

Dec. 6, 1938.

J. SCHWEISS  
ACCELERATING PUMP  
Filed Dec. 3, 1935

2,139,387

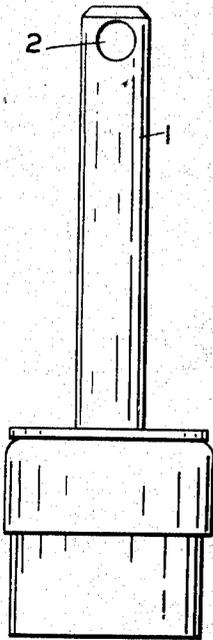


FIG. 1

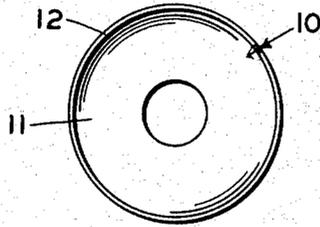


FIG. 3

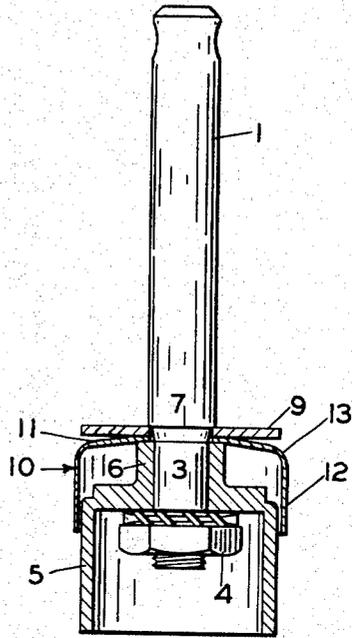


FIG. 2

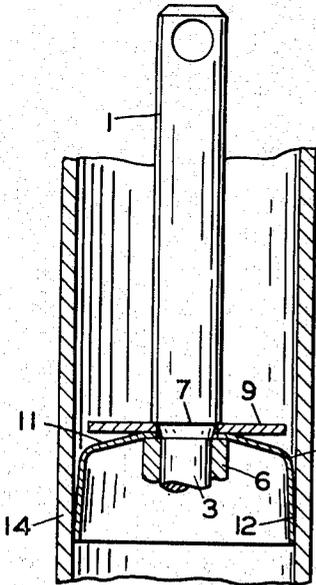


FIG. 4

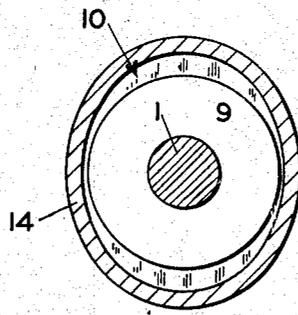


FIG. 6

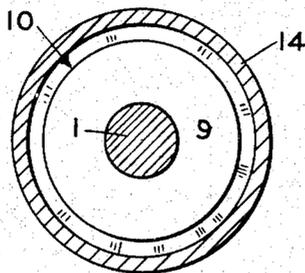


FIG. 7

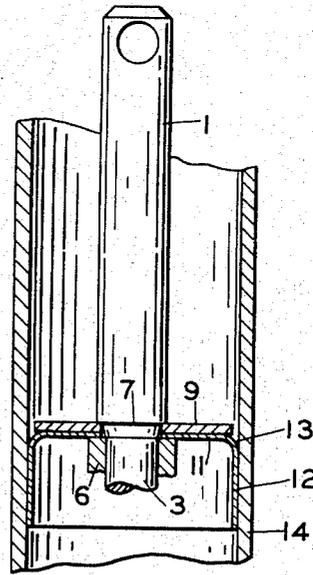


FIG. 5

JOSEPH SCHWEISS  
INVENTOR

BY *Donald U. Rich*  
ATTORNEY

## UNITED STATES PATENT OFFICE

2,139,387

## ACCELERATING PUMP

Joseph Schweiss, St. Louis, Mo., assignor to Carter Carburetor Corporation, St. Louis, Mo., a corporation of Delaware

Application December 3, 1935, Serial No. 52,651

1 Claim. (Cl. 309—33)

This invention relates to piston or plunger devices particularly adapted for use in carburetor accelerating pumps.

Carburetor accelerating pumps have frequently been equipped with leather pistons or pistons having leather peripheral parts for engaging the chamber walls. Such pistons are commonly provided with spring devices for urging the leathers outwardly and in engagement with the pump chamber wall. In other cases solid metal pistons have been provided and usually these are formed of the same kind of metal as the chamber wall or of metal having a similar coefficient of expansion in order to equalize thermal strains in the piston and chamber due to friction or the temperature changes of an associated engine.

Where leather pistons are used there is great difficulty in maintaining uniformity in the size and texture of the leather parts due to variations in the hides from which the leathers are made and for other reasons. A leather piston, being absorbent, swells when immersed in liquid with the result that such a piston, if fitted to its chamber when saturated, may not function properly when allowed to dry out. Leather pistons also are subject to substantial wear due to friction with the chamber wall and parts may be dissolved or washed away by the fluid resulting in loss of compression even though the piston apparently fits tightly within its chamber.

Solid metal pistons are subject to the objection of being rigid in contour and thus unable to yield so as to conform with the shape of the chamber, particularly when the piston and chamber are worn or do not exactly fit together for any other reason. Such a piston also embodies a substantial percentage of non-functioning material on the inside thereof which adds to the cost and weight of the piston.

A piston for a carburetor accelerating pump or similar device is not subjected to great force, but in an automobile carburetor, such a piston may make millions of reciprocations during the life of the car. Some wear necessarily occurs between the piston and chamber wall and a solid or rigid piston must be discarded when such wear exceeds narrow limits. In carburetor accelerating pumps, a clearance between a solid metal piston and the chamber wall of approximately .001 inch in excess of the normal working clearance ordinarily results in loss of pressure and improper functioning of the carburetor, particularly during acceleration. Pistons of leather, even though expansible, do not have substantially better wearing properties than rigid pistons.

An object of the present invention is to provide a piston particularly adapted for use in a carburetor accelerating pump, which will function satisfactorily for a substantially greater period of

operation than previous pistons of this type, and ordinarily for the life of the automobile on which the carburetor is used.

Another object is to provide a metal piston adapted to function properly within wider clearance limits than previous metal pistons.

Another object is to provide a metal piston which is substantially easier and cheaper to manufacture within extremely close limits of variation than previous metal pistons.

Another object is to produce a piston capable of automatic expansion to take up its own wear.

Another object is to provide a piston of the above type adapted to conform with a chamber wall which is worn or otherwise out of shape so as to maintain a sealing fit therein.

Another object is to provide a resilient, expansible, and pliable metal piston.

Another object is to provide a new method of manufacturing metal pistons.

These objects and other more detailed objects hereafter appearing are attained by the structures illustrated in the accompanying drawing in which:

Figure 1 is a side view of a piston and piston stem embodying the invention.

Figure 2 is a section taken on the longitudinal center line of the device in Figure 1.

Figure 3 is an end view of the piston disassembled from the stem.

Figures 4 and 5 are exaggerated diagrammatic sections showing the piston assembled with a pump chamber but under different operating conditions.

Figure 6 is an exaggerated top view and section showing the novel piston assembled with a cylinder worn out of round.

Figure 7 is a view similar to Figure 6 but showing the cylinder worn evenly all around.

The embodiment illustrated in the figures comprises a piston rod or stem 1 having an aperture 2 at one end for attachment to associated mechanism and a reduced portion 3 at the other end threaded for a nut 4. Mounted on the reduced end of stem 1 is an air dome member including a cup-shaped portion 5 extending beyond nut 4 and a bushing portion 6 directly receiving portion 3 of the stem. Secured between the upper end of bushing portion 6 which in effect forms a shouldered part of the stem structure, and a shoulder 7 at the end of portion 3 of the stem is a washer 9 and a piston member generally designated at 10. The piston and stem may be assembled in any suitable manner, and the air dome structure may be varied as desired, or omitted.

Air dome portion 5 extends slightly within cup-shaped piston member 10 and serves as a protector for the free edge of the piston member. A small clearance is provided between the piston member and air dome portion 5 to permit flexing 60

of the piston skirt as described hereafter. Piston member 10 is formed conveniently though not necessarily, by the stamp drawing process from a piece of sheet aluminum of approximately .006 inch thickness and comprises a disk-like end wall 11 and a cylindrical side wall portion forming a skirt 12. The side and end wall portions are preferably joined by a fillet as at 13 and the end wall portion is inclined slightly outwardly from the apertured center thereof (Figures 2 and 4). In the assembled device, the clamping washer 8 and bushing portion 6 are drawn together tightly against the flattened center portion of the generally dome-like or frusto-conical end wall of the piston.

The above described shaping of the piston side and end walls is readily attained by the stamp drawing process in which the sheet metal is forced into a cylindrical die, the re-shaping of the metal under pressure resulting in slight bowing or "cupping" in the disk-like center portion of the blank which forms the end wall of the cup. Where thin resilient metal is used, as in the present case, the end wall forms, in effect, a flexible diaphragm and the offset center portion thereof may be flexed under axial pressure and upon release of the pressure will re-assume its original position provided the flexing does not exceed the elastic limit of the material. During inward flexing, the metal yields in a direction parallel to its surface and the peripheral portion thereof is expanded.

In the piston described above, substantially the entire end wall 11 of the cup including the fillet 13 may flex, as described, during the application of pressure coaxially of stem 1, or only a portion thereof may be cupped so as to function in this manner. The side wall or skirt of the piston or a portion thereof, preferably, though not necessarily, is inclined slightly outwardly from the end wall portion as at 13 and this shaping also is readily formed by the stamp drawing process where resilient metal is used.

Figures 4 and 5 illustrate on a greatly exaggerated scale, the manner in which the novel piston functions to seal a cylinder or chamber. In Figure 4 the piston end wall is contracted and cupped, as is the case when substantially no pressure is applied thereto through stem 1. A portion of skirt 12 is shown as spaced from the chamber wall 14. In practice only very slight clearance is provided between the skirt and chamber wall and the skirt throughout its depth may engage the chamber wall.

Figure 5 illustrates the condition of the parts during the application of pressure through stem 1. End wall 11 is flattened and the periphery thereof expanded towards the chamber wall, resulting in the application of pressure transversely against the chamber wall through piston skirt 12. The skirt is thus forced against the chamber wall and into sealing engagement therewith.

The skirt, being laterally flexible, can yield to conform with the cross sectional shape of the chamber wall. Figure 6 illustrates, in great exaggeration, a condition in which the piston chamber is non-circular in cross section due to wear, or for any other reason, the piston skirt being distorted correspondingly. Such a condition may exist due to production tolerances or after the chamber is worn by use.

In Figure 7, the chamber, while cylindrical, is

slightly larger all around than the piston. In this case, the piston expands uniformly all around when pressure is applied to stem 1 to force the piston skirt into sealing engagement with the chamber wall.

Pistons constructed substantially as described may be more cheaply produced in quantities and will function properly within wider tolerance limits than the solid or non-flexing metal pistons heretofore used. The piston is desirably, though not necessarily, formed of aluminum, or other material which has a greater coefficient of thermal expansion than the chamber wall, ordinarily brass in carburetor accelerating pumps, so that the seal will be improved when the piston becomes heated. The piston will function properly for a period of time longer than non-flexing pistons, even though formed of softer material than the chamber wall, or vice versa, due to its ability to expand and to conform with a non-circular chamber. Aluminum is a satisfactory material for forming the piston due to its resistance to corrosion, lightness, strength, resilience, and workability.

The piston need expand or distort only a very small amount and no actual expansion may occur where the piston closely fits within its chamber. The pressure developed in a carburetor accelerating pump during each stroke of the piston is not very great, but this pressure, in addition to the friction between the piston skirt and chamber wall, offers sufficient resistance to forces applied through the piston stem to insure slight flexing of the piston end wall provided the cupping or bowing of this portion of the piston is not too great.

The novel sheet metal piston has important advantages even though the end wall portion thereof is formed flat instead of being slightly cupped. The yielding skirt portion will readily conform with cylinder wall irregularities or imperfections and may be easily stretched or shaped, particularly at its free edge by a suitable tool or instrument. It has been found that the pressure developed by the piston and consequently the rate of ejection of fuel from a carburetor accelerating pump in which the piston is used may be increased by merely expanding the piston skirt. This in particular, facilitates servicing of used carburetors. The facility and cheapness of manufacture, durability and uniformity of such a piston also constitute distinct advantages not attained in other types of metal and leather pistons.

Obviously the shaping and proportion of various parts of the illustrated embodiment may be varied and certain parts may be eliminated without departing from the spirit of the invention. Also the piston may be formed by a process other than stamp drawing. The exclusive use of all such modifications as come within the scope of the appended claims is contemplated.

I claim:

A piston comprising a thin sheet metal cup having an annular rim with a substantially smooth surface both inside and out, at least a portion of the end wall of the cup being substantially of frusto-conical shape whereby pressure exerted at the center of said end wall in one direction will tend to cause expansion of the outer wall of the cup.

JOSEPH SCHWEISS.