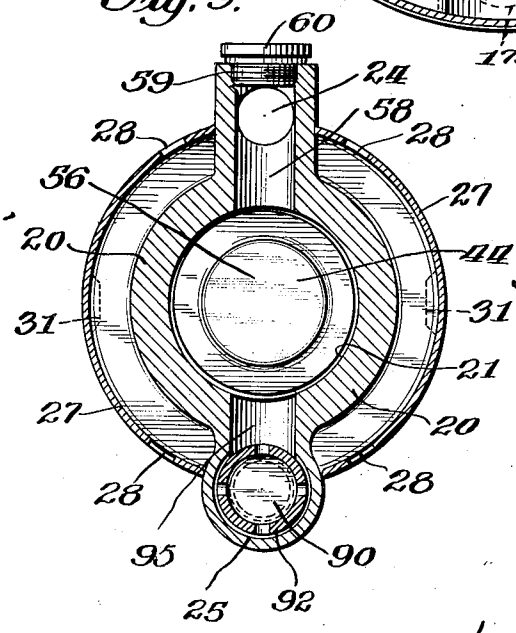
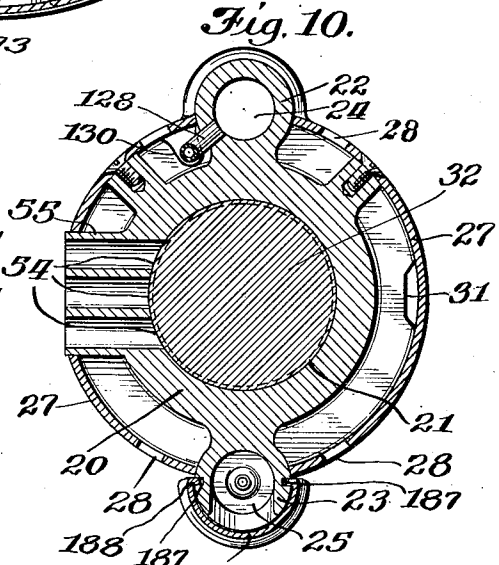


Fig. 10.



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UNITED STATES PATENT OFFICE

1,934,935

CARBURETOR FOR INTERNAL COMBUSTION ENGINES

William Luxmore, Chicago, Ill.

Application September 10, 1930
Serial No. 480,895

7 Claims. (Cl. 261—99)

The present invention relates to internal combustion engines, and is particularly concerned with engines of the type covered by my prior application, Serial No. 264,843, filed March 26, 1928.

The power hammers of the type shown in my said application are adapted to be used for riveting by structural steel and iron workers, and for a great many other uses analogous to the use of compressed air hammers, and one of the important advantages of the power hammer is the elimination of the auxiliary equipment which would be required for an air hammer of the same size. It is also highly desirable that the hammer have a minimum of hose or wire connections leading from the hammer, and consequently the hammer is preferably provided with a built-in fuel tank and carburetor, and with an appropriate ignition system, such as a small dry battery and ignition coil for supplying high tension current.

One of the objects of the present invention is the provision of an improved internal combustion power hammer of the type covered by said prior application.

Another object is the provision of a power hammer of the class described, having an improved arrangement of parts, thereby making the hammer more light, unitary, compact and capable of more economical manufacture and assembly.

Another object is the provision of an improved power hammer having its fuel supplying devices so arranged as to insure uniform supply of fuel to the hammer, irrespective of the position in which the hammer is held or used, and/or irrespective of the amount of fuel in the tank at any time.

Another object is the provision of an improved carburetor and tank arrangement which is capable of supplying a constant mixture whether the tank be wholly or partly filled, and whether the tank be right-side up or inverted.

Another object is the provision of an improved carburetor arrangement adapted to avoid flooding of the cylinder and adapted to give an indication of excessive opening of the needle valve and to dispose of excessive fuel without affecting the operation of the engine, thereby making the engine practically "foolproof" insofar as flooding the engine is concerned, and effecting more uniform carburetion.

Another object is the provision of an improved tool holder for power hammers of the class described, which is capable of positively securing the tool in the hammer, but which also permits release of the tool and substitution of another tool with a minimum expenditure of time and effort.

Another object is the provision of an improved arrangement of conduits and connections for supplying the fuel whereby an effective and liquid-tight assembly may be constructed at a minimum cost.

Another object is the provision of an improved engine having means for varying the cushioning return of the piston to regulate the speed of the engine, to regulate the force of impact, and to permit more free return of the piston in the starting operation.

Other objects and advantages of the invention will be apparent from the following description and from the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the drawings, of which there are four sheets;

Fig. 1 is a side elevational view of the improved power hammer;

Fig. 2 is an end elevational view of the handle end of the hammer;

Fig. 3 is a sectional view taken on the plane of the line 3—3 of Fig. 2, showing the internal construction of the engine and its accessories;

Fig. 4 is a longitudinal sectional view through the tool holder;

Fig. 5 is an elevational view of the tool holder and tool;

Fig. 6 is a sectional view taken on the plane of the line 6—6 of Fig. 3, through the cylinder;

Fig. 7 is a sectional view taken on the plane of the line 7—7 of Fig. 3, through the one-way valve and conduit for supplying pressure to the fuel tank from the engine;

Fig. 8 is a sectional view taken on the plane of the line 8—8 of Fig. 3, through the fuel tank, with the end of the cylinder shown in plan;

Fig. 9 is a sectional view taken on the plane of the line 9—9 of Fig. 3, through the intake valve and fuel transfer conduit;

Fig. 10 is a sectional view taken on the plane of the line 10—10 through the cylinder at the exhaust ports; and

Fig. 11 is a fragmentary sectional view similar to Fig. 3, through a modified form of carburetor arrangement adapted to prevent flooding of the engine.

Referring to Figs. 1 to 3, the internal combustion power hammer preferably includes a cylinder 20 consisting of an integral metal member formed with a longitudinally extending cylindrical bore 21 which is open at both ends. The cylinder 20 is preferably substantially cylindrical in shape with laterally projecting cylindrical for-

mations 22 and 23 carried by opposite sides of the cylinder 20 and extending longitudinally of the cylinder for enclosing fuel conduits 24 and 25.

In order to provide for the cooling of the cylinder 20, it is preferably provided with circumferentially extending fins 26 which may extend from the sides 22 of the fuel conduit formation to the sides 23 of the other fuel conduit formation, and the fins 26 may be covered with a curved shield 27 provided with a plurality of apertures 28 located at the ends of the fins and adapted to register with the cooling air spaces 29 between the fins 26. The air may pass in at any of the apertures 28 which happen to be disposed lowermost and out of the apertures 28 which happen to be uppermost at that time, and the cooling of the cylinder is thus taken care of by convection air currents between the fins 26 which provide an increased radiation area.

Each side of the cylinder is preferably provided with similar fins 26 and a similar shield 27, and the air intake conduits 30 are preferably so located as to draw air from beneath the shields 27 so that the air used by the engine may be preheated through contact with the hot cylinder wall beneath the shield 27. The ribs 26 may be cut away at 31 to provide a continuous passage down the side of the cylinder beneath the central portion of shield 27 for bringing a supply of air to the air intake ports 30 from all parts of the cylinder 20. If desired, in some embodiments, the shields may be eliminated.

The present tool is preferably provided with an improved tool holding arrangement illustrated in detail in Figs. 4 and 5 and adapted to hold tools of all kinds, such as rivet sets, chisels, drills, etc., in such manner that other tools may be very readily substituted, but the tool is positively held in the tool head of the cylinder and the tool is adapted to be projected into the cylinder by the reaction of the work on the tool when a greater pressure is exerted on the handle by the operator, thereby causing the piston 32 to effect a heavier impact on the tool shank.

Referring to Fig. 4, the left end of the cylinder 20 may be termed the tool head 33 and the tool head is preferably provided with an enlarged bore 34 forming an annular shoulder 35 at the end of cylinder 20. The tool head 33 is preferably provided with a guide comprising an annular member or ring 36 which is adapted to be secured in the counter-bore 34 by a pressed frictional fit against the shoulder 35 and the bore 37 of guide 36 is adapted to slidably receive the reduced cylindrical portion 38 of the tool shank 39.

The tool shank 39 is preferably of sufficient size adjacent the tool 40 to be slidably received in the bore 34, and the tool shank 39 is thus provided with an annular shoulder 41 forming a spring chamber 42 in the bore 34.

A helical spring 43 is confined in the annular spring chamber 42 between the shoulder 41 and the end of guide 36 and the spring 43 resiliently urges the tool 40 into the position of Fig. 4, but permits the tool to be forced into the interior of the cylinder 20, in which case the cylindrical portion 38 of the shank would project into cylinder 20. A packing 43*a*, preferably of asbestos-graphite material, is confined between the end of spring 43 and guide 36, and the packing is held in place by a metal ring 43*b* which provides a seat for spring 43. The spring 43 automatically takes up any wear in the packing.

The operation of the present tool in connection with the engine is substantially the same as that described in my prior application, in that the piston 32 is adapted to reciprocate back and forth without striking the tool shank 38 when the tool is in the position of Fig. 4, but when the tool 40 is brought into engagement with the work, and the shank 38 projects into the bore 21 of cylinder 20, the end of shank 38 is struck by the anvil formation 44 on piston 32 and the strength of the blow may be regulated by the pressure on the handle, since the pressure on the handle of the tool determines the amount of projection of the shank into the cylinder bore 21.

The cylinder 20 is preferably provided at its tool end with an annular groove 45 and with a spring clip 46 having a pair of arms 47 extending longitudinally of the cylinder and provided with inwardly turned ends 48 for engaging the annular shoulder 49 on the tool 40. The arms 47 of the spring clip are joined by a cylindrical band 50 which, however, extends only part of the way about the cylinder 20, terminating at the points 51 which are located beyond a diametrical line passing through the cylinder so that the annulus 50 extends more than half way about the cylinder 20 and may be sprung apart to be removed from the cylinder 20. The annulus 50 is preferably made thicker than the spring arms 47 so that the band 50 is adapted to be received in the annular groove 45, engaging the annular shoulder 52 to prevent longitudinal movement of the spring clip 46.

It will thus be observed that the spring clip 46 may be removed by sliding it downward in Fig. 5, the retaining flanges 48 passing laterally off the annular shoulder 49 of tool 40, after which the tool 40 may be slid out of bore 21 and guide 36, and any other type of tool easily substituted.

However, the spring clip is preferably not removed, but is only spread far enough to remove or insert a tool.

The tool illustrated is a tool used for riveting or upsetting operations, but any convenient form of hammer actuated tool may be employed, and the spring clip 46 provides a positive mode of securing the tool in place, so that it cannot be dislodged by the impact of the piston on the tool shank, nor by the pressure of the gases in the cylinder caused by operation of the engine.

The piston 32 preferably comprises a substantially cylindrical metal member provided with an outwardly projecting anvil formation for engaging the end of the shank 38 and the piston 32 may be provided with piston rings of the usual or any convenient type and/or oil grooves 53 if desired.

The cylinder 20 is preferably constructed of cast steel and the piston 32 of tool steel or other metal having substantial weight and adapted to serve as a hammer.

The cylinder is preferably provided with a plurality of exhaust ports 54 located to be exposed by the piston 32 when the piston 32 has reached such a position that the expansive gases have accomplished their work, after which the exploded gases exhaust through the ports 54 which are in communication with the exhaust conduits 55 leading through an aperture in one of the shields 27.

The conduit 24 constitutes a fuel transfer conduit for transferring a supply of fuel from the fuel intake chamber 56 to the combustion chamber 57. Thus the conduit 24 may be placed in communication with the cylinder bore 21 by boring laterally from the outside through the

formation 22 into the bore 21, making the port 58.

The outer cylinder wall may be threaded at 59 and closed with a screw plug 60, leaving the conduit 24 in communication with the cylinder through conduit 58. The opposite end of conduit 24 is preferably provided with a counter-bore 61 which is adapted to receive a valve cage and valve seat of a one-way valve 62 capable of permitting the fuel to go into the combustion chamber 57, but closing to prevent the return of fuel through the conduit 24 on the compression stroke. The valve seat 63 may consist of an annular metal member 64 formed with an annular seating surface 64 at one end and the valve seat 63 may be provided with a gasket 65 confined in the lower end of counter-bore 61.

Counter-bore 61 may be provided with an annular enlargement 66 surrounding valves 61 and seat 64 to reduce the valve resistance and the valve 62 may be confined in a valve cage 67 comprising an annular member 68 having a plurality of laterally projecting fingers 69 for holding the seat member 63 in place, and a plurality of radially extending fingers 70 for supporting the valve 62. The valve 62 consists of a relatively light metal disc adapted to be opened by the intake of fuel gas moving in the direction of the arrow in conduit 24 and adapted to be closed by the tendency of the gases to return, or any increase of pressure in the combustion chamber 57.

The outer end of counter-bore 61 may be threaded to receive an ordinary spark plug 71, the outer edge of which preferably engages the valve cage 67 to secure the parts of the valve in position in the counter-bore 61 and the annular groove 66 surrounding valve 62 communicates with the combustion chamber 57 through an intake port 72.

The open end of cylinder bore 21 at the right of Fig. 3, is preferably closed with a cylinder head 73 which may be threaded into the cylinder bore 21 and which is preferably provided with an annular shoulder 74 for compressing a sealing gasket 75. The cylinder head 73 is preferably provided with a port 76 leading to an enlarged bore 77, which is adapted to receive the disc 78. The bore 77 communicates with a threaded bore 79 adapted to receive a guide plug 80 having a bore 81 for slidably receiving a pin 82 carried by disc 78.

The disc 78 is urged from the position of Fig. 3 by a spring contact 83 which is secured to the cylinder head 73 by a screw bolt 84. The cylinder head also supports a block 85 of electrical insulating and heat resistive material secured to the cylinder head by a screw bolt 86 and adapted to provide an insulated support for an adjustable screw contact 87. The screw contact 87 is provided with lock nuts 88 for securing it in any adjusted position and for providing a connector for securing the contact screw 87 to the conductor 89 which forms one of the wires of the primary coil of the ignition system as shown in my prior application.

The cylinder and ignition switch are shown in the position which they assume when the piston has reached the ignition point and consequently the contacts 83—87 are closed but the contact spring 83 normally pushes the pin 82 and disc 78 to the left from the position of Fig. 3, and the switch 83, 87 is only closed responsive to the predetermined ignition pressure in the combustion chamber 57.

The intake conduit 25 is also preferably provided with a one-way valve 90 of substantially the same construction as that shown in my prior application and described with respect to valve 62. The valve seat 91 and cage 92 for the valve disc 90 may be secured in place in the counter-bore 93 by a screw plug 94. The conduit 25 communicates with the fuel chamber 56 through the valve 90 by means of the port 95 which may be bored at the same time the port 58 is made for the opposite side of the cylinder.

The end of the conduit 25 adjacent cylinder head 73 is preferably threaded to receive the body 96 of a carburetor nozzle 97 which projects into the conduit 25 past the air intake ports 30. The nozzle 97 is provided with a relatively fine aperture 98 formed with a needle valve seat 99 at its inner end and communicating with a counter-bore 100 forming a guide for a needle valve 101. The body 96 of the nozzle may also be formed with an annular shoulder 102 and with an outwardly projecting cylindrical wall 103 forming a spring chamber for receiving a coil spring 104.

The needle valve 101 is provided with a substantially cylindrical enlargement 105 slidably mounted in a screw plug 106 which is threaded into the cap 107. The screw plug 106 is adapted to be secured in place by the lock nut 108 and adapted to act as a stop for determining the maximum opening of the needle valve 101. The needle valve 101 is provided with an annular shoulder 109 against which is secured a diaphragm 110 by means of a washer 111, and the joint between the needle valve 101 and the diaphragm 110 is preferably soldered, or made gas and liquid tight in some convenient manner.

The spring 104 is confined between the washer 110 and the end of nozzle plug 96 which is preferably provided with an annular lug 112 for maintaining the spring 104 in place, and the spring 104 is adapted to urge the needle valve 101 into open position. The external edge of the circular diaphragm 110 is clamped between the cap 107 and the wall 103 of plug 96, and the diaphragm 110 thus provides a movable and liquid-tight support for the needle valve 101, so that it is unnecessary to provide the needle valve 101 with any form of packing, and the needle valve is also adapted to be more readily moved and easily actuated, so that the valve is readily responsive to any movement of the actuating member 113.

The end of the cylinder 20 adjacent cylinder head 73 is preferably provided with a laterally projecting attaching flange 114 providing a support for the fuel tank 115 and handle 116, which are carried by a base plate 117. The base plate 117 is preferably substantially oval in shape, as shown in Fig. 8, and provided with a centrally located series of apertures 118, 119, 120, adapted to provide space for the spark plug 71, cylinder head 73 and carburetor nozzle 96. The base plate 117 may be secured to the cylinder by a plurality of screw bolts 121 passing through the base plate and threaded into the body of cylinder 20.

The fuel tank 115 is carried by the base plate 117 which forms the lower wall of fuel tank 115, and the fuel tank preferably comprises a tank of the largest size possible conforming to the exterior outline of the base plate 117, but leaving a recess 122 at the central part of the cylinder end for receiving the spark plug, cylinder head, and carburetor.

Thus, the gas tank is provided with an interior wall 123 which is oval in section, as shown in Fig. 8, with an exterior wall 124 of substantially the same shape, but larger in diameter, the space

between the walls 123 and 124 defining a fuel chamber 115. The walls 123 and 124 are covered at the right end of Fig. 3, with an end plate 125 which closes the major portion of that end of tank 115, but the tank is also provided with a longitudinally projecting handle formation 116 which preferably communicates with the tank 115, and provides additional space for receiving fuel. The tank is provided with a filling plug 126 which may be threaded into the base plate 117, and the attaching flange 114 may be provided with an aperture 127 for actuating the filling plug 126.

The fuel tank 115 is also preferably in communication with the fuel intake chamber 56 or fuel conduit 24, in order that the tank may be provided with a source of fluid pressure from the engine to maintain the fuel in the tank under constant pressure. Thus, a conduit 128 extends from the port 129 in intake conduit 24, along a groove 130 in the cylinder wall, and the conduit 128 communicates with a valve plug 131 in the tank 115.

The tank 115 may be provided with an annulus 132 which is soldered or welded to the tank as at 133, and which is threaded to receive the valve plug 131. An annular metal member 134 having an annular internal groove 135 is provided with an aperture 136 for receiving conduit 128, which may be soldered to annulus 134 and the valve plug 131 is provided with a bore 137 which communicates with the annular groove 135 through radial apertures 138.

The bore 137 may be provided with an annular shoulder 139 against which a gauze or fine metal screen 140 may be secured by soldering, and the valve plug 131 is preferably formed with a valve seat 141 to be engaged by a valve 142. The inner end of valve plug 131 may be threaded to receive a valve cage 143 having upwardly projecting fingers 144 for supporting valve 142, but permitting the flow of fluid or gas between the fingers 144, and a spring 145 may be tensioned between the cage and the valve disc 142.

It will thus be observed that the valve 142 will permit the flow of fluid, such as fuel, vapor or air, in the direction of the arrow in Fig. 7, into the tank 115, and pressure generated by the engine in the fuel intake chamber 56 or conduit 24, will be transmitted to the fuel chamber 115. As a result, each stroke of the piston causes an increment of gas or vapor to pass through the valve 142 into the fuel chamber 115, and when the engine is operating, the fuel is maintained under a constant predetermined pressure, which assures the proper supply of fuel to the engine.

The gauze 140 is added as a precautionary measure against ignition by backfiring, although the valve 62 will ordinarily be closed when the fuel in the combustion chamber is under compression, thereby preventing any backfire.

The internal wall 123 of fuel tank 115, preferably supports a guide stirrup 146 comprising a sheet metal member of substantially U-shape, and having a pair of laterally projecting attaching flanges 147 which are soldered, welded or otherwise secured to the side of the fuel tank 115.

Another gauze 140*a* is preferably carried by the inner end of valve cage 141 to protect the valve from foreign matter in the fuel.

The guide stirrup 146 slidably supports a connecting rod 148 having one end laterally bent to provide an abutment 149 for engaging the end of needle valve 101. The other end 150 is provided with a slot 151 for receiving a rivet 152 carried by a U-shaped sheet metal stirrup 153. The stirrup 153 may be secured to the handle 113 by means of a rivet 154 which also secures a leaf spring 155 to the lever 113, and the connecting rod 148 is thus adapted to be slid back and forth in guide stirrup 146 by means of the lever 113.

The grip 116 is preferably provided with an inwardly projecting lug 156 adapted to be received between the parallel flanges 157 of the actuating lever 113, and the actuating lever 113 is pivotally mounted on lug 156 by means of a rivet 158. Actuating level 113 preferably comprises a sheet metal member of substantially U-shape in cross-section, having its parallel flanges 157 extending towards the clip 116 so as to provide a relatively smooth gripping surface 159 on the opposite side for engagement with the fingers of the operator.

The spring 155 is arranged to be placed under tension when the actuating lever 113 is in the position of Fig. 3, and the spring 155 is of greater strength than the needle valve spring 104, so that spring 155 is adapted to urge the needle valve to closed position as shown in Fig. 3. On seizing the grip 116 with the hand and pulling on lever 113 with the fingers, the connecting rod 148 will be moved to the right in Fig. 3 against the tension of spring 155, and needle valve spring 104 will move needle valve 101 into open position, the amount of opening depending on the relative position of the control lever 113.

The adjustment of the needle valve is preferably such that the operator may grip the control lever 113 without effort at regulation, the valve opening sufficiently to operate the engine at full speed.

The diaphragm 110 is adapted to provide a fluid-tight connection between the movable needle valve 101 and the supporting body of the valve plug 96, without any possibility of the needle valve binding, and consequently the valve stem 105 follows the connecting rod 148 when control lever 113 is moved to the right. Release of the control lever immediately closes the needle valve and shuts off the supply of fuel to the engine.

The present internal combustion hammer is preferably provided with a source of fuel supply which would not be affected by the position in which the hammer is held. Ordinarily, a fuel tank attached to such a movable internal combustion engine would supply fuel under vastly different conditions, depending upon the amount of fuel in the tank, and whether the tank was held right-side up so that the fuel could run into the supply conduit, and it will be evident that the amount of fuel passing out of the supply conduit would depend not only on the pressure in the tank, but also on the height or depth of the fuel above the carburetor nozzle at any time.

Furthermore, an ordinary tank might not supply any fuel in certain positions, but the present arrangement is peculiarly adapted to provide a constant supply of fuel under all conditions, whether the tank be full or partially empty, and irrespective of the position of the tank.

For this purpose, the tank is preferably provided with a fuel supply conduit 160 which also includes piping connections to the nozzle bore 98, as will be described in detail, but the conduit 160 is provided with means for conducting the fuel to the conduit from all parts of the tank, and for assuring a constant supply of fuel without permitting any air or air bubbles to pass out of the nozzle 97. This means may consist

of a capillary member 161, such as a wicking of cotton threads extending longitudinally within the conduit 160 and substantially filling the same and projecting out of the conduit 160 and hanging downward or at random into the fuel tank 115.

In the embodiment illustrated, a plurality of separate cotton threads or strings are used, arranged substantially parallel to each other or with a slight twist within the conduit 160, but any form of wicking may be employed, provided the wicking substantially fills the conduit 160, so as to exclude air bubbles and prevent the forcing out of any air from the tank 115, even though the conduit 160 may not be immersed in the liquid fuel.

The wicking 161 hangs down into the liquid fuel and by capillary attraction conducts liquid fuel up into the conduit 160, which is at all times substantially full of liquid fuel and the wicking. It is found that the air pressure within the tank 115, combined with such a fuel conducting member, assures a constant supply of liquid fuel under pressure at the carburetor nozzle 97, without any possibility of air bubbles, and the power hammer may thus be made unitary with a built-in fuel tank for assuring constant and efficient operation without the necessity for fuel hose connections.

The ignition system may also be attached to the exterior of the fuel tank 115, or connected by wires extending from the hammer.

In order to support the wicking 161 in tank 115, the tank is preferably provided with a recess 162 above the base plate 117 at one side, the interior wall 123 being cut away for this purpose, and the space above the recess 162 being closed by a metal supporting plate 163 brazed, soldered or otherwise secured to the tank. The supporting plate 163 is provided with a threaded bore 164 and the conduit 160 may consist of an integral metal tubular member formed with a plug head 165 closing one end, and with the opposite end open for receiving the wicking 161.

The threaded portion 166 of conduit 160 is threaded into the supporting plate 163 so that the major portion of the tubular conduit 160 projects into tank 115, and the conduit 160 is provided with a plurality of laterally extending bores 167 at the closed end of the plug for communicating with conduits leading to the nozzle 97. The wicking may be retained in tubular conduit 160 by a pressed metal cap 168 having an inwardly turned edge 169 provided with a plurality of teeth, and the cap 168 may be wedged on the end of tube 160 after the wicking 161 has been passed through the cap 168, the teeth and inwardly turned edge 169 serving to retain the wicking in the conduit 160.

The base plate 117 and attaching flanges 114 of the cylinder, are provided with apertures 170 registering with the recess 162 for receiving the plug 165 and to provide space for pipe connections and gaskets, as follows:

The head 165 is preferably provided with an annular seating surface 171 at its lower side, which is adapted to engage a gasket 172 confined between an annular member 173 and the head 165. A similar gasket 174 is confined between the other end of annular member 173 and the supporting plate 163.

The annular member 173 comprises a metal member having a bore 175 adapted to receive the cylindrical part 176 of the conduit 160 and the annular member 173 is provided with an annular groove 177 which communicates with the interior of conduit 160 through the radial bores 167 at all times. The annular member 173 may be provided with a short section of metal pipe 178 extending into one side of the annular member 173 and soldered or otherwise fixedly secured therein, and the other end of pipe 178 is similarly fixedly secured in a second annular member 179.

The annular member 179 is provided with a similar annular groove 180 communicating with the nozzle bore 98 through radial apertures 181, and gaskets 182 are located at each end of the annular member 179, which may be confined between the end of the cylinder 20 and an annular shoulder 183 carried by the body of nozzle plug 96.

It will thus be observed that the soldered connections which are necessary at the ends of the pipe 178, may be made before the device is assembled, after which the annular members or sealing rings 173, 179 may be put in place and the liquid or fluid-tight seal effected by means of the gaskets 172, 174, 182, by merely screwing into place the nozzle plug 96 and conduit plug 165.

Internal combustion engines of the type described are capable of taking only a limited amount of fuel, and the excessive opening of the throttle or needle valve at the nozzle 97, results in flooding of the engine with liquid fuel, and it is therefore desirable to provide the engine with some means for preventing access of liquid fuel to the cylinder bore 56. Consequently, the engine is preferably provided with a liquid fuel trap 184 which may consist of a conical member 185 of gauze or relatively fine brass screen, which may be supported in the fuel conduit 25 in position for the spray from the nozzle 97 to strike the gauze cone 185.

The gauze cone 185 permits the passage of atomized or vaporized fuel coming out of the nozzle 97, but any liquid fuel or excessive liquid fuel is intercepted by the gauze 185 down which it runs to the walls of the conduit 125. The gauze 185 may be supported in conduit 125 by soldering the gauze to a supporting ring 186, which is frictionally fitted within the bore 25.

The conduit 25 is also preferably provided with a liquid trap comprising a pipe 196, carried by a ring 199, and forming an annular trap 198 for collecting excess liquid fuel from gauze 185.

The formation 22 is preferably provided with longitudinally extending grooves 187 for slidably receiving the inwardly turned flanges 188 carried by a curved sliding closure 189 for closing the observation aperture 190. The closure 189 is provided wtih drain apertures 191 on each side of the gauze cone 185 so that any excess liquid fuel intercepted by the cone and running down to the walls of the bore 25 may be drained out of the apertures 190, 191.

In the modified form of liquid fuel trap shown in Fig. 11, the fuel conduit consists of a pipe 192 within which the nozzle 97 is fixedly supported adjacent a tapered ring 193, forming a Venturi aperture 194. Air intake apertures 195 are located in tube 192 adjacent the Venturi aperture 194 and the gauze cone 185 is fixedly secured in tube 192, in position to be engaged by the jet, by soldering the cone in the tube. The trap is preferably provided at each side of gauze cone 185 with tubular members 196, 197, extend-

ing toward the cone and forming an annular trap 198, 199 at each end for entrapping the excess liquid fuel and preventing it from running into the continuation of the intake conduit or tube 192. Trap pipe 196 is soldered to a supporting ring 199 and trap pipe 197 to a supporting ring 200, the latter being frictionally secured in the tube 192.

The drain apertures 190, 191, located at each end of the trap, are adapted to drain excess liquid fuel out of the annular spaces 198, 199, thereby preventing any accumulation of unvaporized liquid fuel and making it practically impossible to flood the engine by excessive opening of the needle valve.

Cylinder bore 21 is preferably provided with a spring actuated release valve 210, located in a threaded bore at the end of fuel chamber 56, to permit release or regulation of fluid pressure at this point. Valve 210 comprises threaded bolt 211, having conical valve surface 212 engaging conical seat 213, and having longitudinal slot 214. The bolt 211 is provided with an actuating lever 215 fixedly secured thereto and the actuating lever 215 is urged in a clockwise direction by the spring 216 which is coiled about the bolt 211 having one end hooked about lever 215 and the other end hooked in a socket in the wall of the cylinder 20.

In some embodiments of the invention, the fluid pressure may be released through the threads surrounding the bolt 211 when the conical valve surface 212 is screwed out of engagement with the seat 213, but the slot 214 may be provided to insure a wider passage for release or regulation of the pressure in the fuel chamber 56.

One of the purposes of the release valve 210 is to facilitate the prompt starting of the engine under all conditions, such as, for example, the following condition. When the hammer has been standing idle with the tool end downward, the piston 32 would naturally sink to the bottom of the cylinder bore 21 until the piston 32 rests upon the end of the tool shank 38. The gradual leakage of gas past the piston into the combustion chamber, and the force due to the weight of the piston would generally bring the piston to the lower end of the cylinder when the engine is idle.

If, under these conditions, the tool end of the hammer were tilted upward and the piston had passed the ports 58 and 95, the suction generated in the cushion chamber beneath the ports 58 and 95 would be such as to prevent return of the piston, and it would be necessary to wait until there had been sufficient leakage past the piston to permit the piston to move down past the ports 58 and 95 when the tool end of the hammer is held upward. The release valve 210 may be moved in a counter-clockwise direction by the finger of the operator when the tool end of the hammer is tilted upward, thereby immediately releasing the piston and permitting it to drop more quickly toward the compression end of the cylinder. The suction effect previously described would be eliminated by the air passing through the ports of valve 210, and the immediate movement of the piston in the starting operation would be assured under all conditions.

The valve 210 also performs another very important function in the fact that this valve permits the regulation of pressure in the fuel chamber below the ports 58 and 95 and the operator may readily release the pressure of fuel and other gas entrapped below the piston, to such an extent that the piston is not returned so quickly as it otherwise would, and the speed of operation of the engine may be effectively regulated by means of the valve 210 which regulates the pressure of the piston returning gases. The force of return of the piston also determines in some measure the amount of compression and the rate of speed of movement of the piston, and also the force of impact on the return movement and the release of a certain amount of pressure in the fuel pressure chamber 56 permits the piston to come into contact with the tool shank 38 at points where the piston might not otherwise engage the tool shank.

The valve 62 opens about the time that the piston 32 passes the exhaust ports 54 and the new charge of fuel from the lower end of the cylinder passes into the upper end of the cylinder, driving the exhaust gases out of the exhaust ports 54 and tending to scavenge the combustion chamber.

The operation of the present invention is as follows:

The cycle of the engine is substantially the same as that disclosed in my prior application, and the engine may be started by tilting the tool end of the hammer upward and downward so that the piston 32 slides back and forth in the cylinder 20 due to gravity.

When the piston is in the position of Fig. 3 and moving toward the right, it is compressing a supply of fuel in the combustion chamber 57, the return of the fuel through the fuel transfer conduit 24 being prevented by seating of the valve 62. The fuel intake chamber 56 is then filled with a new supply of fuel gas which has been drawn in from the conduit 25 by the movement of the piston 32 to the right, the suction opening the intake valve 90, permitting fuel gas and air to pass into the cylinder from conduit 25 and air ports 30. When the piston has reached the limit of its travel to the right, and the charge in combustion chamber 57 has reached a predetermined compression, the pressure of the gases will actuate the pressure responsive ignition switch 83, 87 by virtue of the pressure on the disc 78, which moves pin 82 to the right against tension of spring contact 83 and closes contacts 83, 87. This closes the primary circuit of the ignition coil and causes a surge of high tension current in the spark plug circuit and a spark across the electrodes of the spark plug 71, igniting the charge in combustion chamber 57 and driving the piston 32 to the left from the position of Fig. 3. The piston 32 passing to the left under the expansive force of the exploded charge, places the fuel in the fuel chamber 56 under some compression, closing the intake valve 90 and causing an impulse of fuel to pass along the fuel transfer conduit 24 to open the valve 62.

After the piston passes the intake port 95 and fuel transfer port 58, fuel gas is entrapped in the bore 21 below the piston 32 and compressed by the piston 32 to such an extent that the piston is stopped in its movement and given a backward impulse toward the position of Fig. 3, during which movement the exhaust ports 54 are closed and the charge in combustion chamber 57 is again compressed to the predetermined point at which ignition occurs due to the pressure responsive ignition switch.

The piston 32 thus reciprocates back and forth under the impulses caused by the explosion of fuel, but unless the tool shank is projected farther into the cylindrical bore 21, no impact re-

sults, and consequently it is possible to regulate the force of impact by the projection of the tool shank 38 into the cylinder bore 21 when the tool shank 38 is projected into the cylinder bore 21 by the engagement of the tool 40 with the work, the air cushion space is diminished somewhat by the presence of the shank in the cylinder bore, and the piston also returned by the rebound from impact with the shank 38, but the shank 38 being smaller than the bore 21, there is still space for an air cushion about the shank 38 at all times for assisting in the return of the piston 32.

The pressure release valve 210 permits the immediate release of suction generated when the tool is inverted to cause the piston to drop down and start the engine and the valve 210 is also adapted to permit the regulation of the speed of the engine and force of impact at any time. For instance, the valve 210 might be opened slightly in the beginning of a riveting operation to reduce the force of impact at that time, but after the end of the rivet is properly upset, the valve 210 may be closed and the rivet head subjected to the full force of impact of the hammer at full speed.

The fuel tank 115 is maintained under constant pressure by the increments of the fluid under pressure transmitted from the fuel conduit 24 through the pipe 128 and one-way valve 142, so that the fuel in the tank 115 is under a constant pressure after the engine has been started. The mere shaking of the hammer in the starting operation, or the shaking of the tank end of the hammer, is sufficient to generate a small amount of pressure in the tank, sufficient to start the jet on opening of the throttle, after which the operation of the hammer quickly builds up the pressure to the most desirable point.

The combined effect of the wicking and source of fuel under pressure is adapted to permit effective operation of the built-in tank, even though the tank may be only partially filled or upside down, because the wicking conveys the fluid to the closed pressure conduit 160, after which the fluid pressure in the tank forces a constant supply of liquid through the subsequent piping to the nozzle 97, and it is found that although the supply conduit 160 is not immersed in any liquid there is no tendency for air to pass out through the nozzle and a constant supply of liquid under pressure is assured by the present arrangement.

The liquid fuel trap arrangement also prevents the flooding of the engine by excessive opening of the throttle and makes the power hammer practically "foolproof" insofar as the flooding of the engine is concerned. The amount of opening of the throttle may also be regulated by the adjustable stop 106 which engages diaphragm 110 and definitely limits its movement, but the hammer is also preferably provided with some form of liquid fuel trap in connection with the simple jet type of carburetor, although the fuel trap may be eliminated with other types of more complicated carburetors which do not present the possibility of flooding.

The wicking 161 also serves as a filter for entrapping sediment and impurities in the fuel and protecting the needle valve from clogging. This fact is evident from the amount of sediment, dirt and foreign material accumulated by the wicking after the engine has been in operation for a certain period of time, and the wicking is preferably renewed from time to time in order to maintain its efficiency as a filter.

It will thus be observed that I have invented an improved internal combustion hammer which is more economical to manufacture and assemble, and which includes an improved arrangement of parts, fuel pipe connections and a built-in tank capable of supplying a constant supply of fuel at all times.

The provision of the built-in tank makes the hammer a unitary article which does not require hose connections for the supply of fuel, and the specific arrangement of the carburetor and tank assures a constant supply of fuel without regard to the position of the tank or the amount of liquid in the tank.

The present fuel supply arrangement is also substantially "foolproof" insofar as flooding is concerned, which is an important feature in view of the fact that such power hammers may be used by unskilled laborers, who do not understand the possibility of flooding an internal combustion engine.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim is new and desire to secure by Letters Patent of the United States, is:

1. A carburetor comprising a body having a threaded bore with an air inlet, a valve body having complementary threaded formations and a nozzle projecting into said bore, an annular shoulder on said valve body, and an annulus having a seating surface at each side for sealing engagement with said annular shoulder and said first-mentioned body, said annulus having an annular inner chamber and said nozzle having a conduit communicating with said chamber.

2. A carburetor for portable internal combustion engines comprising a tank carried by the piston head and having a handle formation, a nozzle carried by the piston head and extending into a tubular member, a conduit communicating between said nozzle and said tank and comprising a tubular member, said tubular member being completely filled with wicking to exclude air therefrom and said wicking extending into the remotest parts of said tank to conduct fuel to said tubular member, and a source of pressure for said tank whereby said nozzle is assured of a constant supply of liquid fuel.

3. A carburetor for portable internal combustion engines comprising a tank carried by the piston head and having a handle formation, a nozzle carried by the piston head and extending into a tubular member, a conduit communicating between said nozzle and said tank and comprising a tubular member, said tubular member being completely filled with wicking to exclude air therefrom and said wicking extending into the remotest parts of said tank to conduct fuel to said tubular member, a source of pressure for said tank whereby said nozzle is assured of a constant supply of liquid fuel, a tubular enclosure surrounding the discharge end of said nozzle, said enclosure having air intake ports adjacent said nozzle, and a conical gauze having its point extending toward said nozzle for passing atomized fuel and intercepting liquid fuel.

4. A carburetor for portable internal combustion engines comprising a tank carried by the piston head and having a handle formation, a nozzle carried by the piston head and extending into a tubular member, a conduit communicating

between said nozzle and said tank and comprising a tubular member, said tubular member being completely filled with wicking to exclude air therefrom and said wicking extending into the remotest parts of said tank to conduct fuel to said tubular member, a source of pressure for said tank whereby said nozzle is assured of a constant supply of liquid fuel, a tubular enclosure surrounding the discharge end of said nozzle, said enclosure having air intake ports adjacent said nozzle, and a conical gauze having its point extending toward said nozzle for passing atomized fuel and intercepting liquid fuel, said enclosure having a collar at the base of said gauze forming an annular space between said collar and enclosure for receiving liquid fuel to prevent liquid fuel from passing into the internal combustion engine.

5. A carburetor for portable internal combustion engines comprising a tank carried by the piston head and having a handle formation, a nozzle carried by the piston head and extending into a tubular member, a conduit communicating between said nozzle and said tank and comprising a tubular member, said tubular member being completely filled with wicking to exclude air therefrom and said wicking extending into the remotest parts of said tank to conduct fuel to said tubular member, a source of pressure for said tank whereby said nozzle is assured of a constant supply of liquid fuel, a tubular enclosure surrounding the discharge end of said nozzle, said enclosure having air intake ports adjacent said nozzle, and a conical gauze having its point extending toward said nozzle for passing atomized fuel and intercepting liquid fuel, said enclosure having a collar at the base of said gauze forming an annular space between said collar and enclosure for receiving liquid fuel to prevent liquid fuel from passing into the internal combustion engine, and means for continuously draining liquid fuel from said annular space to prevent accumulation thereof.

6. A carburetor for portable internal combustion engines comprising a tank carried by the piston head and having a handle formation, a nozzle carried by the piston head and extending into a tubular member, a conduit communicating between said nozzle and said tank and comprising a tubular member, said tubular member being completely filled with wicking to exclude air therefrom and said wicking extending into the remotest parts of said tank to conduct fuel to said tubular member, and a source of pressure for said tank whereby said nozzle is assured of a constant supply of liquid fuel, a needle valve adapted to close the rear end of said nozzle, a diaphragm supporting said needle valve, a plunger operatively connected with said diaphragm, a finger lever carried by said handle and operative mechanical connections between said lever and plunger to effect a control of said needle valve.

7. In a carburetor for internal combustion engines, the combination of a closed tank with a source of fluid pressure for maintaining a predetermined pressure in said tank, an atomizing nozzle connected with said tank through a conduit, said conduit including a tubular member, and capillary means completely filling said tubular member and extending into the remotest parts of said tank for excluding air from said tubular member and assuring a constant supply of liquid fuel to said tubular member, the pressure in said tank being adapted to force the liquid fuel out of said nozzle and to atomize the fuel.

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