No. 832,183. PATENTED OCT. 2, 1906.

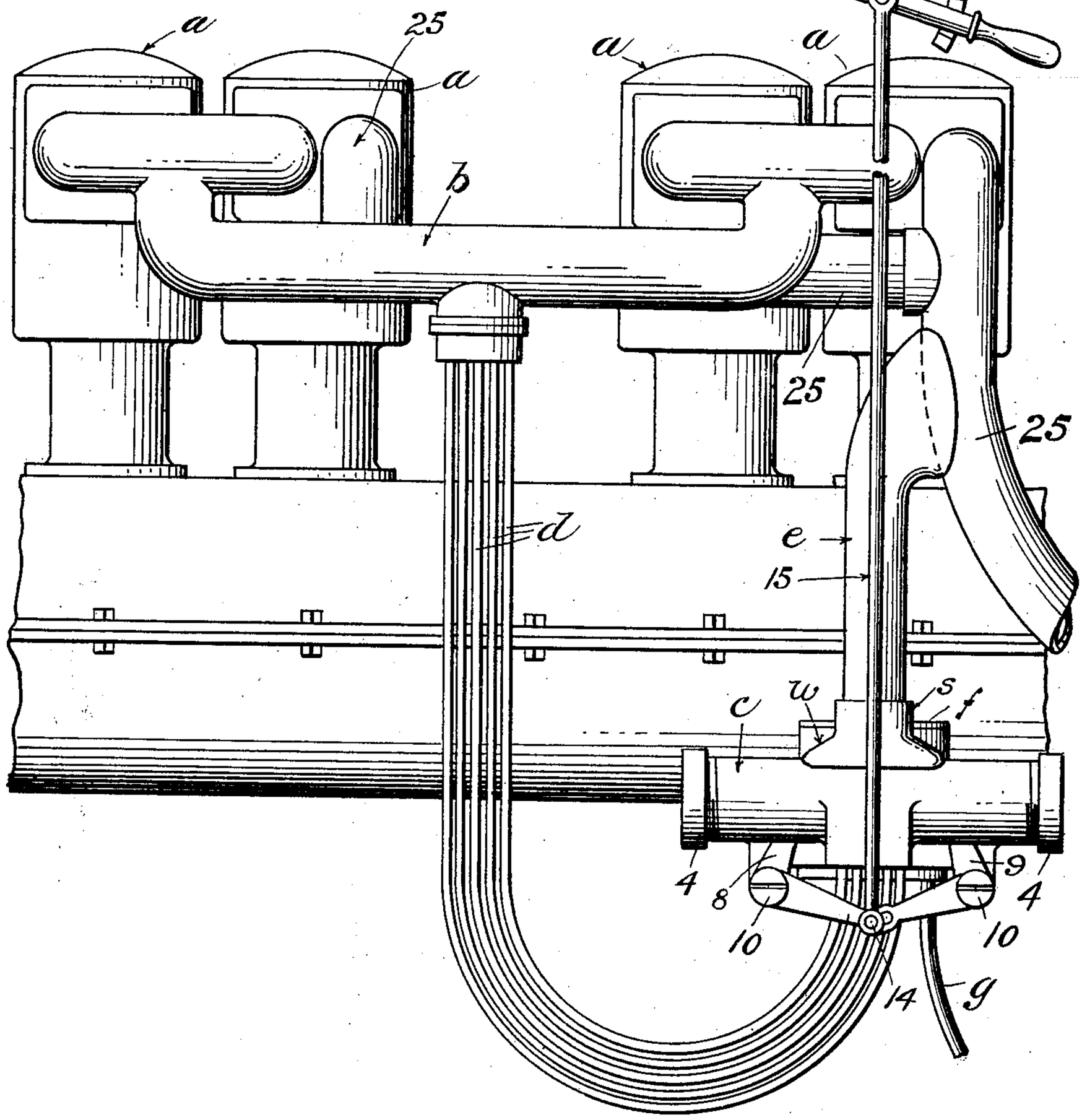
J. F. DURYEA & W. M. REMINGTON.

CARBURETER.

APPLICATION FILED JUNE 19, 1905.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2.

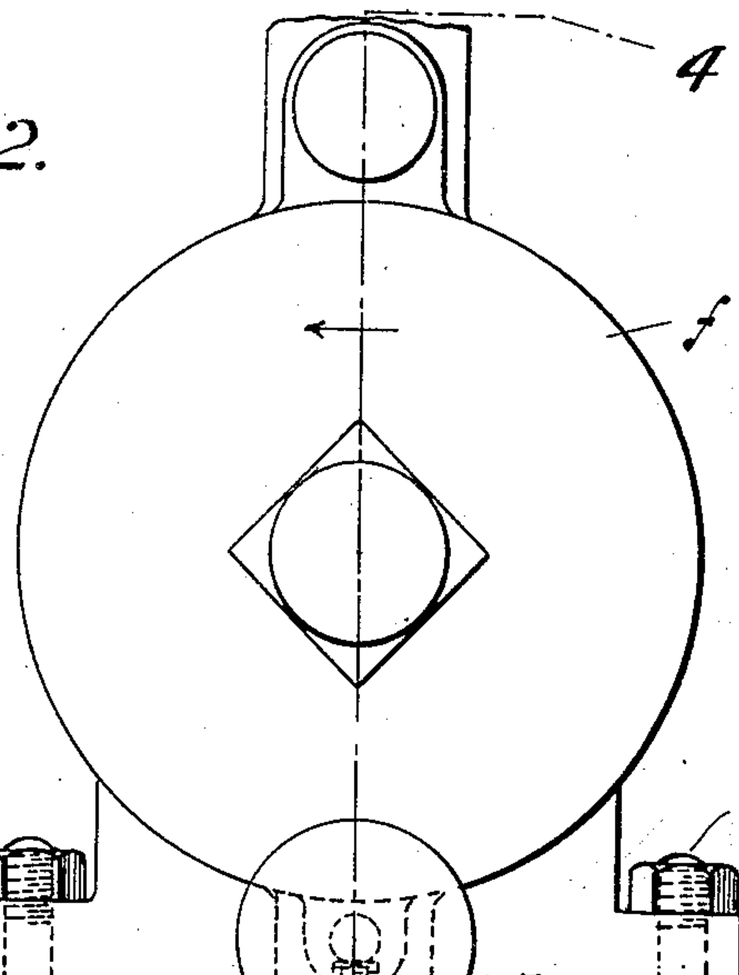

Fig. 3.

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3 SHEETS—SHEET 3.

Fig. 4.

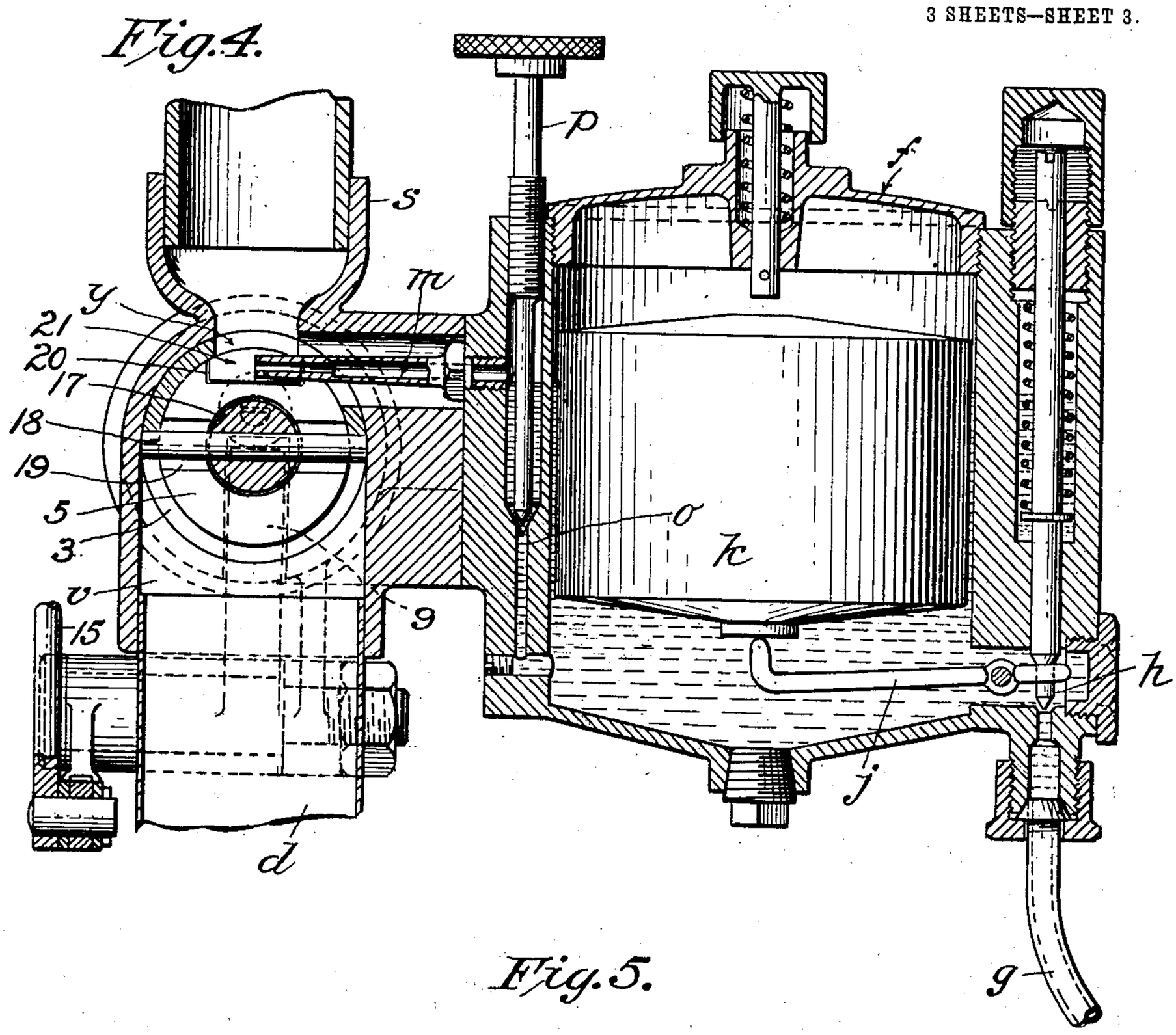
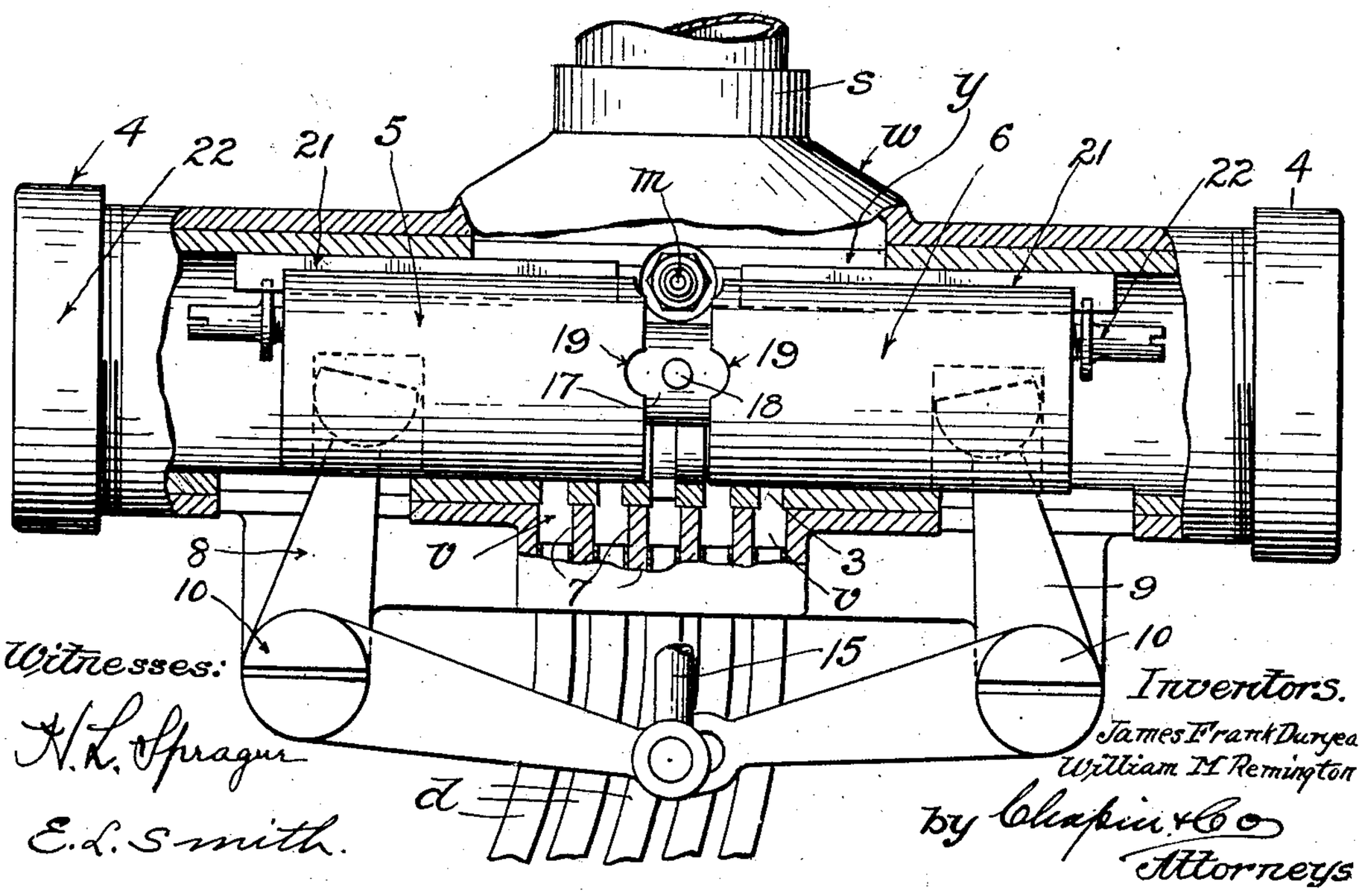


Fig. 5.



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CARBURETER.

No. 832,183. Specification of Letters Patent. Patented Oct. 2, 1906.

Application filed June 19, 1905. Serial No. 266,023.

To all whom it may concern:

Be it known that we, JAMES FRANK DURYEA and WILLIAM M. REMINGTON, citizens of the United States of America, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Carbureters, of which the following is a specification.

This invention relates to carbureters such as are used for the atomization or volatilization of liquid fuels and the proper mixing therewith of the required volume of air to produce a combustible mixture, the carbureter being of that type in which, as is well known, the principle of operation involves means for drawing air through a passage into which a regulated quantity of liquid hydrocarbon is drawn through a suitable inlet by the aspirating effect of the movement of the air through the passage past said inlet-opening, whereby the liquid may be volatilized or atomized and mingling with the air constitute the agent whose combustion within the cylinder of the engine actuates the piston of the latter.

It has been shown in practice that in many kinds of work to which internal-combustion engines are especially adapted far more difficulty is experienced in controlling the engine at points of varying efficiency than is the case with steam, for example, where a substantially constant pressure is used. For example, when the engines are used in driving motor-vehicles the speed and load requirements might vary, say, from one hundred revolutions per minute with practically no load to fifteen hundred revolutions per minute with a full load, and under this wide variation great difficulty has been experienced in providing a carbureter having sufficient "flexibility," as it is termed, to supply to the engine a combustible mixture in which the proportions of the combustible and air will not materially vary. This difficulty arises from the fact that if the area of the passage through the carbureter is great enough to supply the engine with a combustible of the proper proportions and volume to run the engine at its maximum efficiency this passage is then so large that when the engine demands but the minimum supply the air will move through the carbureter on the suction-stroke of the engine at such a reduced velocity as to result in the very imperfect vaporization or atomization of the combustible, and consequently the resulting mixture will be relatively poor in combustible. Therefore as the engine is throttled down the proportion of the volatilized fuel to air diminishes and eventually reaches the point where its ignition is uncertain or impossible.

The object of the present invention is to overcome these disadvantages by the provision of means whereby the area of the air-passage through the carbureter, and coincidently the capacity of the passage from the carbureter to the engine, may be varied according to the requirements of the latter, whereby the force of the aspirations which effect the volatilization of the liquid combustible may under widely-varying conditions of load on the engine be controlled in such manner as to always supply the proper quantity of combustible to the varying volume of air flowing through said passage to maintain a substantially uniform mixture.

In effect, the invention consists in the provision of means whereby the capacity of the atomizing-chamber in the carbureter and the capacity of the passage therefrom to the engine may be contracted or expanded according to the requirements of the engine, in contradistinction to the general practice at the present time of merely contracting or expanding the passage to the engine at some one point or contracting or enlarging the inlet of the atomizing-chamber.

In carrying out this invention means of connection with the carbureter are provided, extending within easy reach of the operator, whereby when it is desired to throttle down the engine the regulating devices of the carbureter are operated through these connections to vary the capacity of the air-passage through the carbureter at or near the atomizing-point in the latter and the capacity of the passage to the engine, all as will be fully described in the following specification and clearly pointed out in the claims.

The invention is fully illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of a part of an internal-combustion engine, showing a carbureter constructed according to this invention operatively applied thereto. Fig. 2 is an enlarged plan view of a carbureter in which the invention is embodied, the intake-pipe being cut off near the carbureter. Fig. 3 is a sec-

tional elevation in the plane of line 3 3, Fig. 2, showing the movable elements within the carbureter whereby the passage through the atomizing-chamber may be regulated and showing also, partly in section, the separate conduits extending from the atomizing-chamber in the carbureter to the engine. Fig. 4 is a sectional elevation in a plane at right angles to Fig. 3, the plane of the section being on line 4 4 of Fig. 3. This view shows a connection between the float-regulated hydrocarbon-reservoir and the atomizing-chamber in the carbureter. Fig. 5 is a side elevation showing the shell of the carbureter and a fixed bushing therein, broken away, the movable space-regulating elements of the carbureter being in full lines.

Referring to the drawings, *a*, Fig. 1, indicates the engine-cylinders; *b*, the intake-pipe connected with the latter; *c*, the carbureter as a whole; *d*, the pipe connections between the carbureter and the intake-pipe *b*; *e*, the intake-pipe of the carbureter.

Referring to Figs. 2, 3, and 4, *f* indicates the reservoir for the liquid hydrocarbon, which is connected by a pipe *g* with a suitable source of supply. The inlet-opening into the reservoir is controlled by a needle-valve *h* of the usual construction, automatically operated through the arm *j* by means of a float *k* to maintain the liquid combustible at the desired level in the reservoir, this, as usual, being somewhat below the level of the pipe *m*, which communicates with the interior of the reservoir through the passage *o* and extends into the atomizing-chamber of the carbureter, as clearly shown in Fig. 4, and constitutes the supply-nozzle for the combustible. This passage *o* is controlled by another needle-valve *p* of ordinary construction. No part of the invention resides in the reservoir *f*, the latter and the carbureter being secured together by the bolts *q*, or, if desired, the body of the reservoir and the shell of the carbureter may be cast together.

The carbureter proper (indicated by *c* as a whole in Fig. 1) consists of a cylindrical shell (specifically indicated by *r*) and having midway between its ends and oppositely located an inlet-opening *s* for the intake-pipe *e* and a plurality of parallel outlet-openings *v*, into which the ends of the pipes *e* enter and in which preferably they are brazed, the aggregate areas of the outlet-openings being substantially equal to the area of the inlet-opening. Preferably the intake-opening *s* in the shell is provided with an elongated enlarged base, in which is the chamber *w*, extending lengthwise of the shell. In the latter is a fixed bushing *x*, in which there is a longitudinally-disposed slot *y* in the upper side thereof within the chamber *w* and having substantially the same length as the chamber, and in the opposite side of the bushing are the several transversely-disposed slots 3, registering with the openings *v*. The shell *r* is closed at each end in any suitable way, as by screw-caps 4.

As shown in Fig. 4, about midway between the ends of the slot *y* the bushing is cut away to permit the inlet-nozzle *m* to enter the bushing, said nozzle terminating directly under the center of the chamber *w*. We have therefore a cylindrical shell for the carbureter having an inlet-opening *s* merging into the elongated chamber *w* and located opposite thereto the outlet-openings *v*, registering with the openings 3 in the bushing, and the latter having an opening communicating with the chamber *w*, whereby a straight passage extending transversely through the shell of the carbureter is provided. It is this passage through the carbureter which is controlled by suitable devices to be described, whereby the capacity thereof may be regulated and coincidently whereby the capacity of the connection leading to the engine may be coincidently controlled. We prefer to effect this regulation of the passage through the carbureter by means of two cylindrical plungers 5 and 6, the contiguous ends of which constitute movable walls of the atomizing-chamber, slidable one toward the other, to the end that when these plungers approach one another the contiguous ends thereof will cover the ends of the slot *y* through the top of the bushing and successively the various openings *v* through the bottom of the bushing until when the ends of the plungers come together the passage is entirely closed, these plungers constituting, in fact, valves for the passage through the carbureter and the space between them constituting the atomizing-chamber. The two plungers 5 and 6 come together in a vertical plane passing through the supply-nozzle *m* and through the edge of one of the partitions 7 between the openings *v*. The object of thus locating the meeting-point of the two plungers at the edge of one of the partitions 7 is that when the plungers separate the edge of the plunger 5 will immediately begin to uncover one of the openings *v*, while the edge of the plunger 6 is moving across the top of one of the partitions 7, and as the rate of movement of the plungers is equal and as the partitions have the same width as the slots *v* in the bushing it follows that by the time one of these slots has been entirely uncovered by the movement of the plunger 5 a second one will begin to be uncovered by the movement of the plunger 6, and thus the increase of the area of the outlet will take place with uniformity, the uncovering of each outlet adding to the capacity of the connection to the engine and the capacity of the atomizing-chamber, whereas if both plungers should start from the center of one of the partitions 7 or one of the slots *v* between them the increase in the area of the passage through the carbureter would take

place by jumps as each opening was uncovered, which would result in an intermittent supply of mixture to the engine. Suitable means are provided to effect the movement of the plungers 5 and 6 in opposite directions simultaneously and to the same degree consist in mounting elbow-levers 8 and 9 on suitable supports 10, on which they may swing, one arm of each lever extending into a cavity 12, located near the end of each plunger, the shell *r* and the bushing *x* being slotted, as at 13, to permit this. The other arms of these levers extend toward each other, one of them being forked to straddle a pin 14 in the other arm, and to this pin an operating-rod 15 is attached, by the endwise movement of which the arms 8 and 9 may be swung on their axes to actuate the plungers 5 and 6 in the manner described. If the space between the contiguous ends of the plungers 5 and 6 were left unobstructed, it would sometimes happen that even when these ends were closely approached one to the other the space between them might be greater than desired, and therefore the contiguous ends of the plungers have been bored out, as at 16, and a plug 17, having an easy-sliding fit in these cavities, is located between the ends of the plungers, being supported on a pin 18, which extends through the plug and through the bushing *x*, a semicircular channel 19 being formed in the ends of the plungers to make room for this pin 18 and permit the ends of the plungers to come together. In this way as the plungers 5 and 6 slide toward or away from one another they will slide on the plug 17, and thus the space between their inner ends, which will be widened or contracted as they move in one direction or the other becomes by reason of this plug an annular space, and by increasing the diameter of the plug it is possible to reduce to very small dimensions the area of the passage between the inlet and the outlet sides of the carbureter by approaching the ends of the plungers 5 and 6 until they nearly meet. This feature provides great flexibility of adjustment to conditions requiring the minimum supply of fuel.

Another useful adjustment provided in the construction of the carbureter consists in milling a channel 20 (see Fig. 4) in the upper edge of each plunger to receive the sliding bars 21, the outer surfaces of which complete the cylindrical surfaces of the plungers, of which the outer surface of the plungers forms the major portion. These bars are movable one toward the other by means of the screws 22, which are mounted in the ends of the plungers and are provided with a flange to engage a slot milled transversely of the ends of the bars. By moving these bars toward or from each other more or less of the slot *y* in the top of the bushing may be left open when the plungers are in contact, to the end that the delivery end of the pipe *m* may always be located in a sort of a chamber, and when the plungers begin to separate, carrying the bars 21 with them, the air which is drawn into the annular space between the ends of the plungers will by reason of the wider opening between the ends of the bars 21 as compared with the space between the ends of the plungers effect the convergence toward the delivery end of the pipe *m* of the currents of air drawn through the carbureter. The space between the ends of the bars 21 when the ends of the plungers are in contact may be adjusted as desired by the screws 22.

The pipe connections *d*, leading from the carbureter to the engine, have been shown herein as rectangular in cross-section, and their combined areas are substantially equal to the area of the intake-pipe *e*. Of course the cross-sectional form of these connections *d* is entirely immaterial, and they are shown as rectangular in section only because that is thought to be the best construction and better adapted to the openings into the carbureter.

Assuming the parts to be in the position shown in Fig. 3, which would be the position of the parts if the engine were running on a very small volume of fuel, and it was desired to increase that volume, the arms 8 and 9 would be operated by the movement of the rod 15 or any suitable means, whereby they might be moved together to separate the plungers 5 and 6. It will be observed that the separation of the ends of the plungers results in the uncovering, by the plunger 5, of the middle passage *v*, which will be open to its fullest capacity by the time the end of the plunger 6 is about to run off of the partition which it overlaps in the position shown in Fig. 3, the parts being so arranged that the various openings at the right and left of the center opening *v* will be opened without a break—that is to say, the beginning of the opening of one of the passages will take place just prior to the completion of the opening of another, and in this way the suction effect through the various pipes *d* is just the same as though a single opening were contracted and expanded; but when the engine is throttled down so that the suction takes place only through one of the tubes *d* the volume of air to be moved between the carbureter and the inlet-pipe *b* of the engine is that only which is contained in one of the pipes, whereas if, as generally constructed at present, a pipe having the diameter of the pipe *b* should extend to the carbureter and the opening through the latter should be restricted to the area of one of the openings *v* it is seen that a relatively large volume of air must be moved before any atomizing effect takes place in the carbureter, and where a very small quantity of combustible is drawn through the carbureter, as when the engine is throttled down to its lowest limit, this volume of combustible would be

greatly diluted by the large volume of air present in a large pipe, whereas by making individual connections with separate openings into the carbureter and extending these connections up to near the point of delivery of the combustible to the engine the same atomizing effect may be obtained by the aspiration of a restricted charge of combustible as would be obtained by the aspiration of a larger charge and there will be practically no variation in the quality or richness of the mixture.

Fig. 1 shows the general arrangement of the carbureter relative to the engine, the intake-pipe *e* being shown with its end in close proximity to the exhaust-pipe, (indicated by 25,) whereby the air may be warmed more or less before passing to the carbureter.

It is of course obvious that this device would be entirely operative if but one of the plungers 5 or 6 were used, thus providing an atomizing-chamber having but one movable wall; but it is preferred to use the two plungers movable toward and from each other, as thereby the degree of movement of these valve elements to provide a given area of opening between them is reduced one-half.

Having thus described our invention, what we claim, and desire to secure by Letters Patent of the United States, is—

1. The combination with an internal-combustion engine, of a carbureter therefor provided with suitable inlet and outlet openings and having a plurality of conduits extending from said outlet-opening to the engine.

2. A carbureter of the character described having suitable inlet and outlet openings and provided with a plularity of separate conduits to extend from said outlet-opening to an internal-combustion engine, and a reciprocating element to cover and uncover the passage-way to the conduits.

3. A carbureter of the character described provided with suitable inlet and outlet openings, an atomizing-chamber located between said openings, there being a plurality of separate conduits extending from the outlet-opening, and means to vary the capacity of the atomizing-chamber to bring one or more of said conduits into, or cut them off from operative communication therewith.

4. A carbureter having suitable inlet and outlet openings, an atomizing-chamber between said openings, a movable member constituting one wall of the atomizing-chamber, and means to move said member to contract or expand the atomizing-chamber, whereby its movement in one direction will close the passage between the outlet and inlet opening, a plurality of conduits in communication with the atomizing-chamber and extending from the outlet-opening, the movement of said member to contract said chamber serving to coincidently close one or more of said conduits, and vice versa.

5. A carbureter having a passage extending therethrough from an inlet-opening on one side to an outlet-opening on the other, cylindrical members in said carbureter movable one toward the other transversely of said passage, the contiguous ends of said members being bored out to receive a cylindrical bar on which said members slide, the space between the ends of the latter constituting an annular atomizing-chamber, whose capacity may be varied by the movements of said members; means to introduce a liquid fuel into said chamber, there being a plurality of conduits in communication with the latter and extending from said outlet-opening, said cylindrical members serving as cut-off valves for said conduits.

6. A carbureter consisting of a cylindrical shell having an inlet-opening on one side and an outlet-opening on the other side, the latter comprising a plurality of parallel slots extending transversely of the axis of the shell; cylindrical members within the shell movable one toward the other, the spaces between the contiguous ends of said members constituting an atomizing-chamber, and said members constituting valves for the passage through the carbureter; a conduit for liquid fuel to enter the atomizing-chamber, said conduit being located in the plane of the meeting-line of said movable chambers.

7. A carbureter of the character described provided with suitable inlet and outlet openings, an atomizing-chamber located between said openings there being a plurality of separate conduits extending from the outlet-opening, and means to bring one or more of said conduits into, or cut them off from, communication with said atomizing-chamber.

8. A carbureter consisting of a cylindrical shell having an inlet-opening on one side and an outlet-opening on the other side, the latter comprising a plurality of parallel slots extending transversely of the axis of the shell; cylindrical members within the shell movable one toward the other, the spaces between the contiguous ends of said members constituting an atomizing-chamber, suitable means to actuate said members to move them simultaneously in opposite directions, the plane of the meeting-line thereof falling between two of said outlet-slots; a conduit for liquid fuel to enter said atomizing-chamber in the plane of said meeting-lines, portions of said members being cut away to permit the location of said conduit within the area of the end of said members.

9. A carbureter consisting of a cylindrical shell having an inlet-opening on one side and an outlet-opening on the other side thereof, a bushing fixed in said shell having an elongated slot through the wall thereof under the inlet-opening, and a plurality of parallel transversely-located slots through the wall of

the bushing opposite the outlet-opening; cylindrical members located in said bushing movable one toward the other, the space between the contiguous ends thereof constituting the atomizing-chamber of the carbureter; means to move said members toward and from each other to enlarge or contract said atomizing-chamber, and to simultaneously increase or diminish the areas of the inlet and outlet slots through said bushing.

10. A carbureter having an atomizing-chamber therein, suitable inlet and outlet openings communicating with the atomizing-chamber, said outlet-opening comprising a plurality of separate apertures; a separate outwardly-extending conduit connected with each of said apertures, sliding members within the carbureter whose contiguous ends constitute two walls of the atomizing-chamber, said members also constituting valves for the inlet and outlet openings.

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