June 15, 1954 C. J. MOODY 2,681,053

STARTING OF INTERNAL-COMBUSTION ENGINES

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FIG. 1

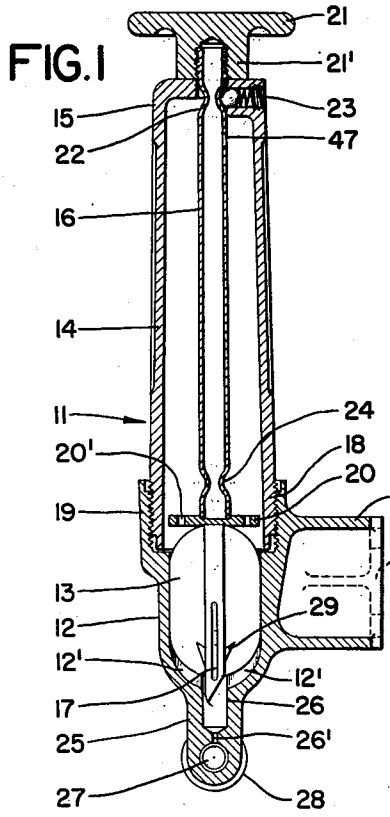


FIG. 2

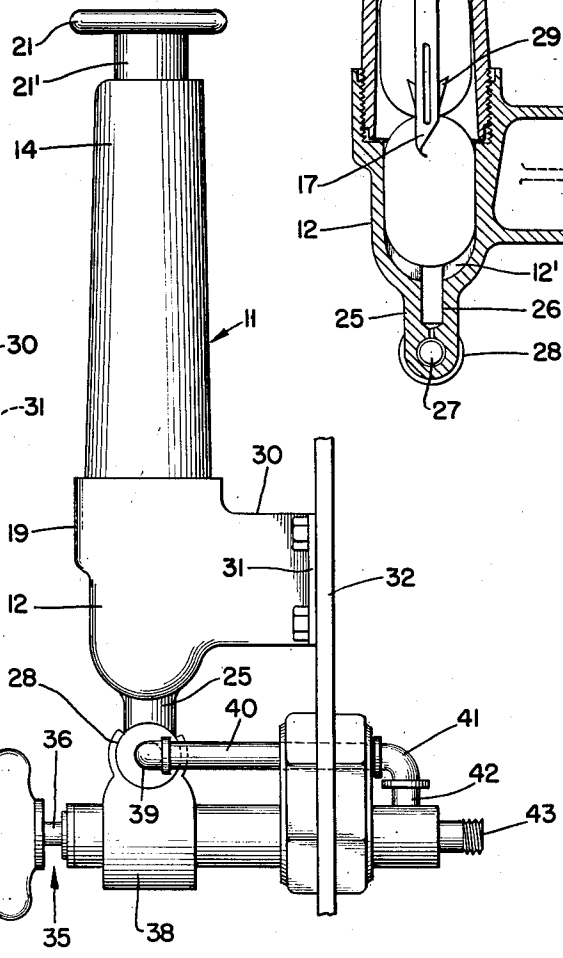


FIG. 3

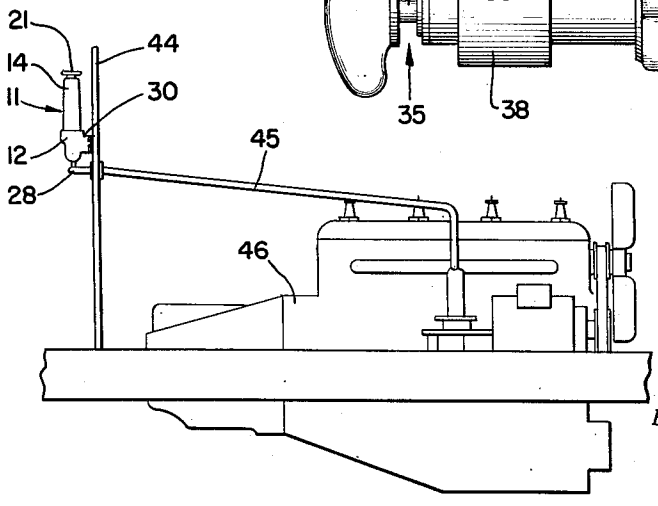


FIG. 4

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FIG. 5

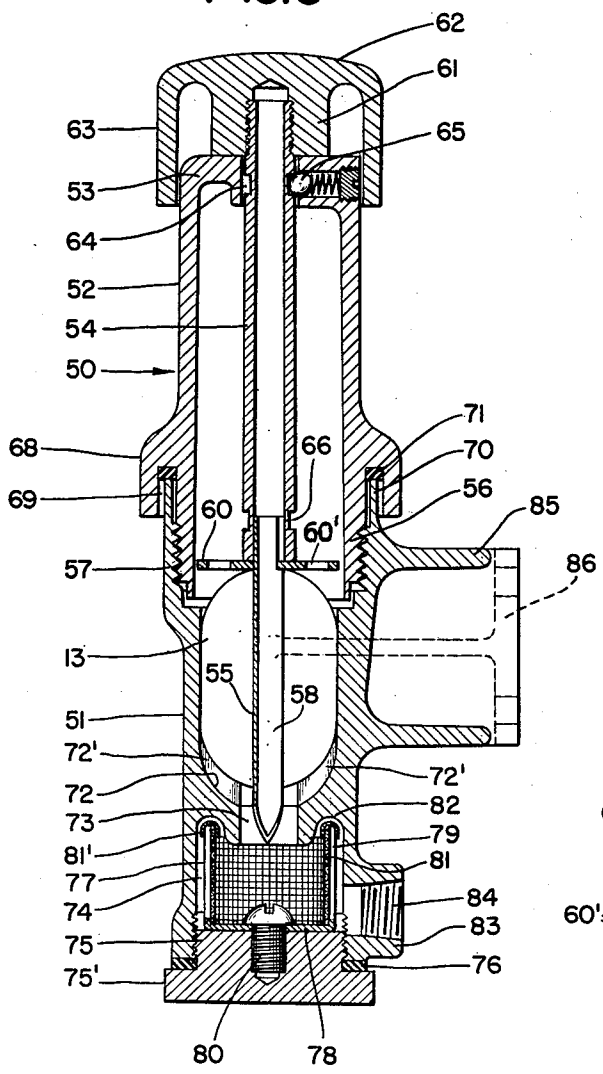


FIG. 6

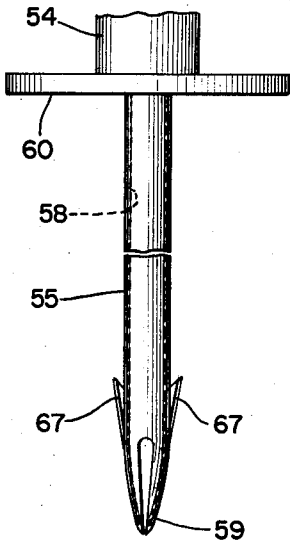


FIG. 7

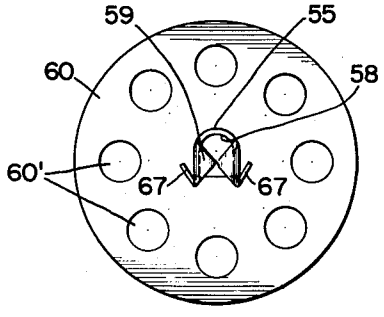
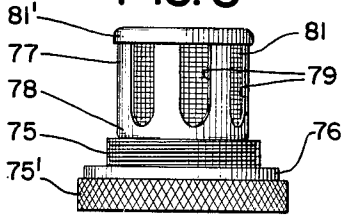


FIG. 8



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STARTING OF INTERNAL-COMBUSTION ENGINES

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Application July 29, 1950, Serial No. 176,691

16 Claims. (Cl. 123—187.5)

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This invention relates to the starting of internal combustion engines in cold weather. The problem of starting automobile and airplane engines under frigid conditions, especially at temperatures substantially below zero, has long been a source of considerable trouble and annoyance. Fluid, containing ethyl ether as its major component, and suitable for quickly starting internal combustion engines in frigid weather, at temperatures as low as —40° F., has been available on the market for years. One mode of application of the fluid to the engine has been through a pump mounted on the dash, and connected to a tank containing the starting or priming fluid, for impelling the fluid through a suitable connection to the intake manifold of the engine. Another method involves the use of spray gun for injecting fluid from a supply tank through a hole in the manifold of a diesel engine or through the air filter of a gasoline engine.

The foregoing methods of starting internal combustion engines in cold weather involve storing substantial quantities of the starting or priming fluid in a supply tank or container, as, for example, a gallon can or a three-pint can, from which fluid is transferred to a smaller can connected to the pump or spray gun. The fluid remaining in the opened gallon or three-pint can creates a storage hazard; while the can connected to the pump or spray gun also stores fluid for repeated use.

The invention disclosed in my application Serial No. 33,365, filed June 16, 1948, now Patent No. 2,516,787, July 25, 1950, obviates the hazards incident to the prior practice in the storage of the inflammable and explosive starting or priming fluid. In accordance with the disclosure in that application, a charge of starting fluid, sufficient for one starting of the engine, is stored in a flexible container which is discarded after a single use; such container specifically comprising a capsule of suitable plastic material, which capsule is placed in a primer cup connected to the engine and then ruptured for discharging its contents into the interior of said engine.

The present invention provides a novel and improved primer cup for receiving and puncturing the capsules. The invention provides a primer cup, simple in construction but particularly efficient in operation, for receiving one or more capsules and puncturing them with marked facility to discharge their contents into the engine.

Other features and advantages of the invention will be hereinafter described and claimed.

This application is a continuation-in-part of

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my application Serial No. 75,950, filed February 11, 1949, and now abandoned.

In the accompanying drawings:

Fig. 1 is a vertical sectional view of a primer cup embodying the present invention.

Fig. 2 is a view in side elevation, showing the embodiment of Fig. 1 mounted on a pump on a dashboard of a vehicle.

Fig. 3 is a view of the lower portion of the primer cup, showing a plurality of capsules therein.

Fig. 4 is a view in side elevation showing the primer cup mounted on the dashboard of a vehicle and connected to the intake-manifold of the engine.

Fig. 5 is a vertical sectional view of another primer cup embodying certain modifications of my invention.

Fig. 6 is a fragmentary detail view showing in elevation the puncturing element of Fig. 5, together with a portion of the supporting plunger.

Fig. 7 is a plan view, looking upwardly from the bottom of the elements shown in Fig. 6.

Fig. 8 is a view of a further detail.

Referring to Figs. 1–4 of the drawings, a primer cup 11 comprises a receptacle portion 12 adapted to receive the capsule 13 of suitable plastic material containing starting fluid, such as the conventional ethyl ether fluid above referred to. As disclosed in my aforementioned application, Serial No. 33,365, conventional plasticized gelatin capsule shells of the type employed for the marketing of bath oils have been found to be well adapted to serve as containers for the starting or priming fluid.

Removably attached to the receptacle 12 is a barrel 14 in the end 15 of which there is slidably mounted a plunger 16 carrying a puncturing tool 17. Conveniently the open end portion 18 of said barrel may be provided with exterior threads, as shown, for engagement with interior threads on a boss 19 extending from the receptacle portion 12.

The puncturing tool 17 may be attached to the plunger 16 in any suitable manner. For instance, the tool may be welded or otherwise secured to a flange 20, attached in turn by welding or otherwise to an end of said plunger 16. The flange 20 may also serve as a guide for said plunger during its movements in the barrel 14. The end of said plunger which projects through the end 15 of the barrel may be threadedly attached, as shown, to a sleeve 21' depending from a knob 21 which may be conveniently grasped for manipulation of the plunger.

The plunger 16 may be solid, if desired, but preferably is hollow to save material and decrease its weight. Adjacent one end the plunger is provided with an external groove 22 for engagement with a spring-pressed ball 23 in the upper end portion of the barrel 14. Said ball 23, in cooperation with said groove 22, thus serves as a detent to hold the plunger in its innermost position. Another groove 24 in the lower end portion of the plunger cooperates with said ball 23 to maintain the plunger in its fully retracted position.

The plunger flange 20 may be provided with holes 20' to facilitate operation of the plunger in the event that liquid from punctured capsules should accumulate in the barrel 14.

The puncturing tool 17 may also comprise barbs 29, for retracting the punctured capsule shell when the plunger is drawn backwardly.

The lower portion of the receptacle 12 is inwardly curved as shown; and projecting upwardly from the curved inner surface of said receptacle portion are a plurality of curved ribs 12'. While two of said ribs are shown in Fig. 1, it will be understood that any desired number thereof (six, for example) may be provided, preferably equally spaced around the interior of the receptacle, to support the lower curved end of the capsule 13. Said ribs may conveniently be formed integrally with the receptacle.

Below its inwardly curved portion, the receptacle 12 is provided with a downward extension 25 having therein a longitudinal channel or counterbore 26. The latter, at its lower end, communicates through an opening 26' with a substantially horizontal passage 27 in a lateral extension 28 of said receptacle. Said passage 28 may be connected to the interior of the engine in any suitable manner. The inner ends of the ribs 12' terminate substantially in line with the channel 26, as shown in Fig. 1; so that the space between said ends of said ribs is of substantially the diameter of said channel. The spaces between adjacent rib surfaces communicate with said space between the ends of said ribs, and thus with said channel 26.

The receptacle portion 12 of the primer cup may be formed integral with, or suitably secured to, a bracket 30 having laterally extending flanges 31 whereby said bracket, and thus the entire primer cup assembly carried thereby, may be readily bolted to the dash-board 32 of an automobile, airplane, or other vehicle.

In Fig. 2, the primer cup assembly is shown mounted on a pump 35 of conventional design, operated by a plunger 36 through a knob 37 readily grasped by the operator. The extension 28 of the primer cup receptacle may, as shown, be mounted in a suitable clamp 38 secured to the pump casing. A pipe elbow 39 is threaded into the passage 27 of said receptacle extension 28 and in turn communicates through pipe section 40, elbow 41, and pipe section 42 with the interior of the pump. The latter is connected through conduit 43 and suitable piping with the intake manifold or other portion of the engine to be started. This arrangement is particularly useful in installations where the engine is at the same or a higher level than the dashboard, as in aeroplanes.

When the primer cup is connected to a point in the engine below said cup, the pump may be omitted, if desired, and a connection made directly between said cup and engine. Such an arrangement is illustrated in Fig. 4, wherein the

cup 11 is secured to the dashboard 14 through the bracket 30 and the passage 27 in the cup extension 28 is connected directly through piping 45 with the intake manifold of the engine 46.

To insert a capsule, the barrel 14 is unscrewed from the receptacle 12. The capsule is then placed in the receptacle, with its lower end seated on the upper surfaces of the curved ribs 12'. Then the barrel 14 is screwed into said receptacle, the plunger 16 having previously been retracted so that its groove 24 is engaged by the spring-pressed detent 23. The plunger may then be pushed downwardly by the operator until the tip of the puncturing tool 17 has passed through both ends of the capsule. The highly volatile priming fluid, released from the punctured capsule proceeds downwardly through the channel 26, opening 26', and passage 27 and thence (in the arrangement of Fig. 4) directly to the engine through the piping 45. In the Fig. 3 arrangement, the fluid passing into said passage 27 is pumped to the engine by the operator through actuation of the plunger 36.

When the plunger 16 is pushed downwardly to its fullest extent, with the tip of its puncturing tool extended through the lower end of the capsule, the upper groove 22 of said plunger 16 is engaged by the detent 23. Also, in this position of the plunger, its barbs 29 have passed completely through the upper end of the capsule. The channel 26 is of sufficient length to permit movement of the puncturing tool 17 to such extent as to pass its tip completely through both ends of the capsule.

After the engine has been started, the plunger 16 is fully retracted, bringing its groove 24 into engagement with detent 23. Through the barbs 29, the punctured capsule shell is completely withdrawn into the barrel 14. Said barrel is then unscrewed from the receptacle 12, and the retracted capsule shell may be readily ejected through the open end of said barrel by pushing the plunger 16 downwardly.

When the engine to be started is of a size larger than one which can be started by a single capsule, a plurality of capsules may be inserted in the barrel 14. Thus, as shown in Fig. 3, one capsule has been placed on the ribs or shoulders 12' in the receptacle 12, and a second capsule has been placed in the barrel 14, with its lower end resting on the upper end of the first capsule. In Fig. 3 the plunger 16 is shown pushed downwardly sufficiently to bring the puncturing tool 17 through both ends of the upper capsule and into the upper end of the lower capsule, but it will of course be understood that the plunger may be moved further downwardly to bring the barbs 29 into the lower capsule and to pass the tip of the puncturing tool through the lower end of said bottom capsule. The contents of both punctured capsules pass down into passage 27 and thence to the engine.

If desired, the hollow interior of the plunger 16 may be open to the exterior through a hole 47.

Turning now to the modified primer cup 50 shown in Fig. 5, the receptacle portion 51 for receiving the capsule 13 has attached thereto a barrel 52. The end 53 of said barrel has slidably mounted therein a tubular plunger 54 carrying a puncturing tool 55. Conveniently, the open end portion 56 of said barrel may be formed with exterior threads, as shown, for engagement with interior threads on a boss 57 extending from the receptacle portion 51.

The puncturing tool 55 may be of sheet steel,

bent along the major portion of its length into U-shaped cross-section to provide a longitudinal channel 58, and having the side walls at its lower end extended and pressed together into pointed formation as shown at 59. The upper end of said puncturing tool fits into the lower end of the tubular plunger 54 and may be secured thereto in any suitable manner, as by welding or brazing. Also secured to the lower end of said plunger and to said puncturing tool, as by brazing or welding, is a flange 60, which serves as a guide for the plunger during the movements of the latter in the barrel 52. Said flange 60 may be provided with holes 60' to facilitate operation of the plunger and the attached puncturing tool in the event that liquid from punctured capsules should accumulate in the barrel 52.

The end of the plunger 54 which projects through the end 53 of the barrel may be threadedly attached, as shown, to a sleeve 61 depending from a knob 62 which may be conveniently grasped for manipulation of the plunger. Said knob 62 is further provided with a depending skirt 63 which, when the knob and plunger are in their normal lowermost position, overlaps the upper end of the barrel 52 and insures against seepage of moisture into the screw threads connecting said plunger and knob, as might otherwise occur in installations where the primer cup is exposed to rain or snow.

Adjacent one end, the plunger 54 is provided with an external groove 64 for engagement with a spring-pressed ball 65 in the upper end portion of the barrel 52. Said ball 65, in cooperation with said groove 64, thus serves as a detent to hold the plunger in its innermost position. Another groove 66 in the lowermost portion of the plunger cooperates with said ball 65 to maintain the plunger in its fully retracted position.

The puncturing tool 55 may also comprise barbs 67, for retracting the punctured capsule shell when the plunger is drawn upwardly.

Near its lower end, the barrel 52 is provided with an outwardly flaring, downwardly extending, skirt 68; the lower end of which skirt is spaced from the adjacent wall of the barrel to provide an open-ended annular channel 69. Said channel receives an upwardly extending flange or extension 70 from the receptacle boss 57 when the barrel 52 is threaded into said boss, as shown in Fig. 5. The resultant over-lapping of said skirt 68 and flange 70 protects the screw threads within said boss from seepage of water into said threads when the primer cup is exposed to the elements. A gasket 71 of rubber or other suitable resilient material, may be interposed between the upper end of the flange 70 and the adjacent end of the channel 69.

Between its upper and lower ends the receptacle 51 is provided with an inwardly curved seat portion 72 having a plurality of upwardly projecting curved ribs 72', similar to the ribs 12' of Fig. 1, to support the lower end of the capsule. Said ribs 72' may conveniently be formed integrally with the receptacle and are preferably equally spaced around its interior. A channel 73 extends downwardly through said ribs 72' and seat 72, and opens into a chamber 74 in the lower end of the receptacle 51. Said lower end is normally closed by a plug 75 having screw threaded engagement with said end, and also having an exterior flange or knob 75' whereby the plug may be readily removed or reinserted. A gasket 76 may be interposed between said flange 75' and the lower end of said receptacle, as shown.

The screw plug 75 carries on its upper surface a cylindrical shell 77 having a bottom 78 and longitudinal slots 79 through its cylindrical wall. A screw 80, threaded through the bottom plate 78 of said shell, attaches said shell removably to the plug 75. Within said shell 77 there is positioned a cylindrical wire screen 81, the lower end of which screen rests on the bottom plate 78 of said shell. A sheet of soft metal such as tin, may be folded over the upper ends of said shell and screen and crimped thereto to bind said ends firmly together, as shown at 81'. After the shell and screen are attached together and to the plug 75, the latter is screwed into the lower end of the receptacle 51, bringing the shell and screen fully into the receptacle chamber 74, with the upper ends of said shell and screen fitting into an annular curved recess 82 in said receptacle above the chamber 74.

A boss 83, extending laterally from the lower end portion of the receptacle 51, is bored internally to provide an outlet channel 84 communicating with the aforementioned chamber 74. Said bore, as shown, is threaded for attachment to a pipe or conduit extending to the intake manifold or other portion of the engine to be started.

When the slotted shell 77 and the screen 81 are inserted into the chamber 74, and the plug 75 is screwed into the lower end of the receptacle, the contents of a punctured capsule seated on the ribs 72' will flow through said shell and screen and thence through the outlet 84 to the engine. At the same time said shell and screen prevent any fragments of the capsule from passing into said outlet. This is of particular advantage in very cold weather, when the capsules may become somewhat brittle, and hardened fragments thereof pass downwardly through the channel 73. Any such fragments are caught by the screen 81, and may readily be removed simply by removing the plug 75.

It will also be apparent that the foregoing construction enables ready removal of the shell and screen as a unit from the plug 75, and their expeditious replacement, whenever either becomes worn out.

It will be noted that when said plug 75 is screwed fully into the receptacle 51, the bottom plate 78 of the shell 77 is above the outlet 84, so that no fluid can accumulate in the shell 77 or screen 81 below said outlet.

The receptacle portion 51 of the primer cup 50 may be formed integrally with, or suitably secured to, a bracket 85 having laterally extending flanges 86 whereby said bracket, and thus the entire primer cup assembly carried thereby, may readily be bolted to the dashboard of an automobile or other vehicle.

The terms and expressions which I have employed are used as terms of description and not of limitation, and I have no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described or portions thereof, but recognize that various modifications are possible within the scope of the invention claimed.

I claim:

1. A primer cup for internal combustion engines, said cup comprising a receptacle adapted to receive a priming-fluid capsule, a barrel extending from said receptacle, a tool for puncturing said capsule, and a plunger slidably mounted

in said barrel and carrying said tool, said plunger extending through an end of said barrel for manipulation to bring said tool into capsule-puncturing position and to withdraw said tool therefrom, and spring-actuated detent means in said barrel cooperating with said plunger to retain the latter and said tool in different positions.

2. A primer cup for internal combustion engines, said cup comprising a receptacle adapted to receive a priming-fluid capsule, a barrel extending from said receptacle, a plunger slidably mounted in said barrel, a tool movable with said plunger for puncturing said capsule, said tool also having barb means movable into said capsule for withdrawing the same upon retraction of said plunger, an end of said plunger extending through said barrel for manipulation by an operator.

3. A primer cup for internal combustion engines, said cup comprising a receptacle adapted to receive a priming-fluid capsule, a barrel extending from said receptacle, a plunger slidably mounted in said barrel, a tool movable with said plunger for puncturing said capsule, said tool also having barb means movable into said capsule for withdrawing the same upon retraction of said plunger, and spring-actuated detent means in said barrel cooperating with said plunger to retain the latter and said tool in different positions.

4. A primer cup for internal combustion engines, said cup comprising a receptacle having an internal chamber for receiving a priming-fluid capsule, spaced ribs in said chamber curved to conform with a curved end of said capsule and forming a seat therefor, said chamber having a discharge opening below said ribs adapted to be connected to an internal combustion engine for discharging priming fluid thereinto, and a tool movable with respect to said receptacle for puncturing said capsule.

5. A primer cup for internal combustion engines, said cup comprising a receptacle adapted to receive a priming fluid capsule, a barrel removably attached to said receptacle, a plunger slidably mounted in said barrel, and a tool movable with said plunger for puncturing said capsule, said plunger extending through said barrel for manipulation to and from capsule-puncturing position, said barrel being of internal volume sufficient to accommodate another capsule adjacent the capsule in said receptacle when said plunger is retracted from puncturing position.

6. A primer cup for internal combustion engines, said cup comprising a receptacle having an internal chamber for receiving a priming-fluid capsule, a seat in said chamber for an end of said capsule, said receptacle having a second chamber below said seat for receiving fluid from said capsule and also having an outlet in communication with said second chamber, and a screen in said second chamber for preventing capsule fragments from entering said outlet.

7. A primer cup for internal combustion engines, said cup comprising a receptacle having an internal chamber for receiving a priming-fluid capsule, a seat in said chamber for an end of said capsule, said receptacle having a second chamber below said seat for receiving fluid from said capsule and also having an outlet in communication with said second chamber, a screen in said second chamber for preventing capsule fragments from entering said outlet, and means comprising a plug engageable with said receptacle for inserting and removing said screen.

8. A primer cup for internal combustion engines, said cup comprising a receptacle having an internal chamber for receiving a priming-fluid capsule, a seat in said chamber for an end of said capsule, said receptacle having a second chamber below said seat for receiving fluid from said capsule and also having an outlet in communication with said second chamber, a screen in said second chamber for preventing capsule fragments from entering said outlet, a plug removably engaging said receptacle, and means for securing said screen to said plug.

9. A primer cup for internal combustion engines, said cup comprising a receptacle having an internal chamber for receiving a priming-fluid capsule, a seat in said chamber for an end of said capsule, said receptacle having a second chamber below said seat for receiving fluid from said capsule and also having an outlet in communication with said second chamber, a screen in said second chamber for preventing capsule fragments from entering said outlet, a plug removably engaging said receptacle, and means for removably securing said screen to said plug.

10. A primer cup for internal combustion engines, said cup comprising a receptacle having an internal chamber for receiving a priming-fluid capsule, a seat in said chamber for an end of said capsule, said receptacle having a second chamber below said seat for receiving fluid from said capsule and also having an outlet in communication with said second chamber, a screen in said second chamber for preventing capsule fragments from entering said outlet, a slotted shell surrounding said screen, and means removably engaging said receptacle and supporting said screen and said shell.

11. A primer cup for internal combustion engines, said cup comprising a receptacle having an internal chamber for receiving a priming-fluid capsule, a seat in said chamber for an end of said capsule, said receptacle having a second chamber below said seat for receiving fluid from said capsule and also having an outlet in communication with said second chamber, a screen in said second chamber for preventing capsule fragments from entering said outlet, a shell having a bottom portion engaged by the lower end of said screen and a slotted wall portion surrounding said screen, and means removably engaging said receptacle and supporting said screen and said shell.

12. A primer cup for internal combustion engines, said cup comprising a receptacle having an internal chamber for receiving a priming-fluid capsule, a seat in said chamber for an end of said capsule, said receptacle having a second chamber below said seat for receiving fluid from said capsule and also having an outlet in communication with said second chamber, a screen in said second chamber for preventing capsule fragments from entering said outlet, a shell having a bottom portion engaged by the lower end of said screen and a slotted wall portion surrounding said screen, means securing the upper end of said screen to said shell, and means removably engaging said receptacle and supporting said shell and said screen.

13. A primer cup for internal combustion engines said cup comprising a receptacle having an internal chamber for receiving a priming-fluid capsule, a seat in said chamber for an end of said capsule, said receptacle having a second chamber below said seat for receiving fluid from said capsule and also having an outlet in communication with said second chamber, a screen

in said second chamber for preventing capsule fragments from entering said outlet, a shell having a bottom portion engaged by the lower end of said screen and a slotted wall portion surrounding said screen, a plug removably engaging said receptacle, and means cooperating with the bottom of said shell for attaching the latter to said plug.

14. A primer cup for internal combustion engines, said cup comprising a receptacle adapted to receive a priming fluid capsule, a barrel having threaded engagement with said receptacle, a tool for puncturing said capsule, a plunger slidably mounted in said barrel and carrying said tool, and means comprising overlapping annular members on said receptacle and barrel, respectively, for protecting the interengaged threads on said receptacle and barrel against entry of moisture thereinto.

15. A primer cup for internal combustion engines, said cup comprising a receptacle adapted to receive a priming fluid capsule, a barrel having threaded engagement with said receptacle, a tool for puncturing said capsule, a plunger slidably mounted in said barrel and carrying said tool, and means for protecting the interengaged threads on said receptacle and barrel against entry of moisture thereinto, said means comprising an annular flange on one of said members extending into an annular opening in the other.

16. A primer cup for internal combustion engines, said cup comprising a receptacle adapted to receive a priming fluid capsule, a barrel extending from said receptacle, a tool for puncturing said capsule, a plunger slidably mounted in said barrel and carrying said tool, said plunger extending through an end of said barrel, a knob having screw threaded engagement with said plunger beyond said barrel, and a skirt on said knob overlapping the adjacent end of the barrel, when said plunger is in normal position, for protecting the interengaged screw threads of said plunger and knob from entry of moisture thereinto.

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