June 8, 1965 W. S. FIEDLER ETAL 3,187,735

INTERNAL COMBUSTION ENGINE STARTING DEVICE AND METHOD

Original Filed Aug. 7, 1961 8 Sheets-Sheet 1

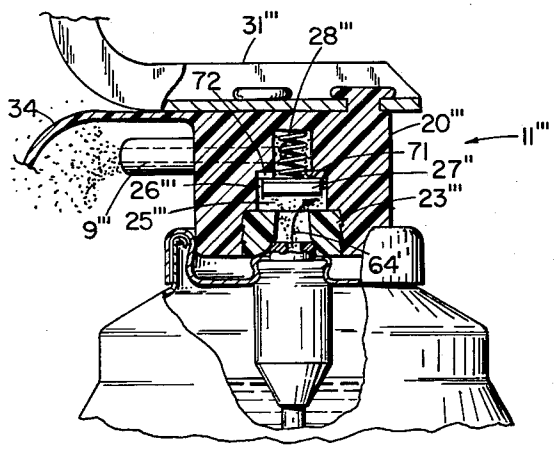


FIG. 12

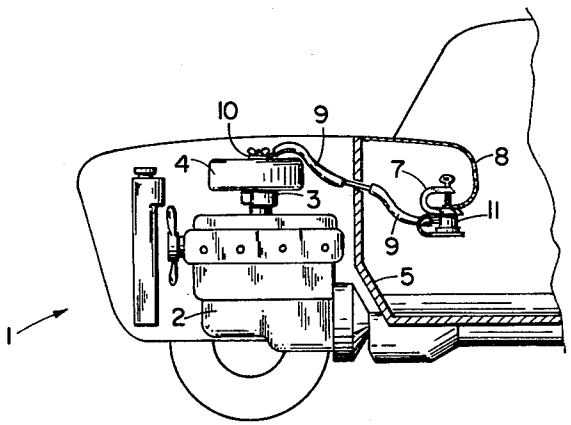


FIG. 1

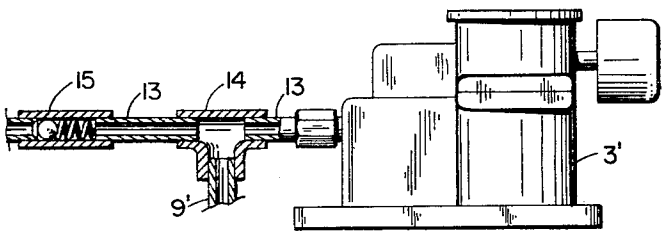


FIG. 2

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INTERNAL COMBUSTION ENGINE STARTING DEVICE AND METHOD

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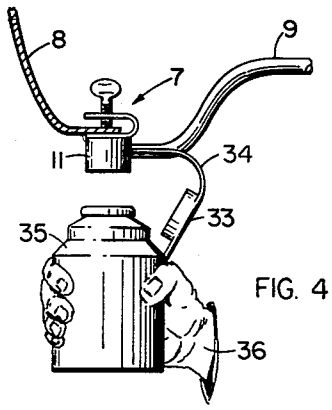


FIG. 4

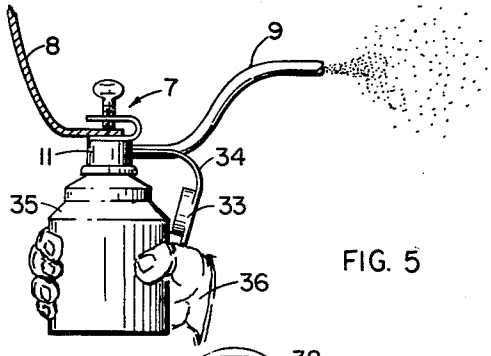


FIG. 5

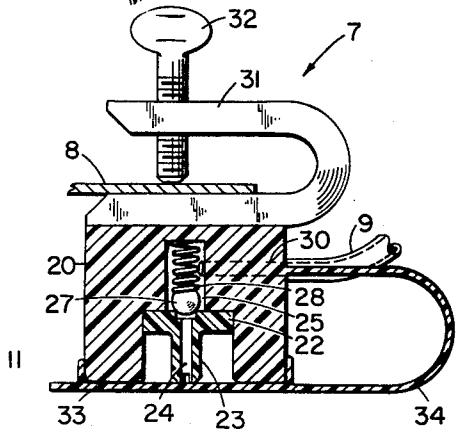


FIG. 3

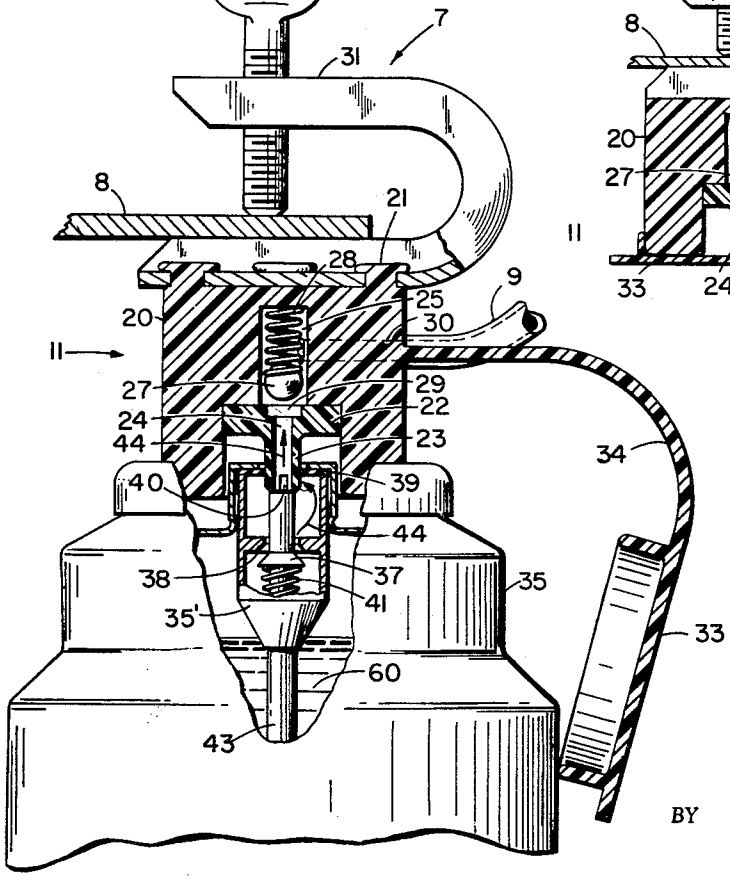


FIG. 6

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INTERNAL COMBUSTION ENGINE STARTING DEVICE AND METHOD

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FIG. 7

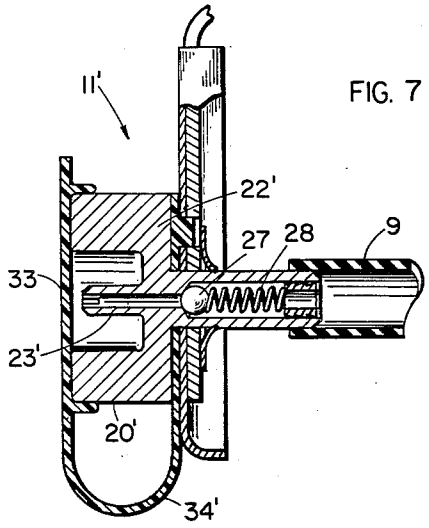


FIG. 8

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INTERNAL COMBUSTION ENGINE STARTING DEVICE AND METHOD

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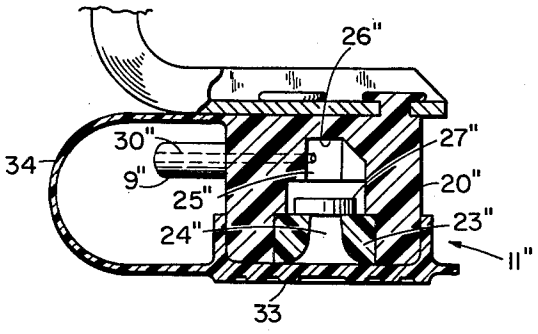


FIG. 9

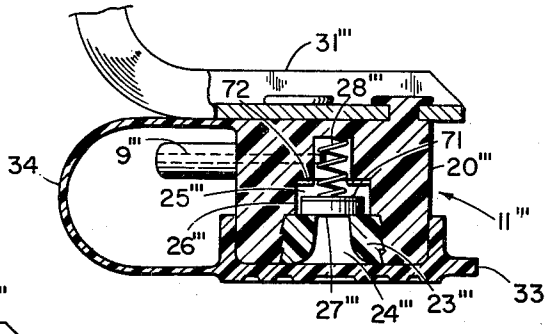


FIG. 11

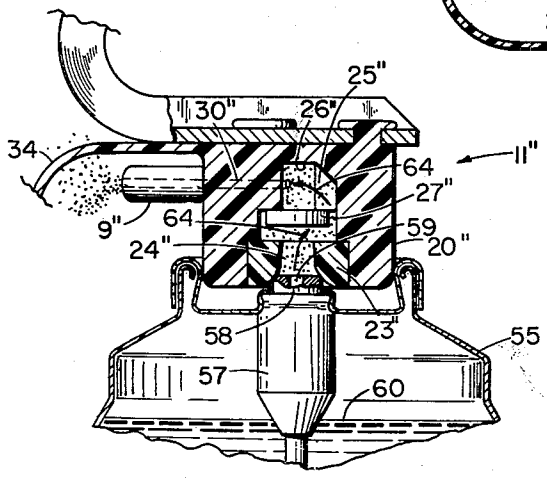


FIG. 10

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INTERNAL COMBUSTION ENGINE STARTING DEVICE AND METHOD

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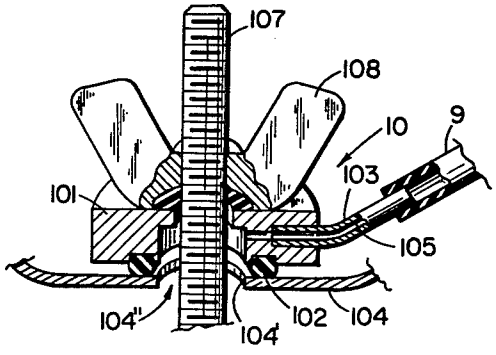


FIG. 13

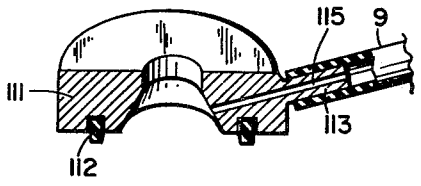


FIG. 14

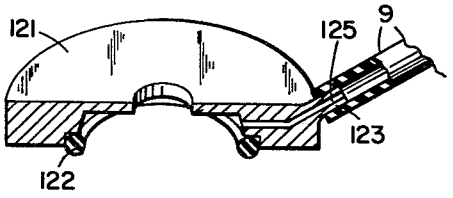


FIG. 15

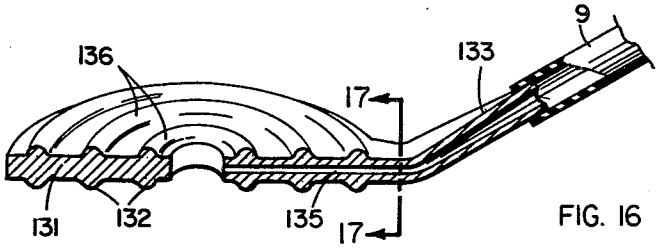


FIG. 16

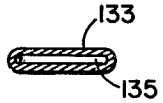


FIG. 17

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INTERNAL COMBUSTION ENGINE STARTING DEVICE AND METHOD

Original Filed Aug. 7, 1961 8 Sheets-Sheet 6

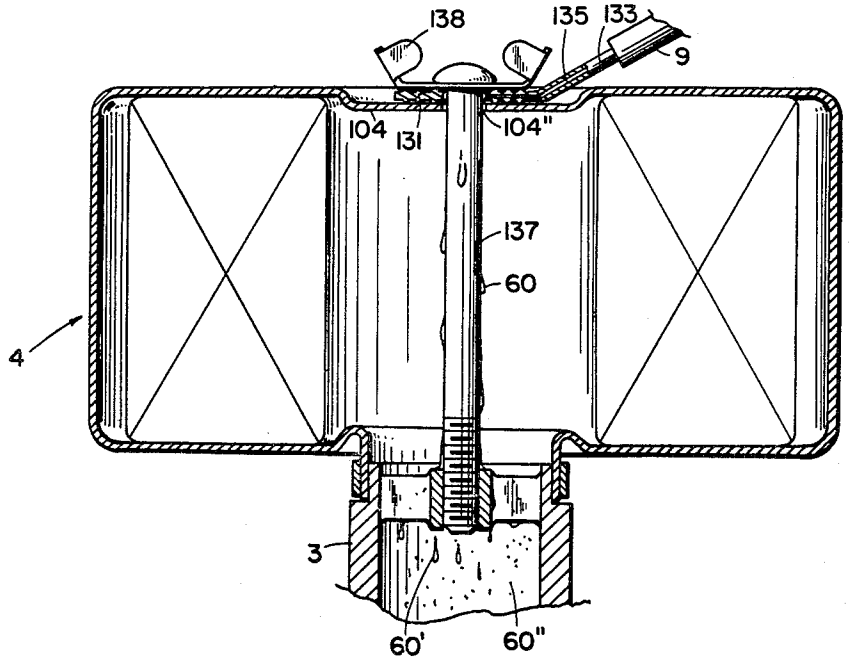


FIG. 18

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INTERNAL COMBUSTION ENGINE STARTING DEVICE AND METHOD

Original Filed Aug. 7, 1961 8 Sheets-Sheet 7

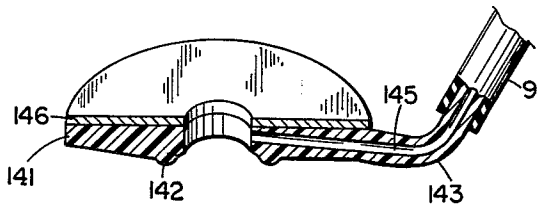


FIG. 19

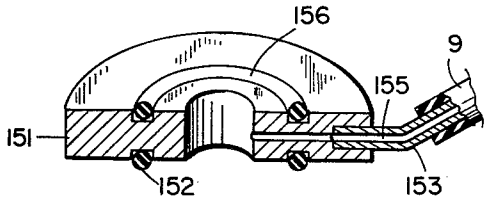


FIG. 20

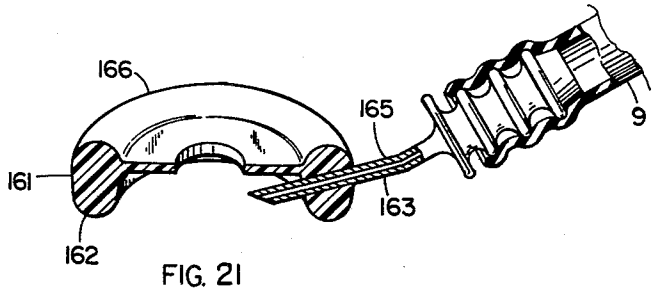


FIG. 21

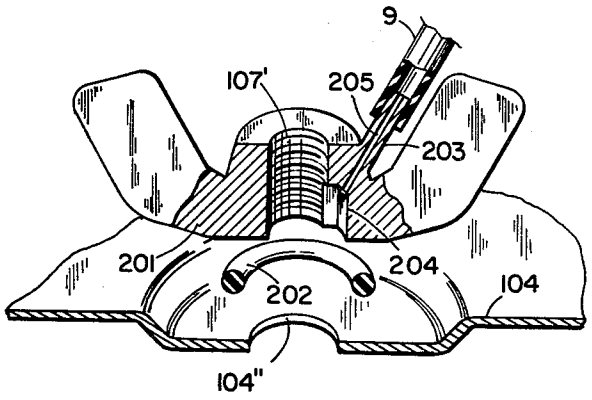
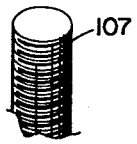


FIG. 22



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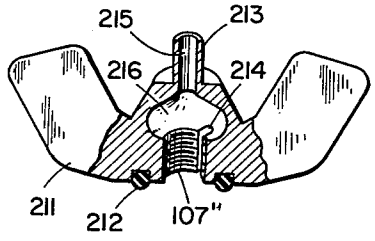


FIG. 23

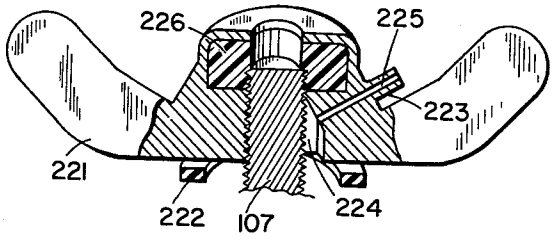


FIG. 24

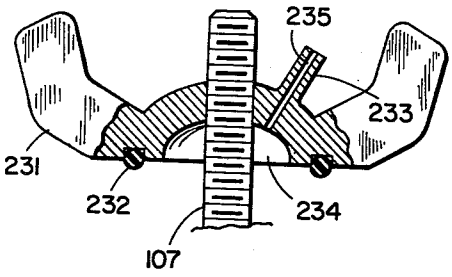


FIG. 25

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United States Patent Office

3,187,735
Patented June 8, 1965

3,187,735

INTERNAL COMBUSTION ENGINE STARTING DEVICE AND METHOD

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Continuation of application Ser. No. 130,234, Aug. 7, 1961. This application Nov. 6, 1963, Ser. No. 332,322
10 Claims. (Cl. 123—187.5)

This invention relates to a device and a method for assisting in starting an internal combustion engine, which may be either a diesel engine or an engine supplied with fuel-air mixture through a carburetor, and more particularly to such a device and method wherein a relatively volatile fluid of low flash point, such as de-ethyl ether, or propane, is introduced into the cylinders of the engine while it is cranked and while normal fuel-air mixture is also supplied to the engine.

This application is a continuation of application Serial No. 130,234, filed August 7, 1961, now abandoned, having the same title.

Such devices have been heretofore proposed which utilize for this purpose a variety of relatively high volatile fluids having a low flash point, and various devices and methods have been proposed for using such fluids to assist in starting internal combustion engines.

The devices heretofore proposed are relatively unduly complex in construction and operation, are relatively difficult to install and to use, and are relatively uneconomical.

In accordance with the invention, means are provided to introduce combustible fluid of relatively high volatility and low flash point into one of the passages through which one of the reactants (that is, fuel or air) enters an internal combustion engine. Such passages include the fuel line leading to the carburetor, the carburetor barrel, the intake manifold, and the interior of the air cleaner. A receiving member or receiver is provided to receive a pressurized valved receptacle containing such fluid. In a truck or car the receiver is preferably attached to the dashboard. Such receptacles are provided with valves of various sorts. The receiver is provided with an orifice member which opens the valve in the receptacle and provides a sealed duct leading from the interior of the receptacle to the interior of the receiver when the receptacle is pushed by hand against the receiver in properly engaged relation therewith. Tube means leads from the receiver to the means provided in one said reactant passages to introduce the combustible fluid into the passage.

It is therefore an object of this invention to provide a device which is relatively simply constructed and which may be installed and used with great ease to facilitate starting an internal combustion engine.

It is another object to provide such a device which comprises a minimum of parts, especially a minimum of valves.

Other objects will become apparent from the drawings and from the following detailed description in which it is intended to illustrate the applicability of the invention without thereby limiting its scope to less than that of all equivalents which will be apparent to one skilled in the art. In the drawings like reference numerals refer to like parts and:

FIGURE 1 is a cross-sectional schematic view of a portion of an automobile provided with an internal combustion engine having the device of the invention applied thereto;

FIGURE 2 is a partially cross-sectional schematic view of a modification of the embodiment of FIGURE 1;

FIGURE 3 is a partially cross-sectional elevation of a portion of the device of FIGURE 1;

FIGURE 4 is an elevation of the embodiment of FIGURE 3, with the receptacle nearby, just prior to operation of the device;

FIGURE 5 is a view corresponding to that of FIGURE 4 with the device in operation;

FIGURE 6 is a partially cross-sectional partially cut-away view of the embodiment of FIGURE 5;

FIGURE 7 is a cross-sectional view of a modification of the embodiment of FIGURE 3;

FIGURE 8 is a cross-sectional partially cut-away elevation of the embodiment of FIGURE 7, together with a receptacle, during operation;

FIGURE 9 is a cross-sectional partially cut-away elevation of another modification of the device of FIGURE 3;

FIGURE 10 is a cross-sectional partially cut-away elevation of the embodiment of FIGURE 9 in conjunction with a receptacle, during operation;

FIGURE 11 is a cross-sectional partially cut-away elevation of a modification of the embodiment of FIGURE 9;

FIGURE 12 is a cross-sectional partially cut-away elevation of the embodiment of FIGURE 11 in conjunction with a receptacle, during operation;

FIGURE 13 is a cross-sectional perspective view of member 10 shown in FIGURE 1;

FIGURE 14 is a cross-sectional perspective view of a modification of the embodiment of FIGURE 13;

FIGURE 15 is a cross-sectional perspective view of a modification of the embodiment of FIGURE 13;

FIGURE 16 is a cross-sectional perspective view of another modification of the embodiment of FIGURE 13;

FIGURE 17 is a cross-sectional view taken on lines 17—17 in FIGURE 16;

FIGURE 18 is a cross-sectional view showing application of the embodiment of FIGURE 16 to an air cleaner;

FIGURE 19 is a cross-sectional perspective view of another modification of member 10;

FIGURE 20 is a cross-sectional perspective view of another modification of the embodiment of FIGURE 13;

FIGURE 21 is a cross-sectional perspective view of still another modification of the embodiment of FIGURE 13;

FIGURE 22 is a cross-sectional perspective "blown-apart" view of an embodiment which may be utilized in place of member 10;

FIGURE 23 is a cross-sectional perspective view of a modification of the embodiment of FIGURE 22;

FIGURE 24 is a cross-sectional perspective view of a modification of the embodiment of FIGURE 22;

FIGURE 25 is a cross-sectional view of another modification of the embodiment of FIGURE 22.

In FIGURE 1 there is shown an automobile indicated generally as 1, having internal combustion engine 2 therein. The invention is equally applicable to such engines which are not in vehicles or are in other vehicles such as boats, aircraft or the like. The engine is fitted with a conventional downdraft carburetor 3 and an air cleaner 4; receiver 11 comprises clamp 7 which may attach the receiver to dashboard 8 of vehicle 1; tube 9 may lead from receiver 11 through firewall 5 to annular member 10 affixed to the top of the air cleaner. Engine 2 may be a diesel engine, an engine supplied with fuel-air mixture through a carburetor, a spark-ignition engine, or any other internal combustion engine.

As shown in FIGURE 2, in accordance with another embodiment of the device of the invention, carburetor 3' (which may supply fuel-air mixture, i.e., reactants, to engine 2) is provided with fuel line 13 leading thereinto. Tube 9' leads from receiver 11 to T 14 in line 13. Check valve 15 is provided in line 13 upstream of T 14 to prevent

flow of fluid in line 13 from the carburetor; that is, to prevent flow in a direction reverse to the normal direction of flow in the line.

Referring now to FIGURES 3, 4, 5 and 6, there is shown receiving member 11 which, as shown, may be made of a suitable plastic such as low-density polyethylene, high-density or linear polyethylene, nylon, polypropylene, polycarbonate, or a copolymer of ethylene with any one of several other materials. Receiving member 11 may comprise body 20, and if made of such material, may be fastened to clamp 7 by any suitable means. If body 20 is made of a suitable plastic, it may be fastened to clamp 7 by hot or cold upsetting of portions 21 which may project from body 20. Receiving member 11 also comprises orifice member 22, which is provided with extending cylindrical portion 23. Portion 23 is hollow inside—that is, it is tubular in form, to provide duct or orifice 24 therewithin, which communicates with a space 25 within body 20, said space being defined by interior wall 26 of body 20. If members 20 and 22 are metal, 22 may be retained in 20 by sweating or soldering or with adhesive. If either member 20 or 22 is of plastic, member 22 is preferably retained in member 20 by use of an interference fit so that placing the two members into the position shown in the figures results in sufficient deformation of each of the members, so that they cannot be taken apart, except with great difficulty. There is preferably provided within space 25 a check valve which may comprise ball 27 biased by coil spring 28 against seat 29 provided in member 22. A passage 30 is provided within body 20, extending from space 25 through inner wall 26 and through the outer wall of body 20 to communicate with the interior of tube 9, so that fluid entering space 25 through duct 24 may leave through passage 30 and thence by conveyed to the engine through tube 9. The clamp indicated generally as 7, may comprise frame member 31 and thumbscrew 32, which may be operated to attach receiver 11 to dashboard 8. Receiver 11 may be provided with cap 33, which may be a very light press fit with the lower portion of body 20 so that, as shown in FIGURE 3, the cap may be engaged with body 20 frictionally and may be then removed from body 20 to the positions shown in FIGURES 4, 5 and 6, by simply pulling downward on the cap. Cap 33 is preferably attached to body 20 by integral resilient member 34, which acts as a hingeable connection to permit installation and withdrawal of the cap with a maximum of ease. Both low-density polyethylene and linear polyethylene have been found suitable as materials of which body 20, member 22 and cap 33 may be made as a single integral unit.

Pressurized valved receptacle 35 may be held in operator's hand 36 and forced upwardly into engagement with receiver 11, as shown in FIGURES 4 and 5, so that receiver 11 and receptacle 35 are engaged as shown in FIGURE 6. After receptacle 35 is engaged with receiver 11 as shown in FIGURES 5 and 6, it may be removed, by pulling downward with hand 36. Such engagement and removal by translatory motion of receptacle 35, as indicated in FIGURES 4 and 5 may be repeated as many times as necessary or desired, effectively until receptacle 35 is empty. As will be described hereinafter, such translatory motion is preferably substantially on the axis of orifice 24.

Receptacle 35 may contain as fluid 60, one or more fluids which are useful in assisting in starting an internal combustion engine. Such fluids include di-ethyl ether, propane, butane, ethylene oxide, and mixtures of two or more of these materials. Such fluid is maintained under pressure by one of these fluids or another fluid; thus any fluid described as useful for this purpose heretofore may be utilized. The receptacle may contain only butane, most of which is in liquid form, some being in gaseous form and providing pressure. A mixture of butane and di-ethyl ether, or of several hydrocarbons having a low molecular weight and mixed with or without di-ethyl ether

or ethylene oxide may be utilized. Such fluids may also be pressurized with non-combustible or less-combustible gases such as CO_2, nitrous oxide, or halogenated hydrocarbons of low molecular weight. Receptacle 35 contains valve member 37 which seats on seat 38; it also comprises sealing washer 39 of elastomeric material. Cylindrical member 23 is provided with one or more notched passageways 40. When receptacle 35 and receiver 11 are engaged as in FIGURES 5 and 6, the interior edge of sealing member 39, which provides a dispensing orifice for receptacle 35, is in sealing engagement with the outer surface of cylindrical member 23 to prevent passage of fluid therebetween, and the end of member 23 presses downward on valve 37, which is biased upwardly by spring 41, so that valve 37 is forced off of seat 38 and fluid may pass upward from dip tube 43 into space 25 as shown by arrows 44.

It may be seen that when receptacle 35 and receiver 11 are engaged as in FIGURES 5 and 6, orifice 24 and the orifice provided by sealing member 39 are in sealed engagement, so that fluid passes upward through the outlet duct provided in receptacle 35 around spring 41 and between valve 37 and seat 38 and along the upper stem of valve 37, thence through passage 40 and duct 24 into space 25, as shown by arrows 44, and cannot pass outward or escape from the device since the orifice members are in sealed engagement; that is, orifice member 22 is in sealed engagement with the dispensing orifice of receptacle 35 provided by member 39.

As shown in FIGURES 7 and 8, a modification of receiver 11 may be provided wherein body 20' is provided with orifice member 22' as an integral portion thereof, so that cylindrical extending portion 23' is integral with body 20'. Clamp member 31' of clamp 7' may be differently configured so that when clamped to dashboard 8', member 23' extends somewhat upwardly against receiver 11' in order to bring it into the position of engagement therewith shown in FIGURE 8.

Clamp 7' may be provided with decorative plate or bezel 46, and cap 33 may be provided with a hingeable, flexible, resilient connecting member 34' to attach it to receiver 11; member 34' being not integral with body 20'. Member 34' may be prevented from rotating about the axis of duct 24 by projecting portion 47 which may extend upwardly into a hole in frame member 31' provided for this purpose. Body 11', member 34', and bezel 46 may be attached to member 31' by the engagement of suitable sharp-edged surfaces of member 48, with the outer surface of a portion of body 11' which extends through holes in members 34', 46 and 31', as shown. Member 48 is provided with sharp-edged metal members which bite into the outer surface of the extending portion of body 11'. Member 49 may be driven into the projecting portion of body 11' to bitingly engage therewith and retain in place coil spring 28 and ball 27 which may seat on seat 29'. Space 25' is defined by inner walls 26' of body 11', and passage 30' extends therefrom through member 49 to communicate with tube 9. Cap 33 may be frictionally engaged with body 11 as shown in FIGURE 7 or disengaged as shown in FIGURE 8. Receptacle 35 may be forced toward and against receiver 11' to move the receptacle with translatory motion on the axes of orifice 24 and the orifice provided by member 39 to sealingly engage the latter orifice with orifice member 23' and to open outlet valve 37 so that fluid 60 contained under pressure in receptacle 35 flows through the outlet duct of receptacle 35, thence through the inlet duct receiver 11' into space 25', lifting check valve ball 27 off its seat 29', thence through passage 30 into tube 9 and thence to the engine, all as described in connection with the embodiment of FIGURE 6.

Referring now to FIGURES 9 and 10, there is shown another embodiment wherein receiver 11'' comprises body 20'', orifice member 23'', and member 27'', which acts as a check valve to prevent reverse flow. Member 23'' provides orifice or duct 24'' leading into the space 25''

defined by inner wall 26'' of body 20''. Member 23'' may be attached to member 20'' in any suitable manner, such as by use of an interference fit or by adhesive. Passage 30'' leads out of space 25'' through inner wall 26'', thence through the outer wall of body 20'' and through tube 9'', which may serve as means for connecting receiver 11'' to tube 9. Cap 33'' may be attached to body 20'' by member 34'' in the same manner as cap 33 is affixed to body 20 by member 34 or in any other suitable manner, and during operation of the device may be removed and easily pushed to one side as shown in FIGURE 5. Pressurized receptacle 55, which may contain fluid 60, of the type described above, may contain outlet valve 57 having a member 58 provided with outlet duct 59, which may also constitute a dispensing orifice, valve 57 being so constructed that when tube 58 is pressed downwardly into outlet valve 57, fluid from the interior of receptacle 55 is dispensed outwardly through orifice duct 59.

In operation, receptacle 55 is forced, by an operator's hand, upwardly toward receiver 11'', so that the upper outer peripheral edge of member 58 is engaged with the interior surface of member 23'', that is orifice duct 24'', which is an inner tubular surface which converges inwardly toward receiver 11'. Thereby, as shown in FIGURE 10, fluid 60 travels upward as shown by arrows 64 through orifice duct 59 and orifice duct 24'', past the point where these two orifice ducts are sealed together at the outer upper peripheral edge of tubular member 58 and the surface of duct 24'' (forcing member 27'' off of its seat), around one edge of member 27'' and through the cut-away portion provided in space 25'' as shown and thence outward through duct 30''.

Member 27'' is preferably a soft elastomeric disk of any suitable material, such as a sulphur-containing rubber material sold under the trade name Thiokol and may be disposed to seat against the rear surface of member 23'' to close orifice duct 24'' if pressure is exerted against the rear side thereof by gas flow from duct 30'' through space 25'' toward duct 24''.

In the modification of the embodiment of FIGURES 9 and 10 shown in FIGURES 11 and 12, orifice member 23''' is attached to body 20''' to provide receiver 11''' having space 25''' therewithin defined by inner wall 26'''. Space 26''' may contain check valve means to prevent reverse flow which may consist of a soft elastomeric washer member 27'' which, as shown, may be identical with the corresponding member in the embodiment of FIGURES 9 and 10, or, as not shown for simplicity, may be varied in dimensions, resiliency, material, softness, or the like. Member 27'' is preferably provided with a back-up member 71, which may be a disk of metal or like rigid material to prevent excessive deformation of member 27'', and members 71 and 27'' may be biased downwardly by any suitable resilient means, such as coil spring 28'''. Interior wall 26''' is provided with a plurality of downwardly projecting members 72 in the rear of member 71 to prevent member 71 from seating against the portion of wall 26''' which is above it and thereby to allow for flow of fluid upwardly around members 27'' and 71 when they are forced into the position shown in FIGURE 12 by reason of flow of fluid through the device as shown therein by arrow 64'.

In operation, the device is utilized as shown in FIGURE 12 to operate in the same manner as described in connection with FIGURE 10.

Introduction into engine

The fluid flowing from receiver 11, 11', 11'' or 11''' toward engine 2 through tube 9 may be introduced into the engine by providing tube 9' in place of tube 9 and thereby introducing the fluid into gas line 13 as described hereinabove in connection with FIGURE 2.

Otherwise, it may be introduced into the engine from tube 9, as shown in FIGURE 1, through member 10 or modifications thereof as described hereinafter.

Referring now to FIGURES 13, 1 and 18, annular device 10 may be applied to the top 104 of air cleaner 4, as shown for member 10 in FIGURES 1 and 13 and member 131 in FIGURE 18.

Member 10 may comprise annular washer-like body 101 and gasket 102 and tube 103. It may surround threaded rod 107 which extends upwardly through top 104 of air cleaner 4 and be held in place by wing-nut 108 threaded on rod 107, which attaches the air cleaner to carburetor 3 as indicated in FIGURE 18. Passage 105 is provided in body 101 and the interior of tube 103 to provide for fluid flow from tube 9 to the interior of body 101, where the fluid may contact the surface of rod 107 and flow downwardly through space 104'' provided between the outer surface of rod 107 and the inner edge 104' of the hole in top 104 through which rod 107 extends.

The annular member shown in FIGURE 14 may be utilized in place of and in the same member as member 10. It may comprise body 111, gasket 112, and extending portion 113 of body 111 with duct 115 extending from the interior of body 111 through part 113 to communicate with tube 9.

Another annular member which may be used in place of and in the same manner as member 10 is shown in FIGURE 15; it may comprise body 121, sealing gasket 122, extending portion 123 of body 121, and passage 125 extending through body 121 from the interior thereof and thence through extending portion 123 to communicate with tube 9.

In the devices of FIGURES 13, 14 and 15, the upper surface of each of bodies 101, 111, and 121 respectively seats against the lower surface of nut 108 with sufficient tightness to prevent escape of fluid therethrough, and the engagement of the threads of nut 108 with the threads of rod 107 is sufficiently tight to prevent escape of fluid therethrough. Thus, fluid reaching the interior of bodies 101, 111 and 121 can flow substantially only downward through space 104'', because each of sealing members 102, 112 or 122 seals the space between the bottom of body 101, 111 and 121 respectively and top 104.

As shown in FIGURES 16, 17 and 18, member 131, having extending portion 133, may be used in place of and in the same manner as member 10. Body 131 is provided with passage 135 extending from the interior thereof outwardly through extending portion 133 to provide communication between the interior thereof and tube 9 and is provided with downwardly extending ribs 132 and upwardly extending ribs 136 to provide a seal respectively with top 104 and member 138 as shown in FIGURE 18.

Further, as shown in FIGURE 18, rod 137 may be utilized in place of rod 107, and member 138 may be a nut corresponding to 108 threaded onto threads at the top of rod 137 or may, as shown in FIGURE 18, comprise a head securely attached by any suitable means, such as welding, to 137, which may thus constitute a stud or bolt which threadedly attaches air cleaner 4 to downdraft carburetor 3.

In some land vehicles, air cleaners are provided in which the filtering or cleaning element is alongside or below the carburetor and at one side of the carburetor and an air duct extends from above the air cleaner to above the carburetor, where it is attached to the top of the carburetor in the same manner as shown for an entire air cleaner in FIGURES 1, 13 or 18, that is, by a threaded rod extending upward from the carburetor through a top portion of the duct portion of the air cleaner. The invention is equally suitable for application to an engine having an air cleaner and downdraft carburetor arranged in such manner.

Referring again to FIGURE 18, fluid passing from tube 9 through passage 135 may pass downward through space 104'' and then if in the form of liquid 60, may run down the sides of rod 137 and thence drip into the

carburetor barrel as shown at 60' or, if a gas, may pass downward through space 104'', thence be mixed with air in the air cleaner, and thence pass into the carburetor barrel as shown at 60'. Also, liquid 60 may evaporate from the side of rod 137 to provide gaseous fluid 60''.

In FIGURE 19 there is shown another device which may be used in place of and in the same manner as member 10, wherein body 141 is provided with sealing projection or rib 142, extending portion 143 adapted to receive tube 9, passage 145 extending from the interior of body 141 through portion 143 to communicate with the interior of tube 9, and back-up member 146 which may have the form of a metal washer. The upper surface of member 146 may be in sealing engagement with a nut such as 108 and portion 142 is preferably adapted to seal with the upper surface of air cleaner top 104.

As shown in FIGURE 20, a device which may be utilized in place of and in the same manner as member 10 may comprise body 151, tube 153, lower sealing member 152 to seal with top 104, and upper sealing member 156, which may have the form of an elastomeric O-ring and seal with the lower surface of nut 108. Tube 153 may extend outwardly to receive tube 9 and passage or duct 155 may extend outwardly from the interior of body 151 through the interior of tube 153 to communicate with the interior of tube 9.

Another device which may be utilized in place of and in the same manner as member 10 is shown in FIGURE 21 wherein body 161 has lower sealing surface 162 (to seal with top 104) and upper sealing surface 166 (to seal with nut 108) and is provided with a metal tubular member 163 extending from the interior thereof outward to receive tube 9, as shown, member 163 having passage 165 in the interior to communicate from the interior of member 161 to the interior of tube 9.

Bodies 101, 111, 121 and 151 may be made preferably of metal or of a relatively rigid plastic such as nylon, polycarbonate, polypropylene, or high-density polyethylene, or usefully may be made of a softer plastic such as low-density polyethylene. Bodies 131, 141 and 161 are preferably made of a relatively more resilient, less hard plastic such as low-density polyethylene, plasticized polyvinylchloride, or the like, or, may usefully be made of even softer and more resilient material, such as an elastomer, such as natural rubber, GR–S, GR–N, or like material of which those which are preferred are those which are most resistant to hydrocarbons, such as a sulphur-containing elastomeric material sold under the trade name Thiokol. Sealing members 102, 112, 122, 152 and 156 are preferably made of such softer and more resilient materials as are useful for bodies 131, 141 and 161.

In FIGURE 22, there is shown a device which may be utilized in place of both member 10 and nut 108. The functions of both nut 108 and body 101 and tube 103 are combined in member 201, which may have the outward appearance of a wing nut, as shown, and may be provided with a central threaded hole 107' to engage the threads of rod 107, cutaway portion 204 adapted to be adjacent the surface of rod 107, extending portion 203, and passage or duct 205 extending from portion 204 through body 201 and portion 203 to communicate with tube 9. It may be provided with sealing member 202 to seal the undersurface of member 201 to the top of air cleaner top 104. Fluid from tube 9 may flow through passage 205, thence through cutaway portion 204 and thence downward through space 104''.

In place of members 201 and 202 of FIGURE 22 there may be utilized in the same manner the device shown in FIGURE 23 wherein body 211 has the outward form of a wing nut, and has a threaded central interior portion to engage the threads of rod 107, a sealing member 212, extending portion 213, cutaway hollow interior portion 216, cutaway portion 214 adjacent threads 107', and passage 215 extending from portion 216 through tube member 213 to communicate with tube 9. Fluid may flow through passage 215, thence through portion 216, thence through passage 214, and thence through space 104''.

Another device which may be used in place of that of FIGURES 22 and 23 is shown in FIGURE 24 wherein body 221 has the outward form of a wing nut and is provided with a threaded interior central portion which is shown as being engaged with the threads of rod 107, cutaway space 224 in the interior of body 221 communicating with threads of rod 107, extending portion 223, and passage 225 extending from cutaway space 224 outwardly through the interior of extending portion 223 to communicate with tube 9. Sealing member 222 may be provided to seal the space between the bottom surface of member 221 and top 104. The upper portion of body 221 is provided with resilient, somewhat elastomeric material 226 in a manner which is conventional with devices sold as "elastic stop nuts" to cause the nuts to be retained on threaded bolts or rods so that lock washers are not necessary.

In FIGURE 25, there is shown another device which may be used in place of and in the same manner as 201, which comprises body 231 fitted with sealing member 232 and provided with outwardly extending portion 233, cutaway space 234 in the interior adjacent the threads of rod 107, and duct 235 extending from cutaway portion 234 outwardly through body 231 and thence through extending portion 233 to communicate with tube 9.

To prevent escape of fluid which flows from tube 9 through any one of passages 205, 215, 225 or 235, means are provided to prevent such escape between bodies 201, 211, 221 and 231 respectively, and top 104, such means being sealing members respectively 202, 212, 222 and 232. In the devices of FIGURES 22 and 25, a tight fit between threads of rod 107 and the threads of bodies 201 and 231 which engage the threads of 107 is relied upon to prevent upward escape of fluid along the threads of rod 107. In body 211, such upward escape is prevented by reason of the fact that rod 107 does not extend entirely through the device; in body 221, means to prevent such escape is provided by elastomeric member 226, which is in sealing engagement with the upper threads of rod 107.

The various embodiments of the invention are preferably operated by forcing, by hand, the receptacle against the receiver while the engine is cranked and normal reactants (fuel and air) are introduced into the engine by the fuel pump and carburetor. Best results are usually obtained if the receptacle is engaged with the receiver for two or more periods of from one to five seconds to introduce fluid into the engine, while it is cranked and normal reactants are introduced thereunto, in a plurality of bursts of one to five seconds duration.

It may thus be seen that the invention is broad in scope and includes such modifications as will be apparent to those skilled in the art and is to be limited only by the claims.

Having thus described our invention, we claim:

1. A device to facilitate starting an internal combustion engine comprising means to receive a receptacle containing pressurized combustible fluid, an outlet valve and an outlet duct extending from said valve upon said receptacle being forced thereagainst by an operator's hand and to open said valve in response to said force and to provide a duct communicating with said outlet duct in sealed relation thereto, conduit means leading from said duct to a passage through which a reactant enters said engine, and means in said duct to prevent reverse flow therethrough.

2. A device to facilitate starting an internal combustion engine in a vehicle comprising a dashboard, comprising means at said dashboard to receiver a receptacle containing pressurized combustible fluid, an outlet valve and an outlet duct extending from said valve upon said receptacle being forced thereagainst by an operator's hand

and to open said valve in response to said force and to provide a duct communicating with said outlet duct in sealed relation thereto, conduit means leading from said duct to a passage through which a reactant enters said engine, and means in said duct to prevent reverse flow thereagainst.

3. The device of claim 2, wherein said means at said dashboard comprises a metal bracket member, a receiver member of synthetic resin attached to said bracket member, said receiver member having an outer wall and an inner wall defining a space therewithin, tube means extending from said outer wall to said inner wall, an orifice member in said receiver member, said orifice member having an orifice communicating with said space in said receiver member and sealingly engageable with the dispensing orifice of a hand-held pressurized valved fluid-containing receptacle, said receiver member and orifice member disposed to receive said receptacle repeatedly in such sealing engagement by translatory motion of said receptacle along the axis of said orifices, the only valve in said receiver member being a check valve comprising a coil spring and a sealing member disposed to prevent flow outward toward said receptacle.

4. The device of claim 3 wherein said orifice member is integral with said receiver member.

5. The device of claim 3 wherein said orifice member is separate from said receiver member and is retained in sealed engaged relation with said receiver member.

6. The device of claim 5 wherein said orifice member comprises a tubular cylindrical outwardly extending portion disposed to extend into a hole in said receptacle so that the seal between the receiver member and the receptacle is at the outer surface of said cylindrical member.

7. The device of claim 5 wherein said orifice member comprises an inner tubular surface which converges inwardly toward said receiver member, disposed to receive in sealing engagement with said inner tubular surface the outer peripheral edge of such a cylindrical tubular member as may extend from a pressurized receptacle.

8. The device of claim 7 wherein the sealing member of the check valve comprises a relatively soft elastomeric disk backed up by a relatively rigid disk.

9. The process of repeatedly assisting in repeatedly starting an internal combustion engine by respectively repeatedly:

forcing into a receiving fitting under hand pressure alone, an outlet portion of a pressurized valved receptacle containing combustible fluid to open said valve and introduce said fluid into a passage through which a reactant enters said engine, and

holding said outlet portion in said receiving fitting under hand pressure alone to hold said valve open and maintain flow of said fluid into said passage, and

releasing said hand pressure to close said valve and stop said introduction of fluid.

10. The process of claim 9, in which hand pressure is exerted and said fluid introduced in a plurality of periods of about one to five seconds duration while the engine is cranked and normal reactants are introduced into the engine.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,187,735 June 8, 1965

William S. Fiedler et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 9, line 6, for "thereagainst" read -- therethrough --.

Signed and sealed this 16th day of November 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents