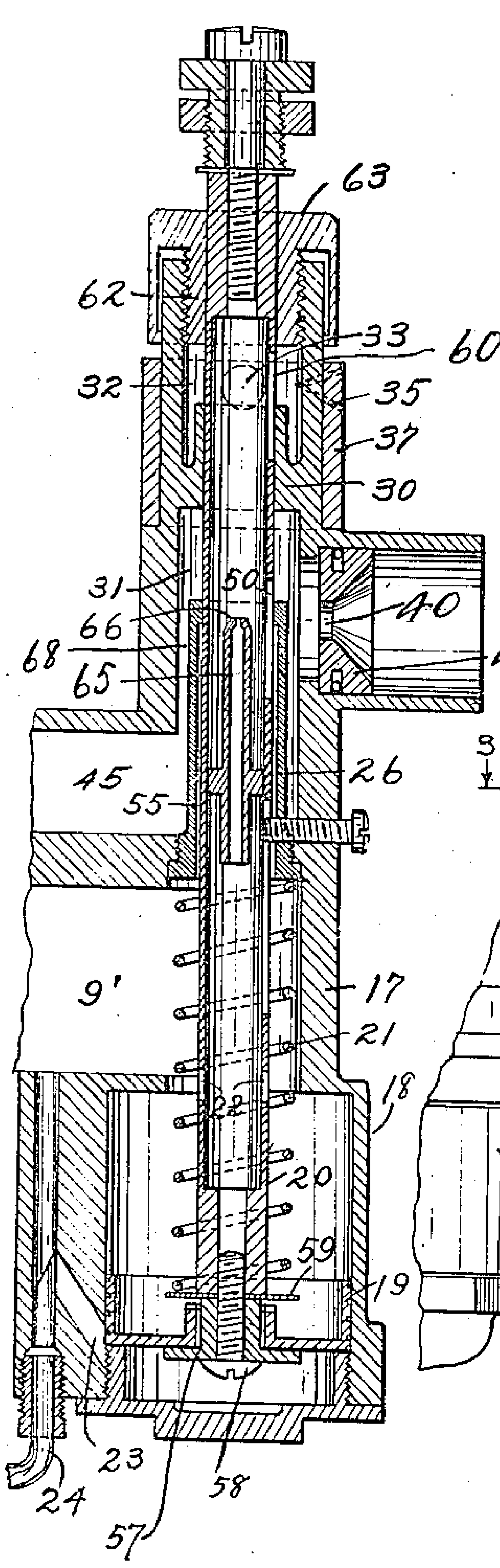
Jan. 2, 1923. | I. M. SMITH ET AL. | 1,440,940.

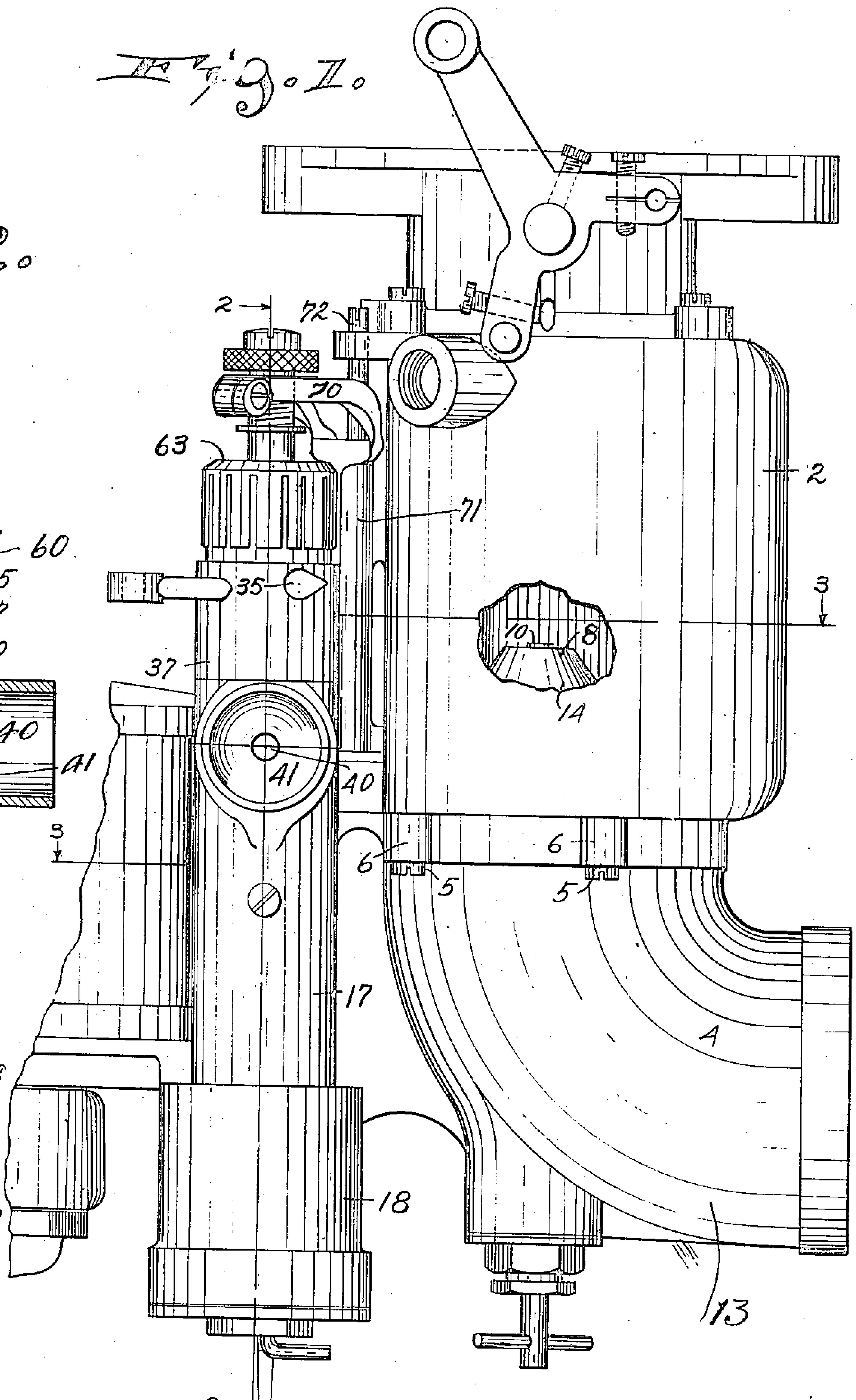
CARBURETOR.

FILED JAN. 21, 1918. | 3 SHEETS—SHEET 1.

Fig. 1.

Fig. 2.





Witness
F. A. O. Wo.
Frederick W. Nolte

Inventor
Ivan M. Smith
Mikjil L. Fykse
By Erwin & Wheeler
Attorneys

Jan. 2, 1923. 1,440,940.

I. M. SMITH ET AL.

CARBURETOR.

FILED JAN. 21, 1918.

3 SHEETS—SHEET 2.

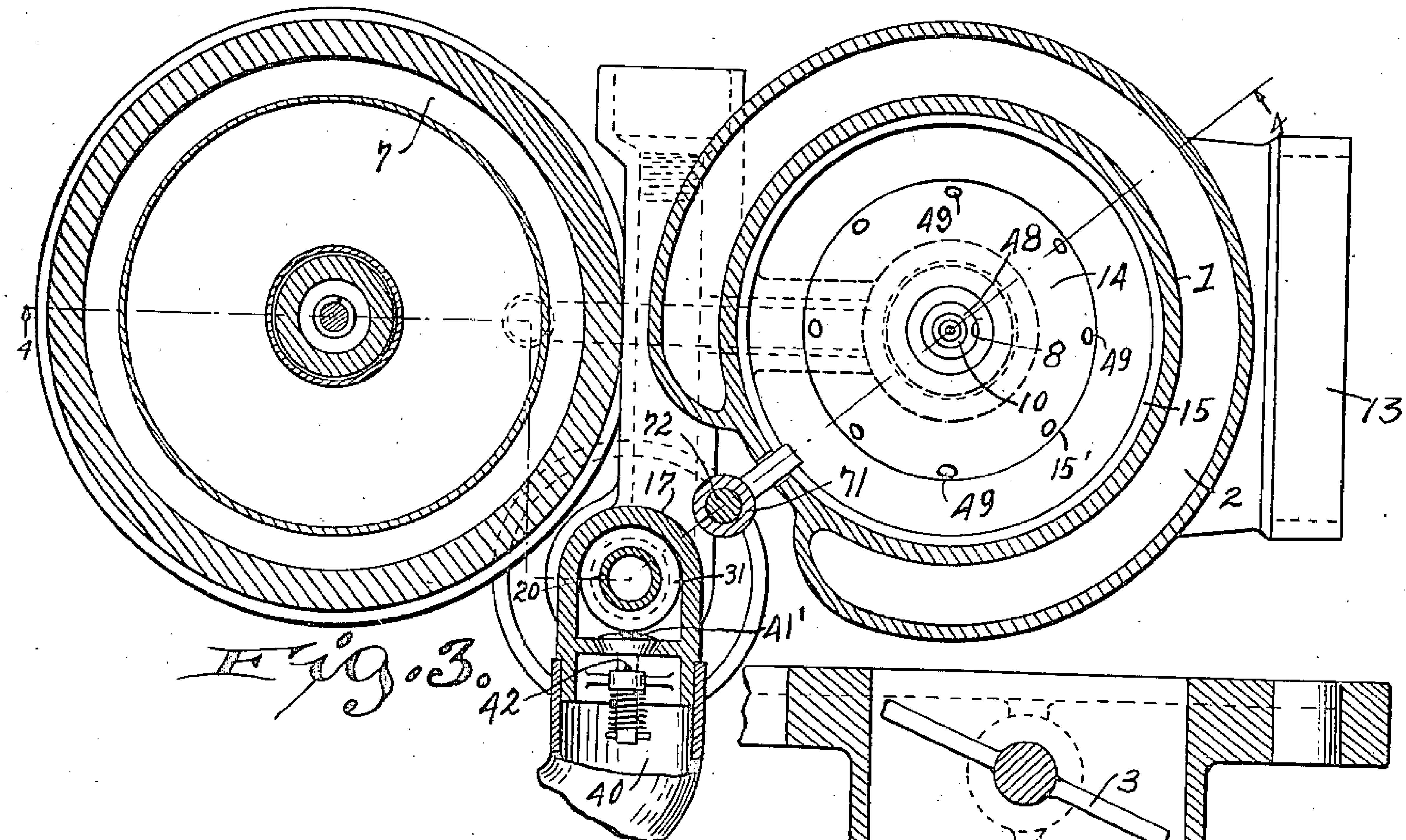


Fig. 3.

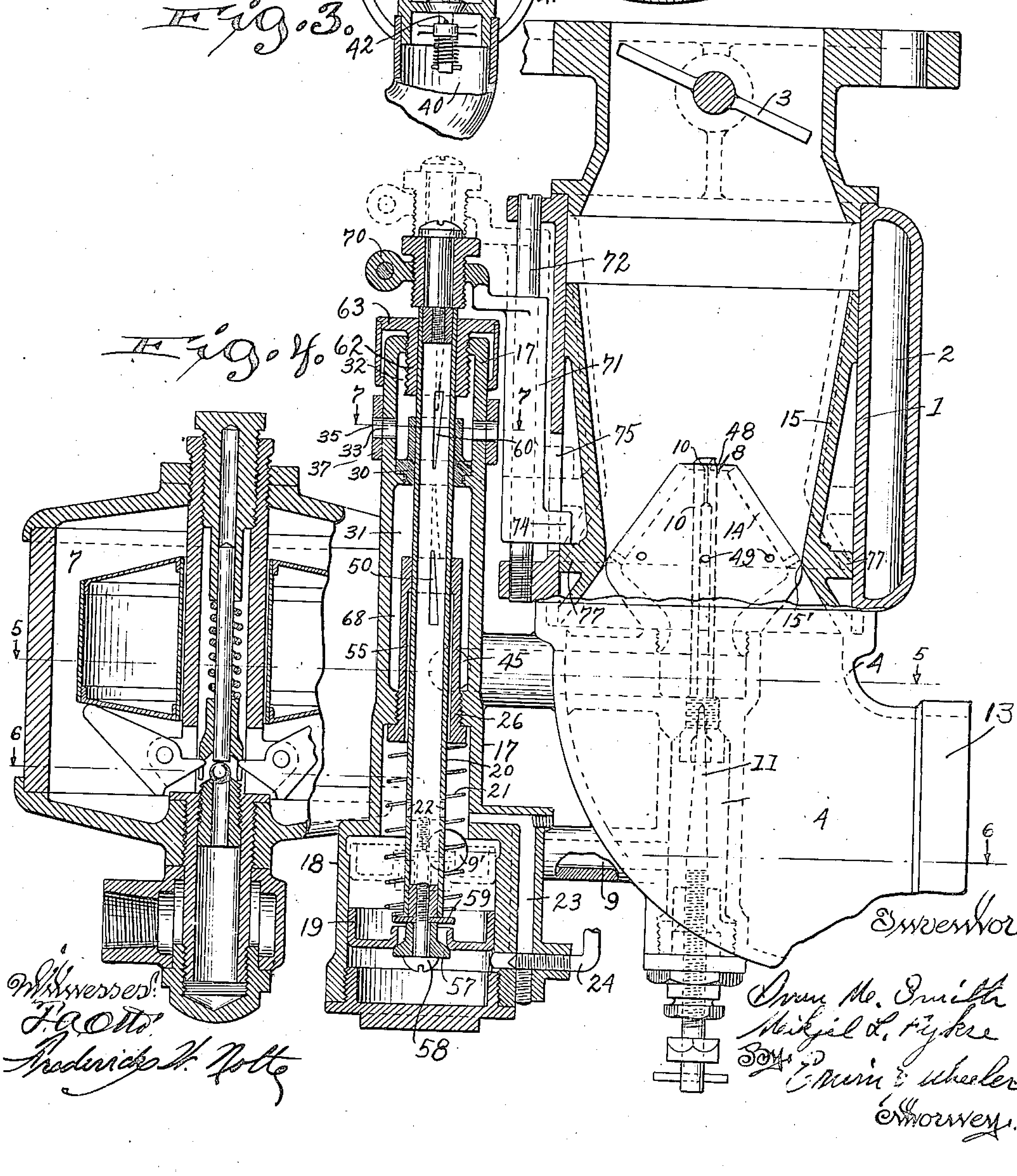


Fig. 4.

Witnesses:
F. A. Otto
Frederick W. Nolte

Inventors:
Irvin M. Smith
Mikjel L. Fykse
By Erwin & Wheeler
Attorneys.

Jan. 2, 1923.

1,440,940.

I. M. SMITH ET AL.

CARBURETOR.

FILED JAN. 21, 1918.

3 SHEETS—SHEET 3.

Fig. 5.

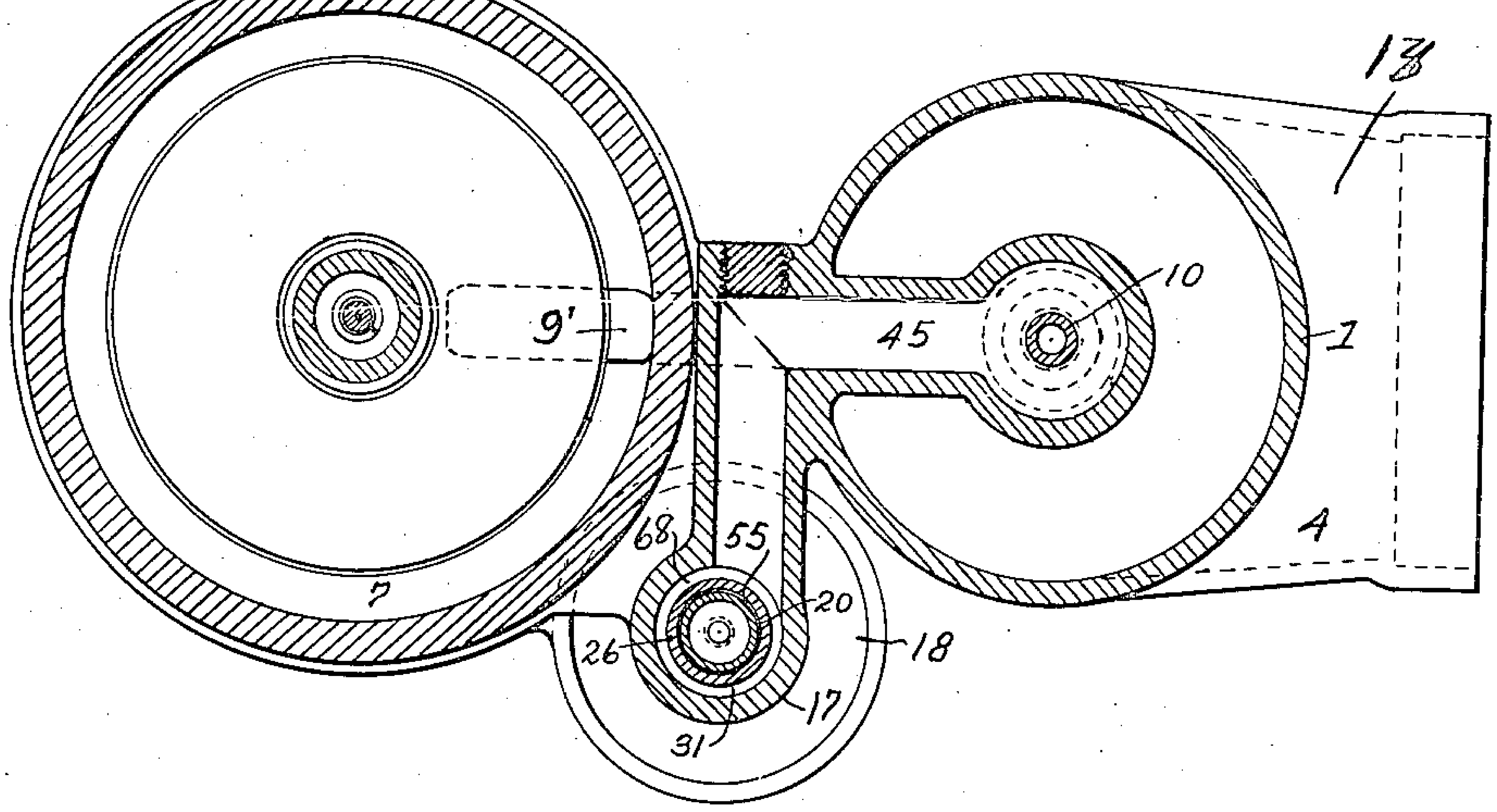


Fig. 6.

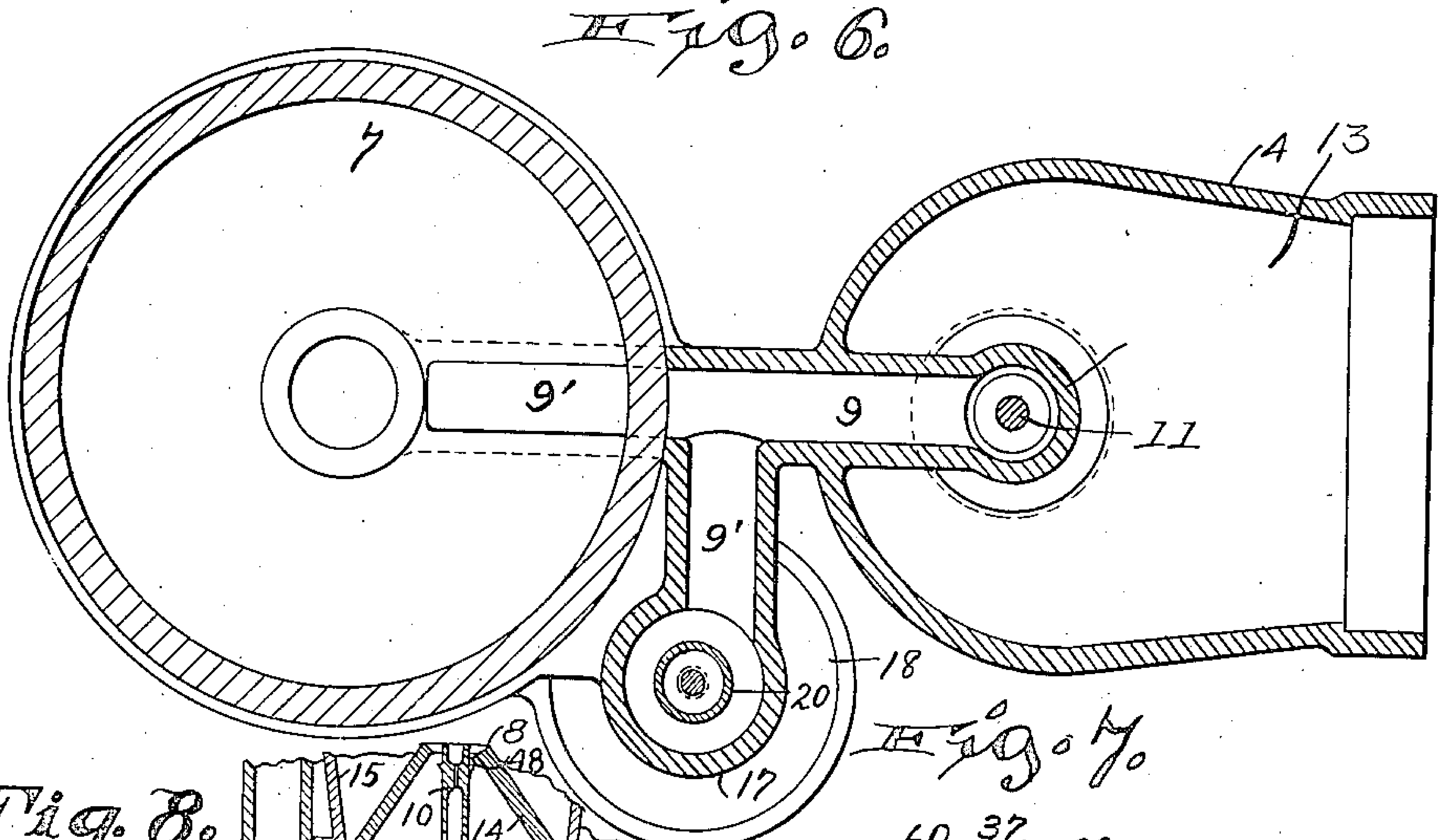


Fig. 7.

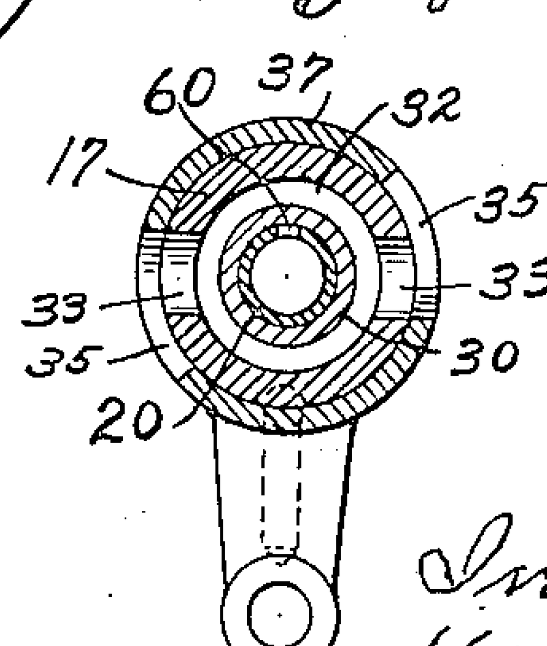
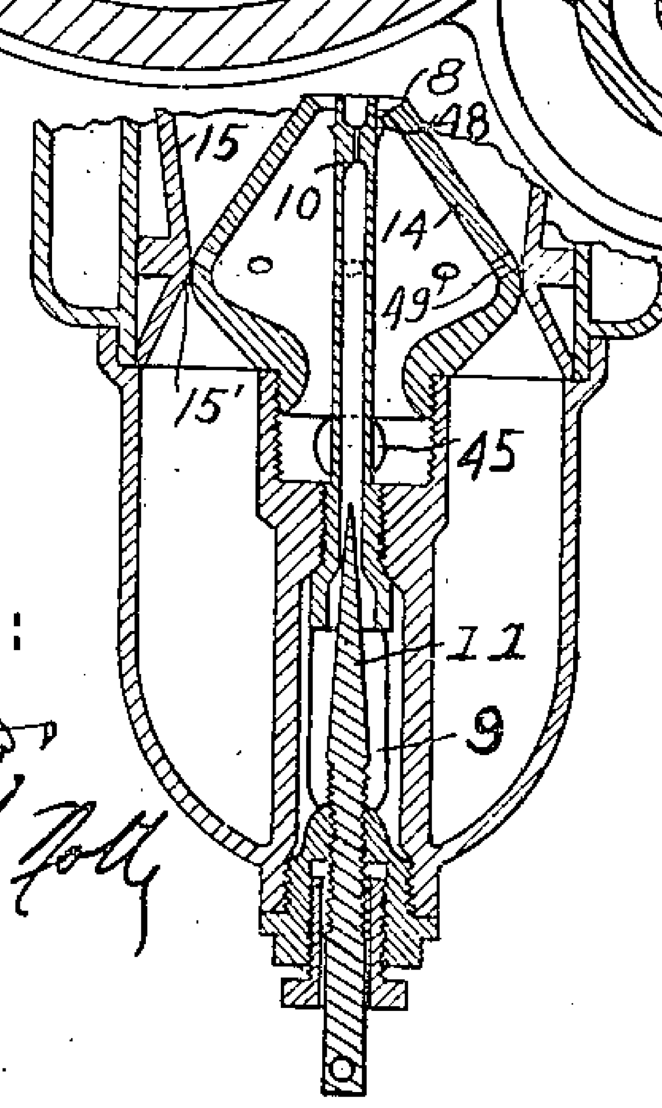


Fig. 8.



WITNESSES:

F. A. Otto

Frederick W. Noll

INVENTOR

Ivan M. Smith

Mikjel L. Fykse

BY

Erwin G. Wheeler

ATTORNEYS

Patented Jan. 2, 1923. **1,440,940**

UNITED STATES PATENT OFFICE.

IVAN M. SMITH, OF MILWAUKEE, AND MIKJEL L. FYKSE, OF SOUTH MILWAUKEE, WISCONSIN, ASSIGNORS TO TURBO CARBURETER CO., OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

CARBURETOR.

Application filed January 21, 1918. Serial No. 212,876.

To all whom it may concern:

Be it known that we, Ivan M. Smith and Mikjel L. Fykse, citizens of the United States, residing at Milwaukee and South Milwaukee, county of Milwaukee, and State of Wisconsin, have invented new and useful Improvements in Carburetors, of which the following is a specification.

Our invention relates to improvements in carburetors.

The object of our invention is to provide a carburetor with a wide range of adaptability, which will furnish a combustible mixture suited, at all times, to the speed and load of the engine to which it may be attached. A second object of our invention is to provide improved means for breaking up the hydrocarbon fuel so that, even though low grade fuel be used, it will be thoroughly atomized.

It is well known that when the speed of a gasoline engine is varied, especially when starting, or under varying loads, it is difficult to deliver correct mixtures of fuel and air to the engine, and it is also difficult to deliver the correct quantity required, these difficulties being particularly experienced during the periods of speed and load variation. But it is necessary that the fuel should be thoroughly mixed with air and that it should be supplied in the correct quantity in order that it may not be wasted, and the efficiency of the engine impaired. Our improved carburetor is therefore designed to provide the exact amount of fuel needed for perfect combustion at all engine speeds and loads and is so constructed that the fuel will be completely atomized and mixed with the air entering the carburetor.

In the drawings:

Figure 1 is a front elevation of a carburetor embodying our invention, the float chamber being partially broken away.

Figure 2 is a sectional view drawn on line 2—2 of Figure 1.

Figure 3 is a section taken on line 3—3 of Figure 1, but showing a slightly modified design.

Figure 4 is a vertical section taken on line 4—4 of Figure 3.

Figure 5 is a section taken on line 5—5 of Figure 4.

Figure 6 is a section taken on line 6—6 of Figure 4.

Figure 7 is a section taken on line 7—7 of Figure 4.

Figure 8 is a vertical section through the low speed fuel nozzle.

Like parts are identified by the same reference characters throughout the several views.

The carburetor casing includes a mixing chamber 1, provided with a water jacket 2, the outlet of the mixing chamber having a throttle valve 3 of ordinary construction, and the lower, or inlet, end being mounted upon a base casting 4, which is secured to the mixing chamber by screws 5 extending through the outwardly projecting ears 6 on the mixing chamber and base respectively. The base has an extension which carries a float chamber 7, which may be assumed to be of any ordinary construction.

A fuel nozzle 8, centrally located in the lower portion of the casing 1, is connected with the float chamber by a passage 9, and hydrocarbon deliveries through the fuel nozzle are controlled by a needle valve 11. The fuel nozzle extends through a hollow auxiliary nozzle member 14 enlarged in its central portion and conically tapered downwardly and upwardly from the central portion, this hollow member forming the inner wall of the main air inlet passage to the mixing chamber and also constituting the outer wall of an annular air nozzle formed between it and the fuel nozzle. An annular slide valve 15 forms the outer wall of this passage, and its inner surface is in substantial contact with the member 14 at 15′, the inner wall of the slide valve being conically enlarged downwardly and upwardly from the circle at 15′.

A vertically disposed tubular member 17 is supported by the base casting, and provided with an enlargement 18, which serves as a dash pot and receives a piston 19, connected with a tubular piston rod 20 adapted to serve as a metering tube to regulate fuel deliveries, as hereinafter explained. A light spring 21 tends to force the piston 19 downwardly to the position in which it is shown by full lines in Figure 4. A by-pass 23 extends around the field of piston movement, and delivery through the by-pass is closed by a needle valve 24. The upper end of the dash pot is closed by a guide sleeve 26, through which the piston rod 20 passes.

The tubular member 17 has its upper portion subdivided by a partition 30 to form a set of cavities 31 and 32, the upper cavity 32 being open to the exterior through a set of air inlet ports 33, and registering ports 35 formed in a sleeve 37, which is adapted to be rotatively adjusted, and therefore serves as a valve to control air admission to cavity 32.

An air inlet passage 40 communicates with the cavity 31, the air admission being regulated in Figure 1 by a ported plug 41, and in Figure 3 by a spring actuated valve 41′, which opens inwardly under light pressure, and which is always open to some extent since a cross pin 42 prevents the valve from wholly seating. In all other respects the member 17 and its chambers may be assumed to be identical in Figures 1 and 2, with those shown in Figures 3 and 4. The outer portion of the cavity 31 communicates through a passage 45 with the interior of the member 14, whereby air may be drawn into the mixing chamber under light engine suction, through the passage 40, cavity 31, passage 45 and member 14, the latter having an opening at the top around the nozzle 10, which forms an annular air outlet 48. A series of openings 49 is also provided in the wall of the member 14, these openings extending through the upwardly tapering portion of the member near the circular point of contact 15′ with the slide valve 15. These openings provide for a delivery into the main air passage of a rich mixture of air and fuel from the metering chamber hereinafter described, and the quantity of the mixture thus delivered will be varied in proportion to the upward movement of the slide valve 15, for the reason that, when this valve opens. deliveries through these apertures 4 will be accelerated, owing to the aspirating effect produced by the rush of air in the main air passage.

The tubular piston rod 20 is provided with a slot 50, the walls of which preferably converge upwardly. This slot affords communication between the interior of the piston rod and cavity 31. The slot is so located that all of it, except the small upper end thereof, is normally enclosed by guide sleeve 26, and the lower end portion of the slot may also communicate, under normal conditions, with the upper portion of the dash pot cavity through an annular passage 55, formed by enlarging the opening through the guide sleeve below its upper end. This. however, is not necessary for the reason that the rod 20 is apertured at 22 to allow free communication at all times with the lower or dash pot cavity above the piston. The float chamber is in communication with the dash pot cavity through the passage 9 and a branch passage 9′, (Figure 4). Therefore the liquid will fill the dash pot cavity, and will rise in the tubular piston rod 20 to the level of the liquid in the float chamber.

Normally the lower portion of the dash pot cavity is in communication with the upper portion, not only through the by-pass 23, but also through a central port in the piston itself, this port being controlled by an upwardly seating check valve 57, connected with the tubular piston rod by a screw 58, and constituting the means for connecting the piston rod with the piston, a disk or washer 59 serving to limit the downward movement of the valve and piston rod, relatively to the piston. But an upward pull on the piston rod will not only seat the valve 57, but will thereafter draw the piston upwardly in the dash pot. The rate of this upward movement is limited by the partial vacuum developed below the piston, time being required for the liquid to return to the lower portion of the dash pot cavity through the by-pass 23. No pressure can develop above the piston. since the liquid is free to return to the float chamber through the passages 9′ and 9.

The upper portion of the piston rod 20 is provided with a slot 60, the side walls of which preferably converge downwardly. When the piston rod is lifted, this slot is progressively closed from its upper end downwardly by means of a bearing sleeve 62, forming part of the cap nut 63 which covers the upper end of the tubular member 17. The sleeve portion of this cap nut is screw threaded in an aperture formed in the upper end of the member 17, and it is therefore vertically adjustable to cover slot 60 to the desired extent. It should nearly close the slot when the metering tube 20 is raised to the fullest extent.

Piston rod 20 projects through cap nut 63, and is connected by an arm 70 with a slide 71, guided by the vertical rod 72. The lower end of this slide has a foot piece 74 which projects through a slot 75 in the wall of chamber 1, in the path of an annular shoulder 77 carried by the annular slide valve 15, the arrangement being such that when the slide valve 15 is lifted, motion will be transmitted from it to the piston rod 17, through this foot piece 74, sleeve 71 and arm 70.

When the engine is running slowly under light load, air will be admitted to the mixing chamber through the passage 40, and will pass downwardly in cavity 31 and through passage 45 to the interior of member 14 through which it passes upwardly, nearly all of it being delivered to the mixing chamber through the opening 48 at the upper end of chamber 14. Only a negligible quantity of fuel will be contained in this air, for the reason that slot 50 is nearly closed under the assumed conditions, but sufficient fuel will be delivered through the nozzle 10 to form a correct mixture under these conditions, since air is admitted only through the member 14 and through the nearly closed annular space between it and the slide valve 15.

As the suction of the engine increases, due to increased speed or load, or to the opening of the throttle valve 3, a greater degree of vacuum will be produced within the mixing chamber, whereupon slide valve 15 will be lifted, thereby admitting a much larger volume of air through the main air inlet 13. The movement of the slide valve will be retarded, not only by the weight of the metering tube 20, but also by the resistance afforded by piston 19, and by the vacuum pull below it. The time required for the upward movement of the slide valve 15 will therefore be sufficiently equal to the time required for liquid delivery through the bypass 23 to satisfy the vacuum in the lower portion of the dash pot. The liquid above the piston may flow back into the float chamber through the passages 9′ and 9, but this tends to slightly raise the level of the liquid in the float chamber, and also in the metering tube 20. As the metering tube rises the open area of slot 50 is increased, and the open area of slot 60 is diminished. Therefore, air delivery from cavity 32 to cavity 31, through the slot 60 and the metering tube, will be progressively diminished, as slot 60 is closed by sleeve 61. The suction exerted by the engine piston upon cavity 31 will, however, be increased, and this will tend to additionally raise the liquid in the metering tube 20. While the slide and metering tube are moving upwardly, the column of liquid in the metering tube 20 also tends to lift to a somewhat higher level than the liquid in the float chamber, owing to the fact that its inertia prevents it from instantly escaping through the holes 22. Therefore, if the carburetor is to be made sensitive, and quickly responsive to an open throttle, or to sudden engine acceleration, it is desirable to provide the metering tube with a nozzle member 65, having a restricted passage 66 for liquid delivery into that portion of the metering tube which is provided with the slot 50. The nozzle member projects upwardly above the level of the fluid in the float member, and therefore liquid delivery through the nozzle member is not affected by a lifting of the metering tube, except in so far as this tends to raise the outlet of the nozzle, and increase the height of the liquid column above the level of the liquid in the float chamber induced by engine suction. The liquid drawn by engine suction through this nozzle is atomized by the downwardly moving air current which enters the metering tube through the partially closed slot 60, and both the liquid and air are delivered through the slot 50 to passage 45, through the annular space 68, between sleeve 55 and the wall of chamber 31.

In Figure 4, the nozzle member 65 is omitted, and therefore in this construction liquid in the metering tube 20 may flow directly across the metering edge formed by the upper end of the sleeve 55. This tends, however, to permit an abnormal flow of hydrocarbon through slot 50 during accelerating periods, unless the needle valve 24 is so adjusted as to make the upward movement of valve 15 and of the metering tube extremely slow, whereby the column of liquid in the tube 20 may escape through the openings 22, substantially as fast as the metering tube 20 is lifted.

With the construction shown in Figures 1 and 2, the quantity of fuel delivered through the nozzle member 65 may be accurately proportioned to the added quantity of air delivered to the mixing chamber of the carburetor by the opening movement of slide valve 15, it being possible, by adjusting the cap nut 63, to accurately control the suction to be exerted on the nozzle 65, by regulating the amount of air admitted through the slot 60. It will be observed that the nozzle 65 has its outlet at a lower level than the nozzle 10 under normal conditions, but that as the nozzle 65 is lifted and proportioned to the quantity of air drawn into the engine, the outlet of this nozzle tends to approach more nearly to the level of nozzle 10 under full speed and load conditions, and the action of the two nozzles is therefore more nearly equalized, and therefore the volume of liquid discharged through the respective nozzles will be more nearly in direct proportion to their capacity.

When slide valve 15 is raised, the air entering through the main air inlet rushes through the venturi passage formed between the member 14 and the slide valve, in such a manner as to exert an aspirating effect at the openings 49 in the member 14, whereby a larger proportion of the mixture within the member 14 will be drawn through these openings than when the engine is idling. The openings 49 therefore prevent throttling effects at the opening 48.

Except as herein noted, the constructions disclosed in Figures 1 and 2 are substantially the same as in the remaining views, and for the purposes of this invention they may be assumed to be identical. In both cases, fuel charges when the engine is idling are regulated entirely by air suction in the chamber 14, and fuel suction exerted upon the nozzle 10, the amount of fuel received from the metering tube being negligible under such conditions. But when the throttle is open, or the engine accelerated, a correct mixture is maintained, not only during the accelerating period, but also subsequently thereto by mechanically controlling the increased fuel delivery in direct proportion to the increased air delivery permitted by the movements of the slide valve 15. We attach great importance to the fact that our improved construction provides for progressively changing the suction upon or within the metering tube in proportion to its vertical movement, by progressively cutting off the admission of air to the metering tube,—this being accomplished in the construction shown, by progressively closing the slot 60.

The term correct mixture as herein used is not intended to indicate that the proportions of fuel to air are exactly the same under all conditions, it being understood in this art that variations in the proportionate quantity of fuel employed are permissible within certain well defined limits, and that when an engine is running at uniform speed and load a relatively lean mixture is permissible, whereas when the engine is suddenly accelerated or an increased load suddenly applied a richer mixture is needed during the period in which the engine is adjusting itself to the new conditions. In this respect our improved carburetor is particularly adapted to meet the requirements, and we prefer the construction shown in Figures 1 and 2 for this purpose, since the variations in fuel supply can be more accurately controlled than with the construction illustrated in Figure 3.

During starting periods when the fuel is cold, we are enabled by manually adjusting the sleeve valve 37 to increase the suction upon the metering tube, by partially cutting off the supply of air through the ports 33. This is of great importance since it avoids the necessity of priming, or of changing any other adjustments upon the carburetor.

We claim:

1. A carburetor for internal combustion engines comprising a float chamber, a mixing chamber, means for delivering a substantially constant supply of fuel to the mixing chamber, a main air valve surrounding said means, auxiliary fuel feeding means, provided with a metering device and interposed between the float chamber and the mixing chamber, means operated by the main air valve for controlling the operation of the metering device, said metering device being adapted to deliver additional air and fuel to the mixing chamber in varying proportions depending upon the position of the main air valve.

2. A carburetor for internal combustion engines, including the combination with a mixing chamber, of an annular slide valve therein, the inner wall of which is conically enlarged from an intermediate point toward its respective ends, an air nozzle projecting upwardly within the mixing chamber, and having an intermediate portion enlarged to substantially contact with the slide valve when the latter is in closed position, said air nozzle having an outlet at its upper end, and an annular row of outlets adjacent to the zone of substantial contact with the slide valve, a fuel nozzle projecting upwardly through the air nozzle, a main air inlet passage adapted for air delivery to the mixing chamber when the slide valve is raised, means for delivering air and fuel to the air nozzle in inversely varying quantities, and means controlled by the slide valve for varying the quantity of fuel and air delivery through the air nozzle.

3. A carburetor for internal combustion engines, including the combination with a float chamber, a mixing chamber provided with a fuel port and a valved main air passage, respectively adapted for delivering a substantially constant supply of fuel and air to the mixing chamber when the engine is operated slowly, of an auxiliary air and fuel feeding device interposed between the float and mixing chambers, and connected therewith by fuel feed and mixture outlet ducts independently of said fuel port, and means connected with the main air valve for progressively increasing the supply of fuel, and decreasing the supply of air delivered to the auxiliary feeding device in proportion to the opening movement of said valve.

4. A carburetor for internal combustion engines, including the combination with a mixing chamber provided with fuel and air inlet passages, and a main air valve adapted to open under air pressure in the air passage, of an auxiliary inlet passage for fuel and air, and means controlled by the main air valve for increasing the fuel supply and diminishing the air supply in said auxiliary passage in proportion to the opening movement of said valve.

5. A carburetor for internal combustion engines, including the combination with a mixing chamber provided with air and fuel inlets, and with a mixture outlet, of a slide valve in the air inlet adapted to be actuated by pressure of the air from a normally nearly closed position to full open position, an auxiliary passage for both air and fuel leading to the mixing chamber, a receptacle adapted for upward and downward movement in said passage, and provided with a lateral outlet, means for delivering liquid fuel to said receptacle from a source of constant level supply, a relatively stationary member partially covering the outlet of said receptacle, and controlling air and fuel deliveries through said auxiliary inlet pas-

sage, and means connected with the slide valve for varying the relative positions of said receptacle and member to vary the quantity of liquid overflow into said passage.

6. A carburetor including the combination of a mixing chamber, provided with an air inlet passage, a slide valve controlling air delivery through said passage, another air passage leading to the mixing chamber, a tubular member therein, in communication with a source of fuel supply, and provided with an air port of variable capacity, said tubular member also having a fuel delivery port of variable capacity adapted to permit fuel delivery into said last mentioned air passage, and means connected with the slide valve for varying the capacity of said air and fuel ports.

7. A carburetor including the combination of a mixing chamber, provided with an air inlet passage, a slide valve controlling air delivery through said passage, another air passage leading to the mixing chamber, a tubular member therein, in communication with a source of fuel supply, and provided with an air port of variable capacity, said tubular member also having a fuel delivery port of variable capacity adapted to permit fuel delivery into said last mentioned air passage, and means connected with the slide valve for lifting said tubular member, and thereby varying the capacity of said air and fuel ports, together with a fuel supply chamber, a piston therein connected with said ported tubular member, and adapted to utilize the pressure of liquid in said chamber to delay the movement of the tubular member when the latter is being actuated by the slide valve.

8. A carburetor provided with a main air passage, a slide valve controlling air delivery through said passage, a source of fuel supply at constant level, a nozzle leading into said passage from the source of fuel supply, an auxiliary passage in communication with said fuel supply, and also in communication with the open air, a metering tube in said passage, having fuel and air inlets, and a lateral outlet intermediate of the fuel and air inlets, a relatively stationary member controlling fuel delivery through said lateral outlet, and connections between the slide valve and metering tube.

9. A carburetor for internal combustion engines, including the combination with a mixing chamber provided with air and fuel inlets, and with a mixture outlet, of a slide valve in the air inlet adapted to be actuated by pressure of the air from a normally nearly closed position to full open position, an auxiliary passage for both air and fuel leading to the mixing chamber, a receptacle adapted for upward and downward movement in said passage, and provided with a lateral outlet, means for delivering liquid fuel to said receptacle from a source of constant level supply, a relatively stationary member partially covering the outlet of said receptacle, and controlling air and fuel deliveries through said auxiliary inlet passage, means connected with the slide valve for varying the relative positions of said receptacle and member to vary the quantity of liquid overflow into said passage, together with means for inversely controlling air admission to the upper portion of said receptacle.

10. A metering device for carburetors, comprising a fuel passage having an upwardly and downwardly movable receptacle therein, a relatively stationary member embracing a portion of said receptacle intermediate of its ends, and adapted to serve as a slide bearing therefor, said receptacle being provided with a fuel inlet below said member, an air inlet above said member, and an outlet for air and fuel in registry with said member, and means for automatically varying the capacity of that portion of the receptacle outlet which is above the upper margin of the member.

11. A metering device for carburetors, comprising a fuel passage having an upwardly and downwardly movable receptacle therein, a relatively stationary member embracing a portion of said receptacle intermediate of its ends, and adapted to serve as a slide bearing therefor, said receptacle being provided with a fuel inlet below said member, an air inlet above said member, and an outlet for air and fuel in registry with said member, and means for automatically lifting the receptacle to increase the discharge of liquid across the member from within the receptacle.

12. A metering device for internal combustion engine carburetors, including the combination of a passage for liquid fuel, a movable receptacle therein ported to receive fuel from said passage, and also having an outlet port at a higher level, a relatively stationary member in said passage partially covering said outlet port, means for admitting air to the upper portion of said receptacle, and means adapted to be controlled by engine suction for raising and lowering said receptacle to increase and diminish the flow of liquid over the relatively stationary member through said outlet.

13. A metering device for internal combustion engine carburetors, including the combination of a passage for liquid fuel, a movable receptacle therein ported to receive fuel from said passage, and also having an outlet port at a higher level, a relatively stationary member in said passage partially covering said outlet port, means for admitting air to the upper portion of said re-

ceptacle, means adapted to be controlled by engine suction for raising and lowering said receptacle to increase and diminish the flow of liquid over the said relatively stationary member through said outlet, said receptacle actuating means including means for inversely regulating air delivery through said receptacle to the outlet therefrom.

In testimony whereof we affix our signatures in the presence of two witnesses.

IVAN M. SMITH.
MIKJEL L. FYKSE.

Witnesses:
LEVERETT C. WHEELER,
O. C. WEBER.