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PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION.

No. 9760, A.D. 1922.

An Improved Method and Apparatus for Producing Mixtures of Liquids and Gases.

I, GEORGE CONSTANTINESCO, of "Carmen Sylva", Beechwood Avenue, Oatlands Park, Weybridge, in the County of Surrey, a subject of the King of Great Britain and Ireland, do hereby declare the nature of this invention to be as follows:—

The present invention relates to a method and apparatus for feeding liquids into gaseous fluids in motion in any desired proportion such proportion being independent of the suction or the velocity of the gas.

In some cases there may be superposed on the constant proportion an additional or diminishing proportion of liquid to gas to meet special circumstances.

The invention is especially applicable to devices such as carburettors for internal combustion engines, blow lamps, fuel atomisers or other devices in which liquid fuel has to be supplied in constant proportion to the volume of a stream of air in which the velocity of flow varies between wide limits.

The invention is based on the principle that the flow of liquid through an aperture or tube of small bore is proportional to the square root of the pressure difference on the two sides of the aperture or tube hereinafter called the depression $\triangle p$ minus a constant which depends on capillary and surface tension effects. It follows that if a jet is arranged at the same level as the tank supplying it and if the depression is only just sufficient to balance capillary and surface tension effects no delivery of liquid through the jet will take place.

The present invention consists in a method and apparatus for feeding liquids into gaseous fluids in motion in any desired constant proportions by providing a head of liquid above an aperture or jet exactly equivalent to the head which is just capable of balancing the capillary and surface tension effects, the liquid being also subjected to the depression by which the gaseous current into which it is fed is produced.

The invention further consists in the improved method and means for supplying mixtures of liquids and gases in constant proportions with or without an additional proportion arranged to meet special circumstances hereinafter described.

Suppose for example it is desired to supply to an internal combustion engine a mixture of air and liquid fuel the proportions by weight of which are constant independently of the quantity supplied and the velocity of the air stream; if we have for supplying the fuel a jet in the form of a short tube of small bore with a head of liquid above it exactly equal to the height which is capable of just balancing the capillary effects with atmospheric pressure above the liquid and no velocity and atmospheric pressure of the air surrounding the jet, no fuel will flow. If, however, there is a depression however small around the jet produced for example by the suction of the engine, a flow of liquid will take place through the jet which will follow very accurately the formula:—

$$q = \phi\omega\sqrt{2g\gamma \triangle p}$$

where ϕ = a constant
ω = the sectional area of the jet
γ = specific gravity of the fuel
$\triangle p$ = the difference of pressure on the surface of the liquid and the under surface of the jet.

Moreover since the depression in a pipe

[P

through which air is being drawn by suction follows an exactly similar formula it will be seen that under the conditions specified the mass of liquid passing through the jet will be exactly in direct proportion to the mass of air flowing past the jet and that this proportion will be independent of the velocity of flow. By this means, therefore, it is possible to supply mixture of constant proportions to an engine, provided the same depression acts on the fuel and on the air.

In order to obtain this result it is essential that the fuel at the jet is subjected to a constant static pressure very accurately defined and which I have termed the pressure due to capillary effects. This pressure may be obtained by various means, for example:—

(1) The jet may be submerged beneath the surface of the liquid at a depth exactly equal to the head corresponding to the pressure due to capillary effects;

(2) The liquid in the float chamber may be at the same level as in the jet but an artificial pressure may be created on the liquid, this pressure being equal to the capillary pressure above defined, for example, exhaust gases may be employed to produce the required pressure.

A carburettor constructed in accordance with the above method will not required any adjustment or correction of the mixture for different air velocities, the size of the jet and the diameter of the air passage being in constant proportions, the proportion I have found correct being very nearly 1 to 20 for a fuel such as petrol.

No matter what may be the torque or speed of the engine the mixture with such an arrangement will always be in constant proportions, a result which has never previously been obtained by any combination. In various cases, it has been proposed to provide a head above the jet of the carburettor, but my invention is based on the discovery that there is only one very clearly defined head possible in order to obtain constant proportions of mixture. This head is that defined above. A higher or lower head differing only 20 *per cent.* from the exact value required by the theory would vitiate the results obtained.

The method and apparatus according to the invention defined as above indicated enables a constant proportion of mixture to be obtained in carburettors and other devices working either under suction or pressure by subjecting the fuel at the jet to an initial pressure independently of the suction and almost exactly equal to the head corresponding to capillary effect. This critical head or pressure can be ascertained by experiment and may be made fixed or adjustable by suitable means so as to take into account variations of temperature or other causes independent of the suction of the engine.

In carrying the invention into effect as applied to a carburettor of the inverted jet type such as is described in my Patent Specification No. 155,001, all that is necessary is to arrange the head above the jet according to the principles I have enunciated above. In applying the invention to another type of carburettor in which the liquid stands at the same level in the jet as in the float chamber an additional head must be provided which may be effected by means of exhaust gases raising the pressure above the fuel in the float chamber to the desired extent. The rise of pressure may be conveniently controlled by a valve of suitable weight limiting the additional head exactly to that equivalent to the capillary effects.

In another example of the invention applied to a blow lamp, the compressed air passing to the jet may pass through a valve of definite proportions and weight and part of the air on the supply side of this valve may be led to the float chamber, the difference in pressure above and below the valve in the air supply pipe is thus available and should be made equal to the head due to capillary effect required for the purpose of the invention.

It will be obvious that there are many other applications of the principle above described, and the invention is by no means limited to the specific examples given above.

Dated the 5th day of April, 1922.

W. GRYLLS ADAMS,
87, Victoria Street, London, S.W. 1,
Chartered Patent Agent.

PROVISIONAL SPECIFICATION.

No. 10,697, A.D. 1922.

Improved Method and Apparatus for Producing Mixtures of Liquids and Gases.

I, GEORGE CONSTANTINESCO, of "Carmen Sylva", Beechwood Avenue, Oatlands Park, Weybridge, in the County of Surrey, a subject of the King of Great

Britain and Ireland, do hereby declare the nature of this invention to be as follows :—

The present invention relates to an improved method and means for feeding liquids into gaseous fluids in motion in any desired constant proportion, such proportion being independent of the velocity of the gas, and practically independent of the nature of many liquids in a group, and also almost independent of the temperature.

The invention is applicable to many purposes, for example, feeding fuel into air for internal combustion engines, feeding water into air for suction gas plants, and generally in any case in which a constant or known proportion of liquid to gas is to be maintained independently of the velocity of the gas, of variations in the nature of the liquid, and of temperature.

In all methods heretofore proposed for feeding liquids into gases in definite proportions in order to produce as nearly as possible a correct mixture a compromise has been made between various methods of feeding the liquid, some of which give too rich a mixture at high speeds and others too weak a mixture at high speeds and it has been attempted by combining these two characteristics to obtain a feed of liquid which approximately agrees with the constant mixture desired.

In my Patent Application No. 9760 of 1922 I have described a method and apparatus for feeding liquids into gaseous fluids in motion in any desired constant proportions by providing a head of liquid above an aperture or jet exactly equivalent to the head which is just capable of balancing the capillary and surface tension effects, the liquid being also subjected to the depression by which the gaseous current into which it is fed is produced. I have found that in apparatus of this type, the form of the jet itself is of fundamental importance. The capillary and surface tension effects are, I have found, almost entirely controlled by the formation of the external walls of the jet and more particularly the shape of the extreme end of the jet; and this is particularly the case with liquids, such as petrol, which are readily vaporisable and readily wet any solid surface with which they are in contact.

When a liquid is fed through a jet the resistance to flow of the liquid under relatively small pressures or suction is mainly due to surface tension and depends on the curvature of the surface of the meniscus formed by liquid fed slowly through the jet.

In the case of a jet of small aperture with square ends at right angles to the axis, it is found that a liquid such as petrol wets the whole of the under surface of the jet so that the diameter of the meniscus is not that of the aperture of the jet, but is substantially of the same diameter as the outer edge of the jet. On the other hand, if the jet is formed with sharpened edges, although the whole of the bottom edge of the jet may be wetted by the liquid, the meniscus is necessarily of small diameter and approximates to the diameter of the aperture in the jet with the result that a much greater proportional resistance to flow is experienced.

The present invention consists in a method and apparatus for feeding liquids into gases in constant proportions through jets designed so that the surface tension effect shall be substantial so that the head required to overcome capillary and surface tension effect is considerable relatively to the variations of the level of the liquid in the reservoir from which the liquid is fed.

The invention also consists in providing a number of small jets for feeding liquids into gases in constant proportions, the jets being so designed that surface tension effects are made as large as conveniently possible.

The invention further consists in the improved means for feeding liquids into gases hereinafter described.

In carrying the invention into effect, for example, as applied to a carburettor, there is provided at the bottom of the float chamber, which may be of any known type, an inverted jet fitted into an upwardly projecting sleeve so that the entrance to the jet from the carburettor is normally above the level of the fuel in the float chamber. The jet is surrounded by a thimble which allows very little free space above the entrance to the jet, this space being filled with the liquid in the float chamber when suction is applied to the jet. The jet is of conical form on its exterior surface with a small enclosed angle, the walls coming to a moderately sharp edge so that any meniscus formed will approximate in diameter to the aperture to the jet. In this way the surface tension effect is made as large as possible relatively to the other forces acting on the liquid flowing through the jet.

Immediately below the jet there is provided a baffle of inverted conical form having small apertures on the air inlet side and a slot on the engine side, and the throttle which is of butterfly type is pivoted immediately below the jet. For large carburettors a number of jets are preferably employed.

In my Patent Specification No. 9760 of 1922, above referred to, I have explained the method by which the laws governing the flow through the jet and the flow of air in the pipe into which the liquid is to be fed may be made use of to provide a constant mixture. The method described in the said specification requires a head of liquid as nearly as possible equal to the head required to overcome capillary and surface tension effects and according to the present invention, these effects are made relatively large so that the difficulty of providing the exact head necessary is minimised.

The theory of the improved form of jet may be expressed as follows :—

If p is the pressure per unit of surface acting radially outwards on the meniscus skin formed in the bottom of the jet, d the diameter of the meniscus, σ the surface tension per unit of length of the liquid to be fed, γ the specific gravity of liquid, and h the height of liquid corresponding to the pressure p, we have $p\pi\frac{d^2}{4}=\sigma\pi d$ from which $p=\frac{4\sigma}{d}=\gamma h$ and $h=\frac{4\sigma}{d\gamma}$.

It is evident from this that the head required to overcome surface tension is inversely proportional to the diameter of the meniscus, so that with a liquid such as petrol in which the whole of the lower surface of the jet is wet, the surface tension effect can be increased by providing sharpened edges.

It is remarkable that the ratio $\frac{\sigma}{\gamma}$ has approximately the same value for a large number of spirits used as fuels, such as petrol, benzol, alcohol, paraffin, turpentine *etc.*, and is very nearly equal to $^1/_{30}$ cm² (for water it is about $^1/_{15}$ cm²), therefore we have numerically

$$h=\frac{2}{15d}.$$

If h and d are in millimeters we have $h=\frac{40}{3d}$ for the motor spirits group, and $h=\frac{80}{3d}$ for the water group. It is also remarkable that this ratio for motor spirits varies very little with temperature, for practical purposes it may be taken as constant.

It is to be observed that in a carburettor made according to this invention, no adjustment of any kind is necessary nor for flow running no full charge of the engine the mixture being always in the constant ratio required and which depends only from the relative size of section of jet and section of air intake.

Dated the 13th day of April, 1922.

W. GRYLLS ADAMS,
87, Victoria Street, London, S.W. 1,
Chartered Patent Agent.

COMPLETE SPECIFICATION.

Improved Method and Apparatus for Producing Mixtures of Liquids and Gases.

I, GEORGE CONSTANTINESCO, of "Carmen Sylva", Beechwood Avenue, Oatlands Park, Weybridge, in the County of Surrey, a subject of the King of Great Britain and Ireland, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

The present invention relates to a method and apparatus for feeding liquids into gaseous fluids in motion in any desired proportion such proportion being independent of the pressure difference on the two sides of the jet or the velocity of the gas.

In some cases there may be superposed on the constant proportion an additional or diminishing proportion of liquid to gas to meet special circumstances.

The invention is applicable to many purposes, for example, feeding fuel into air for internal combustion engines, feeding water into air for suction gas plants, and generally in any case in which a constant or known proportion of liquid to gas is to be maintained independently of the velocity of the gas or of variations in the nature of the liquid and of temperature.

The invention is especially applicable to devices such as carburettors for internal combustion engines, blow lamps, fuel atomisers or other devices in which liquid fuel has to be supplied in constant proportion to the volume of a stream of air in which the velocity of flow varies between wide limits.

In methods heretofore proposed for feeding liquids into gases in definite proportions in order to produce as nearly as possible a correct mixture a compromise has been made between various methods of feeding the liquid, some of which give too rich a mixture at high gas velocities and others too weak a mixture at high gas velocities and it has been attempted by combining these two characteristics to obtain a feed of liquid which approximately agrees with the constant mixtures desired.

In my Specification No. 17,176/1914, I have described a carburettor having an inverted jet in which the supply of fuel depends upon two factors, one of which is dependent on the suction in the inlet pipe, while the other is positive and depends on a constant head of fuel which is at least sufficient to overcome the surface tension of the fuel in the delivery orifice. In such carburettor, however, owing to the variable nature of flat ended jet, the effect of the constant head of fuel is very variable.

The present invention is based on the principle that the flow of a liquid through an aperture or short tube of small bore and with a suitably formed outlet is proportional to the square root of the pressure difference on the two sides of the aperture or tube, hereinafter called the depression, minus a constant, depending on surface tension effects *i.e.* if Q is the flow, dp the pressure difference and k the constant, Q is proportional to $\sqrt{(dp)-k}$ surface tension effects. It follows that if a jet is arranged at the same level as the level of the liquid in the tank supplying it and if the depression is only just sufficient to balance capillary and surface tension effects no delivery of liquid through the jet will take place.

The present invention consists in a method for feeding liquids into gaseous fluids in motion in any desired constant proportions using an inverted jet with sharpened edges and designed so that the surface tension effect is substantial, the head of liquid above the jet being exactly equivalent to the head which is just capable of balancing the capillary and surface tension effects, the liquid being also subjected to the depression by which the gaseous current into which it fed is produced.

The invention also consists in a carburettor using inverted jets with sharpened edges having a number of small jets for feeding liquids into gases in constant proportions, the jets being so designed that surface tension effects are made as large as conveniently possible.

The invention further consists in the improved method and means for supplying mixtures of liquids and gases in constant proportions with or without an additional proportion arranged to meet special circumstances hereinafter described.

Suppose for example it is desired to supply to an internal combustion engine a mixture of air and liquid fuel the proportions by weight of which are constant independently of the quantity supplied and the velocity of the air stream; if we have for supplying the fuel a jet in the form of a short tube of small bore with a head of liquid above it exactly equal to the height which is capable of just balancing the capillary effects with atmospheric pressure above the liquid and no velocity and atmospheric pressure of the air surrounding the jet, no fuel will flow. If, however, there is a depression however small around the jet produced for example by the suction of the engine, a flow of liquid will take place through the jet, which will follow very accurately the formula:—

$$q=\phi\omega\sqrt{2g\gamma\,\triangle p}$$

where ϕ = a constant
ω = the sectional area of the jet
γ = specific gravity of the fuel
$\triangle p$ = the difference of pressure on the surface of the liquid and the under surfaces of the jet.

Moreover since the air flow and depression in a pipe through which air is being drawn by suction are connected by an exactly similar formula, it will be seen that under the conditions specified the mass of liquid passing through the jet will be exactly in direct proportion to the mass of air flowing past the jet and that this proportion will be independent of the velocity of flow. By this means, therefore, it is possible to supply mixture of constant proportions to an engine, provided the same depression acts on the fuel and on the air.

In order to obtain this result it is essential that the fuel at the jet is subjected to a constant static pressure very accurately defined and which I have termed the pressure due to capillary effects. This pressure may be obtained by various means, for example:—

(1) The jet may be submerged beneath the surface of the liquid at a depth exactly equal to the head corresponding to the pressure due to capillary effects;

(2) The liquid in the float chamber may be at the same level as in the jet but an artificial pressure may be created on the liquid, this pressure being equal to the capillary pressure above defined, for example, exhaust gases may be employed to produce the required pressure.

I have found that in apparatus of this type, the form of the jet itself is of fundamental importance. The capillary and surface tension effects are, I have found, almost entirely controlled by the formation of the external walls of the jet and more particularly the shape of the extreme end of the jet and this is particularly the case with liquids, such as petrol, which are readily vaporisable and readily wet any solid surface with which they are in contact.

When a liquid is fed through a jet the resistance to flow of the liquid under relatively small pressures or suctions is mainly due to surface tension and depends on the curvature of the surface of the meniscus formed by liquid fed slowly through the jet.

In the case of an inverted jet of small aperture with square ends at right angles to the axis, it is found that a liquid such as petrol wets the whole of the surface of the end of the jet so that the diameter of the meniscus is not that of the aperture of the jet, but is substantially of the same diameter as the outer edge of the jet. On the other hand, if the jet is formed with sharpened edges, although the whole of the surface of the end of the jet may be wetted by the liquid, the meniscus is necessarily of small diameter and approximates to the diameter of the aperture in the jet with the result that a much greater proportional resistance to flow is experienced.

The theory of the improved form of jet may be expressed as follows:—

If p is the pressure per unit of surface acting radially outwards on the meniscus skin formed in the the bottom of the jet, d the diameter of the meniscus, σ the surface tension per unit of length of the liquid to be fed, γ the specific gravity of liquid, and h the height of liquid corresponding to the pressure p,

we have $p\pi\frac{d^2}{4}=\sigma\pi d$, but $p=\gamma h$ so that

$p=\frac{4\sigma}{d}=\gamma h$ and $h=\frac{4\sigma}{d\gamma}$.

It is evident from this that the head required to overcome surface tension is inversely proportional to the diameter of the meniscus, so that with a liquid such as petrol in which the whole of the lower surface of the jet is wet, the surface tension effect can be increased by providing sharpened edges.

It is remarkable that the ratio $\frac{\sigma}{\gamma}$ has approximately the same value for a large number of spirits used as fuels, such as petrol benzol, alcohol, paraffin, turpentine *etc.*, and is very nearly equal to $^1/_{30}$ cm^2 (for water it is about $^1/_{15}$ cm^2), therefore we have numerically—

$$h=\frac{2}{15d}.$$

If h and d are in millimetres we have

$h=\frac{40}{3d}$ for the motor spirits group, and

$h=\frac{80}{3d}$ for the water group. It is also remarkable that this ratio for motor spirits varies very little with temperature, for practical purposes it may be taken as constant.

A carburettor constructed with an inverted jet with sharpened edges and with a head of liquid above it as above indicated will not require any adjustment or correction of the mixture for different air velocities, the diameter of the jet and the diameter of the air pass age being in constant proportions, the linear proportion I have found correct being very nearly 1 to 20 for a fuel such as petrol, or their relative areas being therefore in the proportion of 1 to 400.

No matter what may be the torque or speed of the engine the mixture with such an arrangement will always be in constant proportions, a result which has never previously been obtained by any combination. In various cases, it has been proposed to provide a head above the jet of the carburettor, but my invention is based on the discovery that there is only one very clearly defined head possible in order to obtain constant proportions of mixture. This head is that defined above. For example, a higher or lower head differing only by a few millimetres from the exact value required by the theory would vitiate the results obtained.

According to another method the pressure necessary to balance capillary effects may be obtained by introducing exhaust gases from the engine to the float chamber through a small aperture a relief valve being provided of such weight that the pressure in the float chamber is exactly equal to the pressure which will balance capillary effects.

The method and apparatus according to the invention defined as above indicated enables a constant proportion of mixture to be obtained in carburettors and other devices working either under suction or pressure by subjecting the fuel at the jet to an initial pressure independently of the suction and almost exactly equal to the head corresponding to capillary effect. This critical head or pressure can be ascertained by experiment and may be made fixed or adjustable by suitable means so as to take into account variations of density temperature or other causes independent of the suction of the engine for instance change of size of jet or of the nature of the fuel used.

Referring to the accompanying drawings :—

Figure 1 is an elevation of a carburettor constructed according to this invention;

Figure 2 is a sectional elevation on the line 2—2, Figure 1, the parts being shown without fuel in the float chamber;

Figure 3 is a part sectional elevation on the line 3—3, Figure 2;

Figure 4 is a plan of the carburettor, while

Figure 5 is an inverted plan;

Figure 6 is a diagrammatic view showing the application of the invention to feeding fuel to furnaces for boilers or the like;

Figure 7 shows a form of jet suitable for a carburettor to be employed for feeding a mixture of air and oil fuel for furnaces for heating boilers or the like;

Figures 8 and 9 show other forms of jet suitable for the same purpose.

Figure 10 is an enlarged view of the carburettor showing the fuel level.

In carrying the invention into effect as illustrated at Figures 1 to 5 as applied to carburettors for high speed internal combustion engines such as are used in automobiles, the body of the carburettor which forms the float chamber *a* is cast in one piece with a portion of the induction pipe *b*. The throttle valve *c* is of butterfly type and is situated immediately under the jet *d*, a conical baffle *e* being provided below the jet projecting into the induction pipe. The fuel inlet *f* is situated at the side of the float chamber and is controlled by a horizontal valve *g* moving in suitable guides *h* and actuated by means of the float *k* acting on the lever *l*. The jet itself is formed with sharp edges and is of a definite internal diameter which should be about 5 *per cent*. of the effective choke in the induction pipe. For powers up to 40 H-P in four cylinders a jet of $1^m/_m$ diameter is suitable. The body of the jet is merely pushed into the upwardly projecting sleeve *m* which is surrounded by an outer sleeve *r* whose lower end rests on a conical seat *o*, petrol being allowed to enter the space between the two sleeves through the apertures *p*. The float is formed with a central aperture through which the sleeve *r* passes. The weight of the float and the form of the lever *l* are such that the head of petrol above the lower end of the jet when there is no depression is exactly that which is sufficient to overcome surface tension and capillary effects with the result that a constant mixture is obtained independently of the depression as explained above. This head is indicated at Figure 10 by the arrow *z*. The throttle valve *c* is mounted on a spindle at one end of which there is fixed by means of a set-screw an arm r^1 which is actuated by a pin *s* on the throttle lever *t*. A moderately light spring *u* is provided which always tends to keep the throttle lever in the closed position and a second stronger spring *v* is provided which comes into action when the throttle is in the full open position and the lever is pressed beyond this position reversing the direction of inclination of the butterfly valve. By this means at starting the high suction of the engine is allowed to act directly on the jet. There is provided in the throttle valve a small aperture in proximity with the baffle which corrects the mixture to give the right porportions of fuel and air for slow running when the throttle is very nearly closed.

It will be seen that the carburettor is symmetrical about a transverse plane so that either side may be attached to the engine as convenient.

It will be seen from the above description and the drawings that no screwing is necessary in order to assemble the carburettor which can be completely taken down without requiring any special tools. In order to avoid the unpleasant sound due to the petrol passing the edge of the throttle valve when this is nearly closed, a baffle *w* is provided comprising a cap with a suitable air space and a gauze damper held by bolts on to the flange on the inlet side of the carburettor.

It is to be observed that in a carburettor made according to this invention, no adjustment of any kind is necessary either for slow running or for full charge of the engine, the mixture being always in the constant ratio required which depends only upon the relative size of section of jet and section of air intake.

It has been found that to produce the best result the internal bore of the jet should be slightly conical, the cross sectional area decreasing towards the tip of the jet. The form of the end of the jet is of very great importance. Owing to the fact that when a jet has been in use sometime, the petrol soaks into the pores of the metal, a jet with square ends of considerable thickness will give very variable results owing to the uncertain size of the drop which is formed at the end of the jet. As the capillary resistance depends chiefly upon the surface tension effect produced by the outer film of this drop, it will be seen that the flow will vary according to the size of the meniscus. In a jet with square ends of considerable thickness there will be considerable variations in form and size of the drop formed as the velocity of flow is varied. It is not practicable to make the edges of the jet of less than say .2m/m in thickness owing to the liability to damaging the jet. There is therefore necessarily some thickness at the extreme end of the jet and some variation of the diameter of the meniscus with the rate of flow of fuel. It happens, however, that in a carburettor for high speed internal combustion engines, it is desirable to have a richer mixture for starting; that is to say, at low rates of flow it is desirable to have a rather richer mixture than at the higher speeds. Owing to the variation in size of meniscus described above, a jet with moderately thin square ends automatically gives a higher proportion of fuel at the very low speeds while at higher speeds the meniscus decreases in diameter with the result that the mixture remains practically constant over a large range of engine speed.

In cases in which a number of small jets are employed in close proximity to each other, it is desirable to provide means by which the running together of the various drops is prevented. This may be done by packing between the jets a hygroscopic material which the petrol or other fuel is unable to wet. By this means the meniscus can be strictly confined to the outer edge of the metal at the tip of the jet. A suitable material for packing is cotton wool soaked in water and glycerine; or a hygroscopic material such as hyposulphite of soda, or other hygroscopic salt may be employed.

Owing to the fact that the internal diameter of the jet must be kept small, in large sizes of carburettors it will be necessary to place a large number of jets close together.

In the apparatus shown at Figures 6 to 9 the invention is applied to the fuel feed in a furnace.

In this form of the invention a closed fuel tank 31 is provided above the carburettor 32. Compressed air from the fan 33 is led by the pipe 34 to the induction pipe 35 of the carburettor and the carburetted air passes by the pipe 36 to the ordinary furnace burner 37. A branch pipe 38 leads from the pipe 34 to the top of the fuel tank, so that the pressure on the top of the fuel is the same as the pressure in the pipe 34. A second branch pipe 39 also leads to the top of the float chamber of the carburettor.

The carburettor itself is constructed as above described with the exception that there is provided a jacket 40 surrounding the float chamber with suitable inlet and outlet pipes 41 and 42 by which a heating fluid can be circulated. A cock 43 is provided in the passage leading from the fuel tank to the fuel inlet 44 of the carburettor.

Various forms of jet suitable for use with this carburettor are shown at Figures 7, 8 and 9. It is important that one dimension at least of the aperture of the jet should not be more than .5 to 1m/m and the extra jet area required is obtained by increasing the dimensions of the jet or jets in the other direction.

In Figure 7 the aperture is formed between an internal conical member 46 and the outer member 47 so that an annular passage of width about 0.5m/m is provided.

In the form shown at Figure 8, three jets are provided, while in the form shown at Figure 9, a single flat jet is used, bell shaped flanges being provided on the jet body to protect the jet itself.

In this case as in the carburettor above described, the level of the liquid in the float chamber is such that there is a static head which will give a pressure equal to that due to capillary and surface tension effects so that the law governing the flow of air is the same as that governing the flow of fuel from the carburettor.

It will be seen that many other applications of the invention are possible where it is desired to produce a mixture of liquid and gas of a composition independent of the velocity of flow.

In another example of the invention applied to a blow lamp, the compressed air passing to the jet may pass through a valve of definite proportions and weight and part of the air on the supply side of this valve may be led to the float chamber, the difference in pressure above and below the valve in the air supply pipe is thus available and should be made equal to the head due to capillary effect required for the purpose of the invention.

It will be obvious that there are many other applications of the principle above described, and the invention is by no means limited to the few specific examples given.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A method for feeding liquids into gaseous fluids in motion in any desired constant proportions by using an inverted jet or jets with sharpened edges and designed so that the surface tension effect is substantial, the head of liquid above the jet being exactly equivalent to the head which is just capable of balancing

the capillary and surface tension effects, the liquid being also subjected to the depression by which the gaseous current into which it is fed is produced.

2. Apparatus for feeding liquids into gaseous fluids according to the method claimed in Claim 1.

3. A carburettor for high speed internal combustion engines constructed to function according to the method claimed in Claim 1.

4. The improved carburettor for high speed internal combustion engines substantially as hereinbefore described and as illustrated at Figures 1 to 5 and 10 of the accompanying drawings.

5. In apparatus according to Claim 2, a number of jets having between them a packing of hygroscopic material.

6. Apparatus for feeding a mixture of air and fuel to furnaces substantially as hereinbefore described and illustrated at Figure 6 of the accompanying drawings.

7. The improved jets for feeding liquids into gases in motion in constant proportions by the method claimed in Claim 1 as hereinbefore described and illustrated at Figures 1, 7, 8 and 9 of the accompanying drawings.

Dated the 5th day of January, 1923.

W. GRYLLS ADAMS,
87, Victoria Street, London, S.W. 1,
Chartered Patent Agent.

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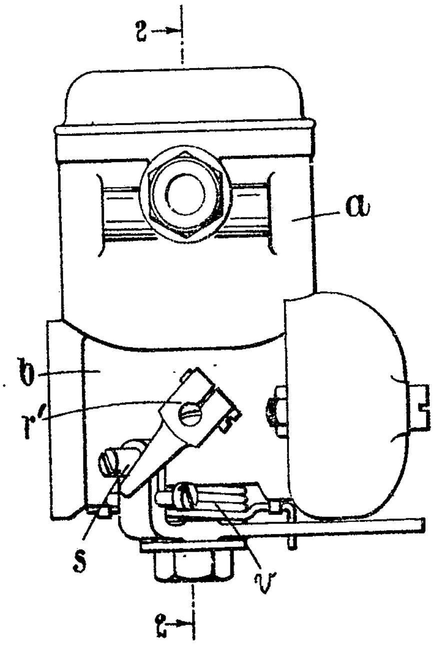
[Wt. 56A.—50/10/1928.]

2nd Edition

Fig. 1.



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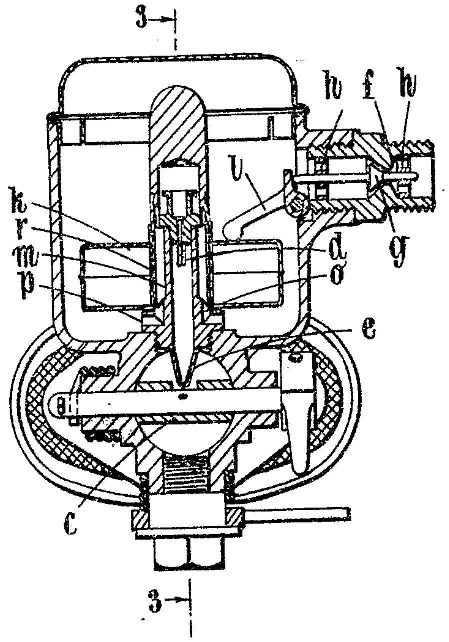
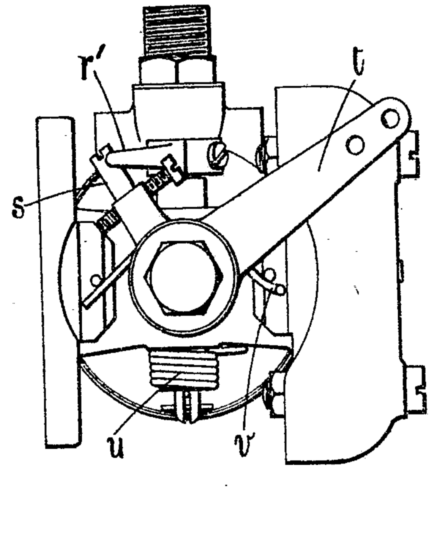


Fig. 5



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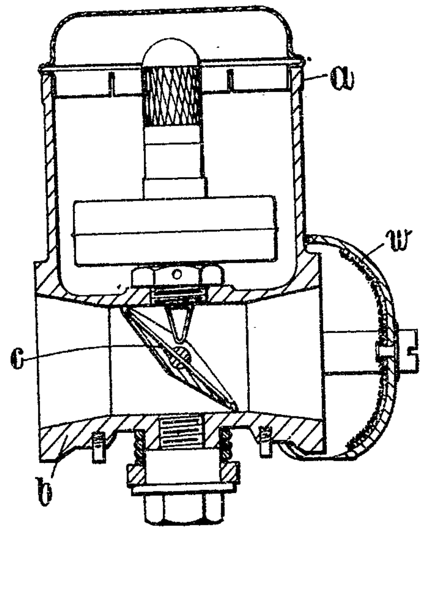

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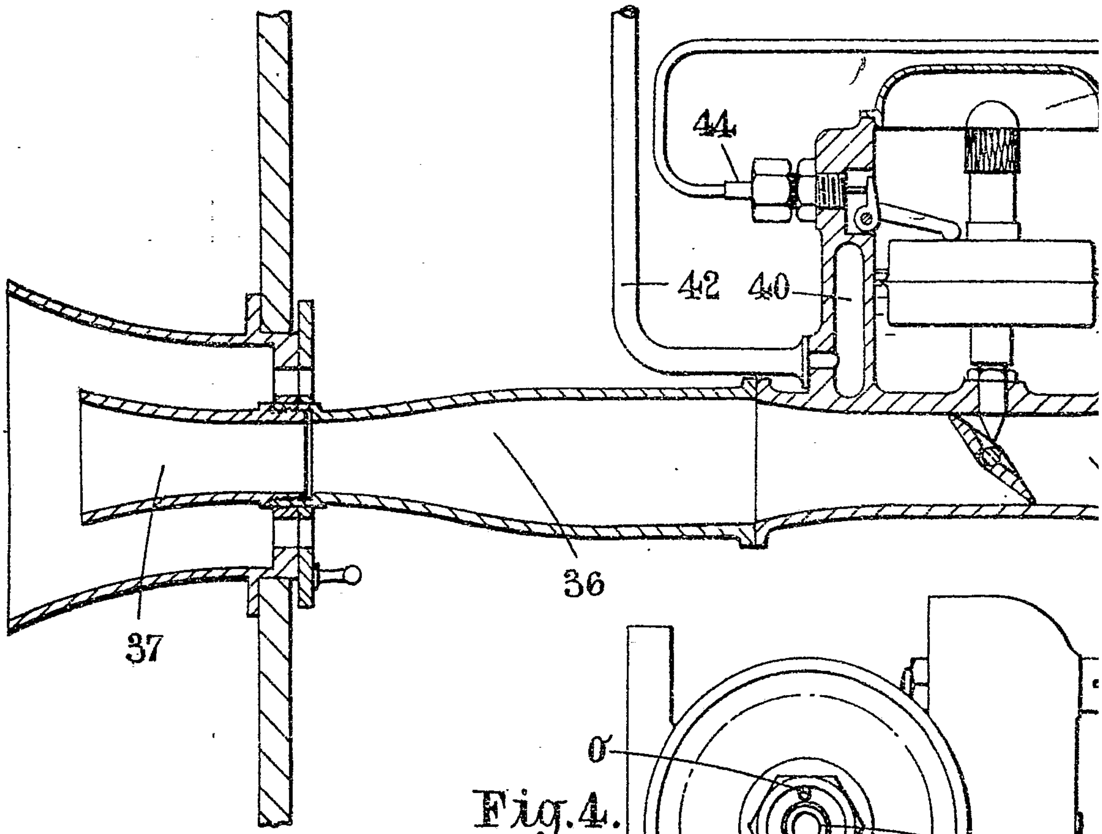
Fig. 6.



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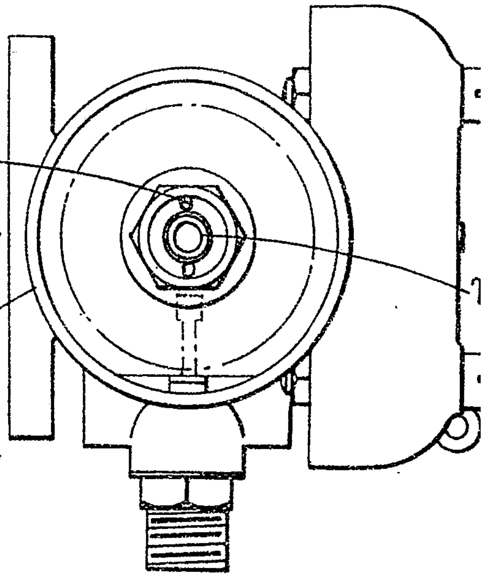

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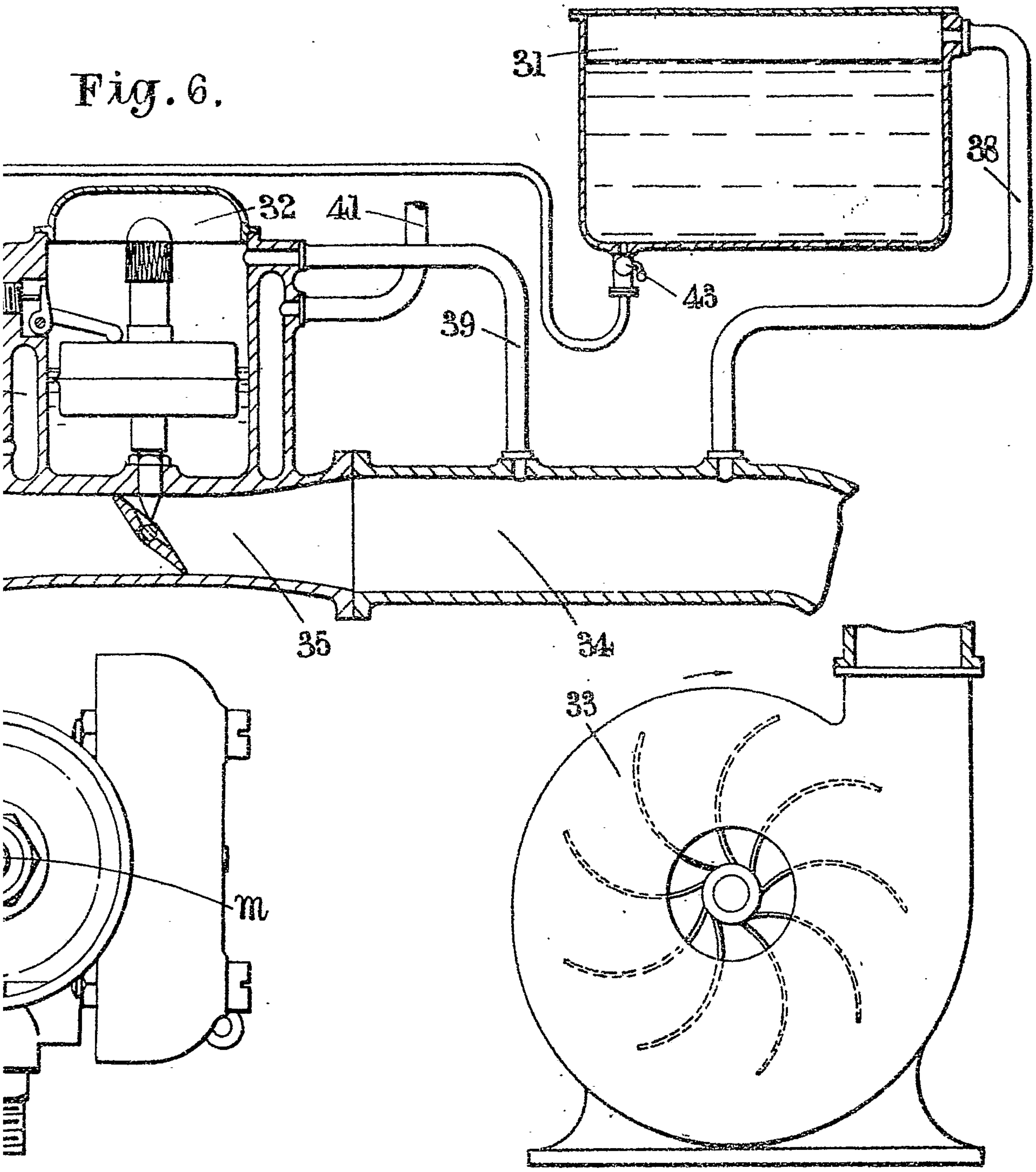

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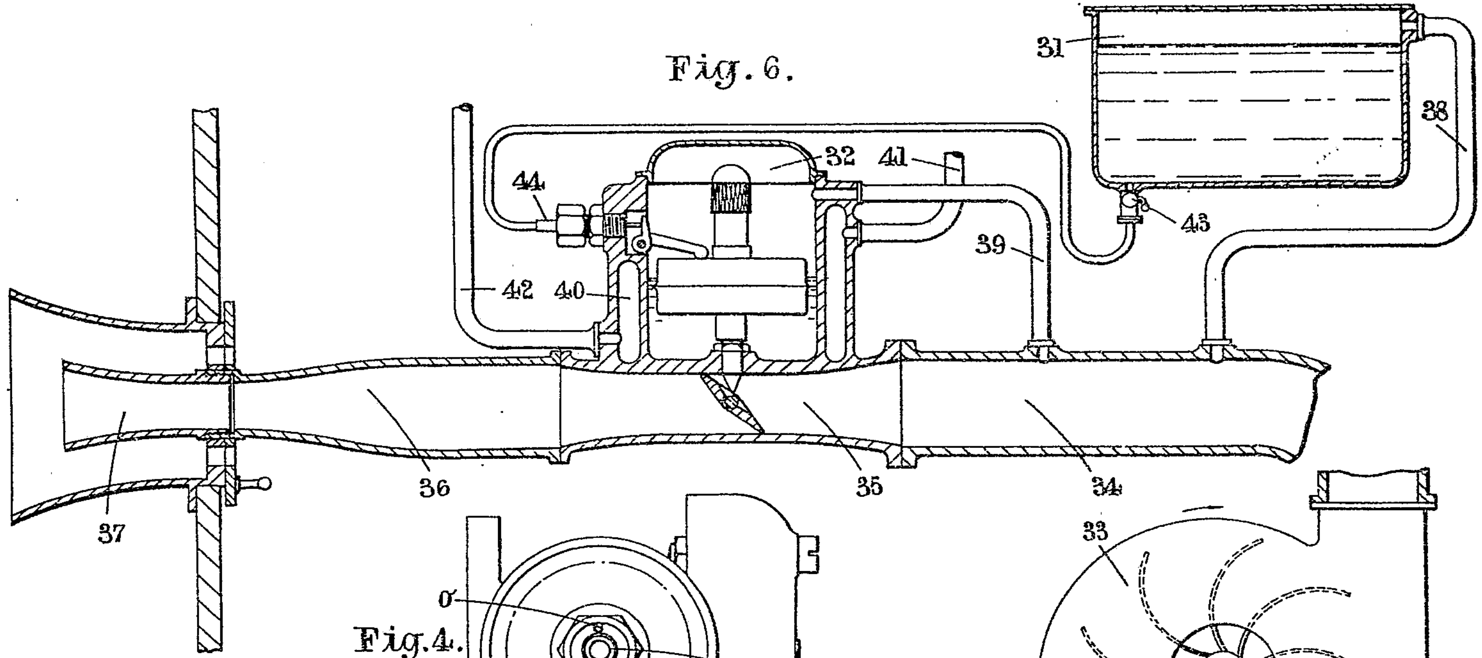
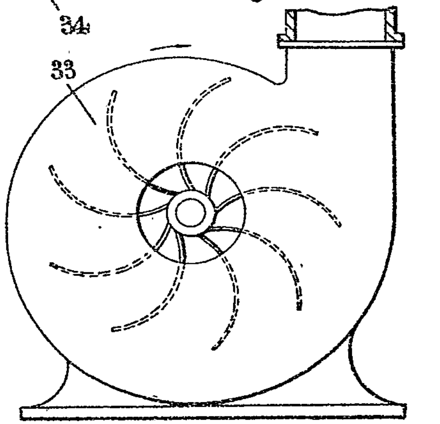
Fig. 6.





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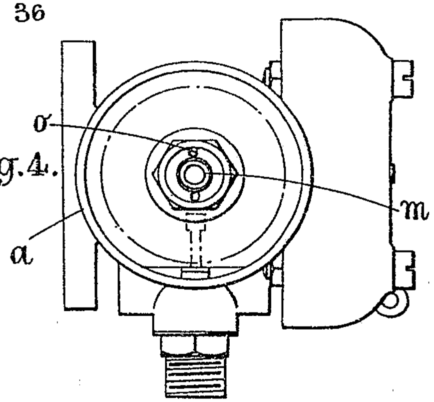

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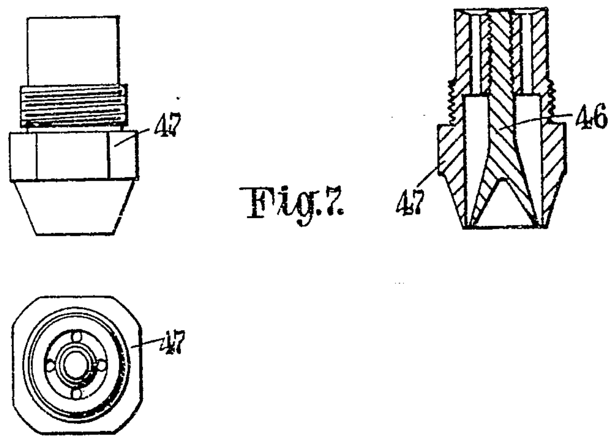

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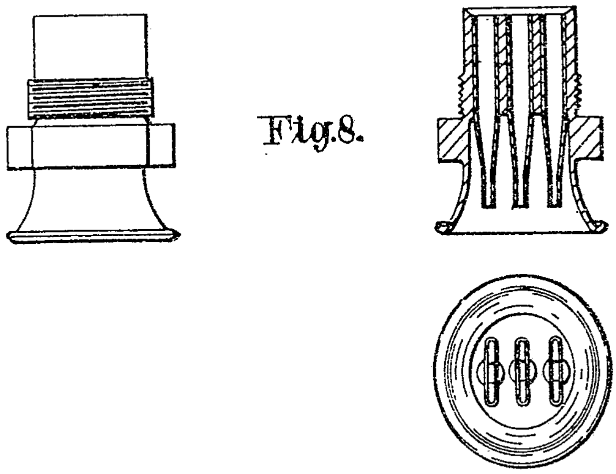

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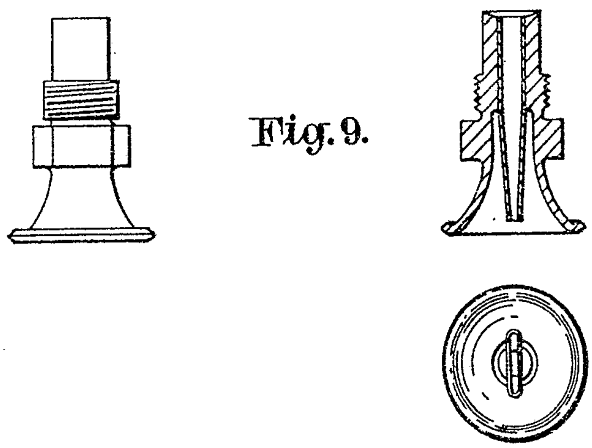
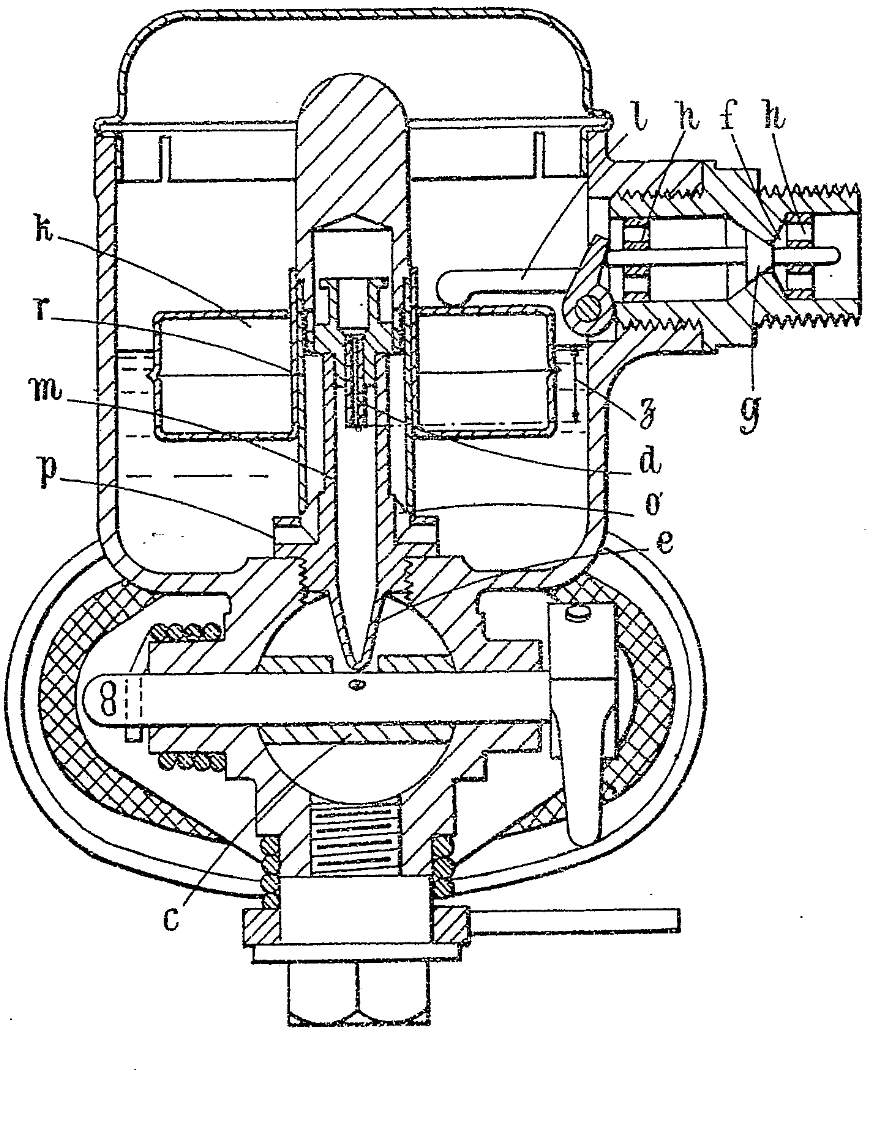


Fig.9.

Fig. 10.



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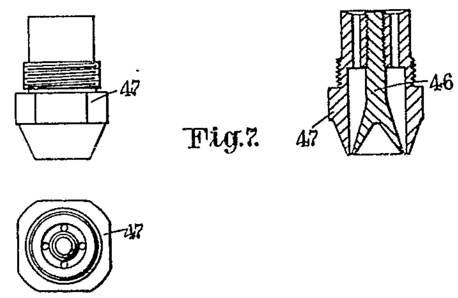

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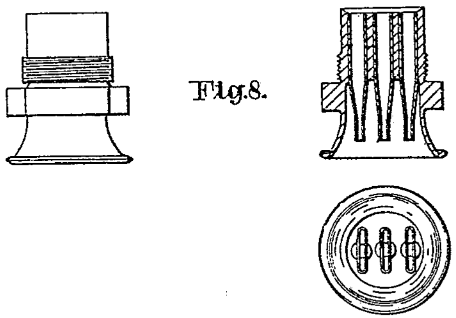

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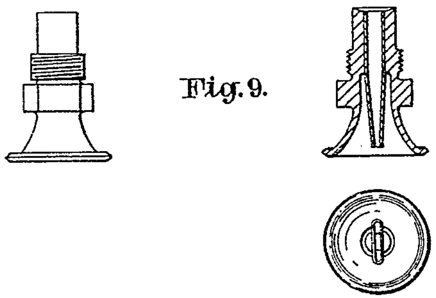
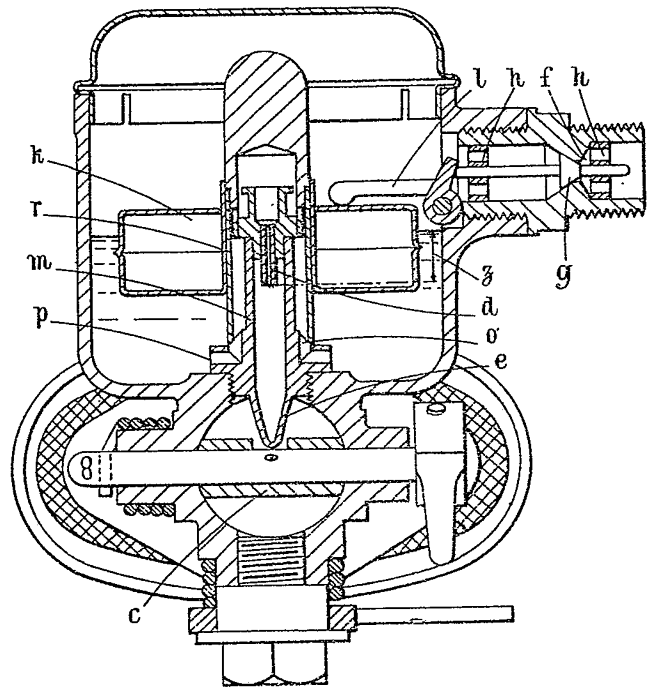


Fig.9.

Fig.10.



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