M. G. CHANDLER.

CARBURETER.

APPLICATION FILED JUNE 13, 1917.

1,372,740. Patented Mar. 29, 1921.

FIG. 2

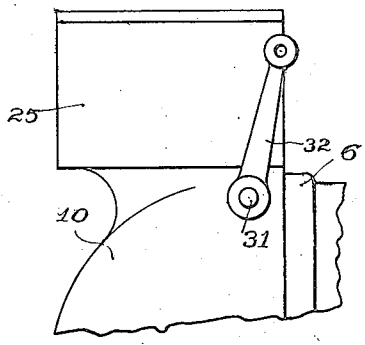


FIG. 2A.

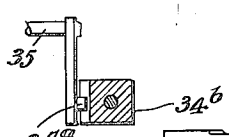


FIG. 3

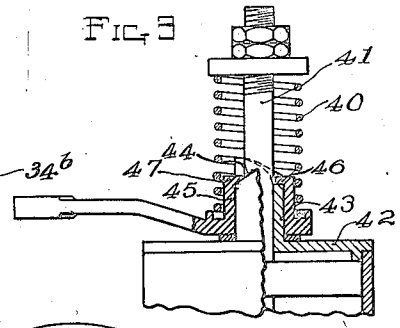


FIG. 1

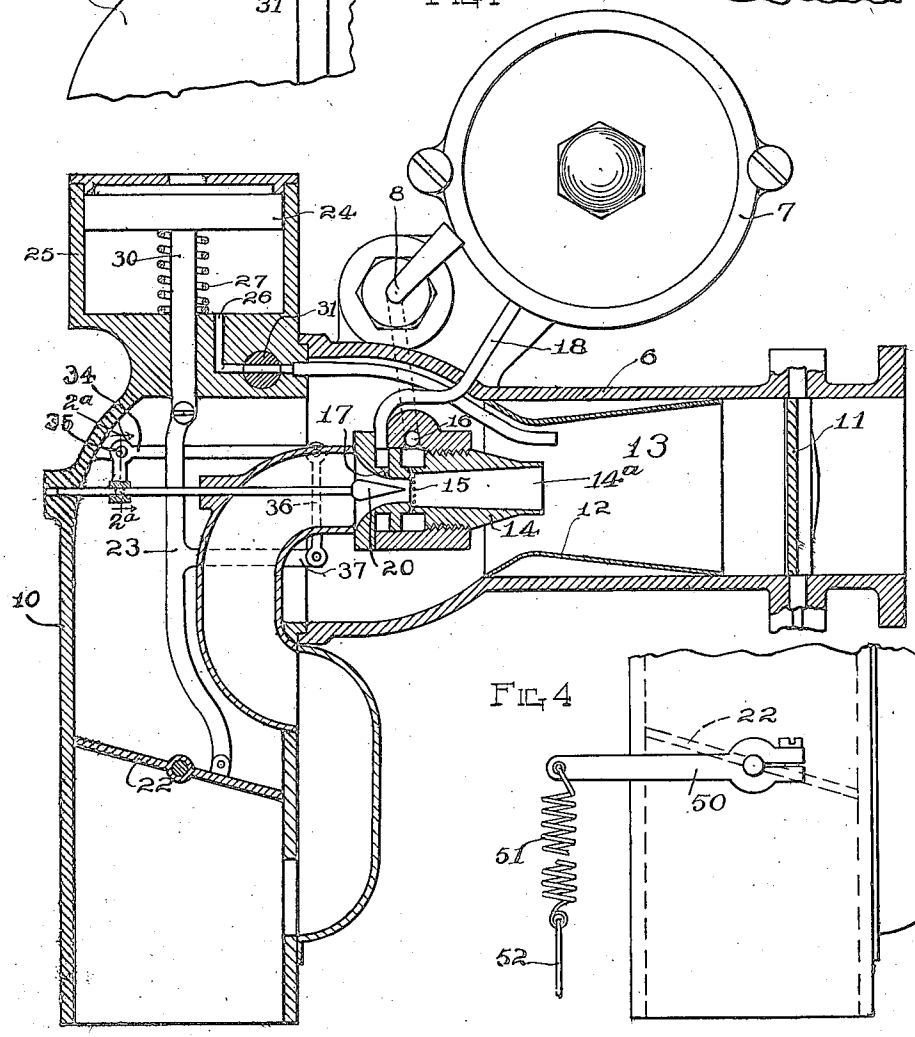


FIG. 4

WITNESSES:

Andrew Printemont

Robert F. Baade

INVENTOR

MILFORD G. CHANDLER

BY William Bradbury & Son

ATTORNEYS

UNITED STATES PATENT OFFICE.

MILFORD G. CHANDLER, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO LYNN A. WILLIAMS, OF EVANSTON, ILLINOIS, AND CURTIS B. CAMP, OF CHICAGO, ILLINOIS, TRUSTEES.

CARBURETER.

1,372,740. Specification of Letters Patent. Patented Mar. 29, 1921.

Application filed June 13, 1917. Serial No. 174,463.

To all whom it may concern:

Be it known that I, MILFORD G. CHANDLER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Carbureters, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to vacuum feed carbureters; that is, carbureters in which the fuel is lifted from the main tank at a lower level to the level of the carbureter by the suction of the engine used for drawing the fuel into the combustion chamber.

My invention is an improvement upon those illustrated in my applications Serial Nos. 134,961 and 168,325, filed respectively December 4, 1916, and May 12, 1917.

Carbureters of the type to which my invention relates are provided with inner and outer Venturi tubes, the inner tube being of such small diameter that a suction sufficient for lifting the fuel from the low level reservoir to the float chamber of the carbureter is created at the throat of the inner venturi, even at the lowest idling speed of the engine, and even with the engine throttle closed to its idling position.

In order that the engine shall not be deprived of part of its power when the throttle is wide open and the ultimate power is desired, it is important that the depression in the mixing chamber of the carbureter and consequently in the engine intake manifold be as slight as possible for the proper breaking up and delivery of liquid fuel into the mixing chamber and for the creation of the proper degree of suction for lifting the fuel from the low level reservoir to the carbureter.

In practice the low level supply tank for automobiles is ordinarily placed at the rear of the automobile and the bottom of this tank is ordinarily not over twenty-five inches below the top of the carbureter float chamber when the automobile is standing on level ground or running along a level road. Under these conditions it is unnecessary that the depression in the float chamber shall be maintained greater than sufficient to lift fuel through say thirty inches. Conditions arise, however, in climbing hills, where the main supply reservoir is for a short period operated at a very much greater distance below the carbureter float chamber, and it is necessary of course that the suction in the float chamber be sufficient for lifting the fuel through this greater distance. If this greater suction were continually maintained upon the surface of the fuel in the float chamber, whether the car were running on a level road or up a grade, the engine would be continually deprived of a part of its power whenever the throttle was opened wide by reason of the greater depression which would be continually maintained in the carbureter mixing chamber and the engine intake manifold.

My present invention, therefore, contemplates means whereby a depression just sufficient for lifting the fuel from the low reservoir to the carbureter, is maintained for all ordinary running conditions, and means whereby the depression in the float chamber may be readily increased from the driver's seat when steep grades are encountered.

My invention further contemplates certain improved linkage mechanisms by means of which the regulating device is moved into and out of the entrance to the inner Venturi tube.

My invention is illustrated in the accompanying drawing, in which—

Figure 1 illustrates a partial horizontal section through a carbureter embodying my invention;

Fig. 2 illustrates a segregated portion of the invention as shown in Fig. 1;

Fig. 2^a is a sectional detail view taken on line 2^a—2^a of Fig. 1;

Fig. 3 illustrates a modification in which a cam is used for increasing the tension of the valve controlling spring; and

Fig. 4 is a still further modification in which an auxiliary spring controlled from the dash is used for increasing the resistance of the automatic auxiliary valve.

The structure of Fig. 1 comprises a main

tubular casting 6, to which the float chamber 7 is integrally connected, the portion between the tubular section and the float chamber containing a fuel passage not illustrated, which is controlled by a needle valve 8. A second tubular casting 10 is connected at right angles to the tubular casting 6, the tubular casting 6 forming the carbureter mixture discharge opening, and the tube 10 constituting the air intake passage.

A manually operable throttle valve 11 is located near the discharge end of the tube 6, and is arranged by the usual appliances, not herein illustrated, so as to be controlled by an operator to adjust the discharge opening from that of idling to that of full speed or full power of the motor. Within the tube 6 is a secondary Venturi tube 12, the constricted portion of which is of proper size to maintain an appreciable depression in the mixing chamber 13 when the engine is running at high speed, even though the air may enter the said Venturi tube at atmospheric pressure.

Supported within the tube 6 and having its discharge opening located substantially in the throat of the secondary venturi 12, is a primary Venturi tube 14, the function of which is to atomize the fuel and to create the depression by means of which the fuel is lifted from the lower level reservoir to the float chamber of the carbureter. This latter Venturi tube is provided with a plurality of fuel discharge openings 15 which connect with the fuel passage 16, which latter connects with the lower part of the float chamber by way of the needle valve 8. The Venturi tube 14 is provided with a small opening 17 slightly anterior to its most restricted part, this opening communicating with the upper spaces of the float chamber through a duct 18. The bore of the primary Venturi tube 14 is abruptly enlarged at the point of entrance of the fuel therein and from this point on to the discharge end the bore gradually enlarges on an even taper of substantially 7½ degrees. The reason for the abrupt enlargement is to make room for the fuel and fuel vapor so that the velocity of the air passing through the Venturi tube will not be abruptly changed at the point of entrance of the fuel. The thing desired in this Venturi tube is to secure the greatest possible difference in suction between the discharge end and the region of the throat. Experiments show that an abrupt enlargement of the bore at the region of the entrance of fuel therein very considerably offsets the effect which the inrushing fuel has upon the vacuum ratio between the discharge end and the region of the throat. I do not have a certain explanation for this effect.

In order that the proper differential pressure shall be maintained between the depression in the float chamber and that at the fuel delivery ports 15 for delivering a proper amount of fuel for an efficient combustible mixture, the regulating device 20 is provided and so arranged that by its movement into and out of the entrance to the small Venturi tube, it increases and decreases the velocity of the air past the entrance 17 to the conduit 18. By this method the depression in the upper spaces of the float chamber is controlled without offering material resistance to the air passing through the primary Venturi tube 14.

In order to maintain a proper depression in the mixing chamber 13 of the carbureter for all engine speeds, I provide an auxiliary air valve 22, which is controlled through a link 23 by means of a piston 24 operating in a cylinder 25, the inner space of which is connected by a passage 26 with a point at the throat of the secondary Venturi tube 12. The suction at the throat of the secondary Venturi tube is thus communicated to the inner side of the piston 24, and the piston is drawn in against the pressure of the spring 27. There is of necessity a slight amount of air leakage between the piston 24 and the cylinder 25, and between the piston rod 30 and the housing through which this rod operates. In order to cause the valve 22 and parts controlling it to respond to the suction at the throat of the secondary Venturi tube 12, I provide a valve 31, which, through its lever 32 and a link, not shown, connecting with the instrument board of the automobile, can be adjusted to suit the conditions of road under which the vehicle is being operated. By moving the valve 32 so as to slightly constrict the opening through the passage 26, the valve 22 will not be opened through as great an angle for a given depression in the mixing chamber, and the velocity through the primary Venturi tube will therefore be increased, and the suction depression on the fuel in the fuel chamber will be increased and the fuel lifted through a greater distance.

The regulating device 20 is preferably controlled by a set of linkages including a bell-crank 34, pivoted to the casing at 35, and having one of its projecting arms connected by means of the link 36 with a moving projection 37 forming a part of the link 23. The other arm of the bell-crank lever 34 is provided with a pin 34^a, which slides in a vertical slot in the collar 34^b, which is secured to the stem of the regulating device 20. By this mechanism the inward movement of the piston 24 causes the regulating device 20 to be withdrawn proportionately from the entrance to the primary Venturi tube 14.

In the operation of the carbureter described above at low speeds the depression in the mixing chamber is insufficient to cause any movement of the piston 24 for

the reason that air leaks past the edges of this piston and around the piston rod 30 as fast as it is withdrawn from the cylinder through the passage 26. Consequently the auxiliary air valve 22 remains in its substantially closed position. This causes almost all of the air entering the mixing chamber to pass through the primary Venturi tube. The diameter of this tube is so small that the air passes through it at a comparatively high velocity, this velocity being sufficient to cause a suction through the opening 17 and the tube 18 sufficient to maintain a pressure reduction in the space above the fuel in the float chamber, which in turn is sufficient to raise the fuel from the supply tank under the ordinary conditions of operation.

As the speed of the engine increases the depression in the mixing chamber likewise tends to increase and this increased depression is communicated through the passageway 26 and the cylinder 25, withdrawing the air through this passage faster than the air can creep in past the edges of the piston, and thereby causing the piston to move downwardly against the action of the spring 27, and opening the auxiliary air valve 22 to a degree corresponding to the depression in the mixing chamber. The increased depression in the mixing chamber at high speeds causes an increased amount of air to be drawn through the primary venturi, and unless some means is provided the increased velocity of this air past the opening 17 would cause a further depression in the space above the fuel in the float chamber. The regulating device 20 is however connected in such a manner with the piston 24 that as the piston 24 is moved downwardly the regulating device 20 is withdrawn from the primary Venturi tube sufficiently to maintain the velocity of air past the opening 17 substantially constant.

In the event that the automobile to which the carbureter is attached ascends a steep hill the distance through which the fuel must be raised from the supply tank to the carbureter increases considerably, and it is therefore necessary to provide increased suction or in other words to increase the depression in the upper part of the float chamber. This is accomplished, in the embodiment of the invention shown in Fig. 1, by means of the valve 31. When this valve is moved to partially restrict the passage 26 the piston 24 moves upwardly, due to the fact that there is a lesser degree of vacuum maintained on the lower side of the piston within the cylinder 25. As the piston 24 moves upwardly it partially closes the auxiliarly air valve 22. It will be noted that the throttle position has not been changed during the above described adjustment of valve 31, and so long as there is no change of speed the engine demands the same quantity of air. Thus it will be clear that a larger quantity of air will be drawn through the primary air passage under such conditions, the auxiliary passage having been reduced in size. Obviously, an increased volume of air flows through the small Venturi tube and this will increase the partial vacuum maintained therein at all points owing to the increase of air velocity within said small Venturi tube accompanying the increase in volume of air passing therethrough. It will be clear that the velocity of the air passing through the small Venturi tube increases at the openings 17 and also at the openings 15, so that both the depression in the top of the float chamber and the depression at the fuel nozzle are increased. Unless devices were provided to prevent such action the depression at the fuel nozzle would increase more rapidly than at the opening 17, because of the fact that the fuel nozzle is located at that point in the Venturi tube where the velocity of the air flowing therethrough is greatest. If such a result were brought about the fuel feeding differential, that is, the difference between the depression or suction maintained at the orifices 15 and 17 would also increase and cause an increased flow of fuel. An increased flow of fuel would be objectionable with the throttle position and engine demand constant and the the regulating device 20 operates in a manner hereinafter fully set forth to maintain the differential pressure between the top of float chamber or orifice 17 and the nozzle openings 15 substantially constant even though the depression in the space above the fuel in the float chamber may have been increased by adjustment of valve 31.

In Fig. 3 the spring 40 for maintaining the throttle 22 normally closed, is located outside the carbureter housing, and is arranged to operate upon a rod 41 carried by the piston 24. In this modification the cylinder head 42 is provided with an outwardly extending sleeve 43 upon the end of which a cam 44 is cut, this cam being preferably provided with two cam surfaces. Around the sleeve 43 is a second sleeve 45 carrying an arm and a spring seat, and also provided with inwardly projecting members 46 and 47 which engage the cam surfaces 44 so that when the sleeve 45 is rotated by means of the arm thereof, the spring 40 may be pressed so as to require a greater degree of depression behind the piston 24, for opening the auxiliary air valve 22 to any predetermined position. The effect of the sleeve 45 is the same as that of the arm 32 of Fig. 2, in that it brings about the increase of depression in the float chamber so that the fuel may be lifted through a greater distance.

In Fig. 4 a still further modification is

illustrated, in which an arm 50 is attached to the pivoted pin of the auxiliary air valve 22, the end of the arm being provided with a spring 51 which may be connected by means of a wire 52 with an adjustable member on the operator's instrument board so that the tension of spring 51 may be added to that of spring 27, in order to add resistance to the movement of the auxiliary air valve for the purpose heretofore described.

In the operation of the herein disclosed carbureter upon an internal combustion engine, starting for example with the throttle nearly closed, almost all of the air which enters the mixing chamber 13 passes through the throat of the small Venturi tube 14. This tube is made of such small diameter that the velocity of air through it, even when the throttle is substantially closed and the engine is running at its lowest speed, is sufficient to create a suction of substantially thirty inches at the opening 17 and a suction of substantially thirty four inches at the nozzle openings 15. If the throttle 11 is opened wider the depression in the mixing chamber 13 will become greater and the velocity of air through the small Venturi tube 14 will be gradually increased as the engine demand becomes greater.

The auxiliary air valve 22 and its controlling devices are so constructed that when the engine is operating at its lowest idling speed, with the throttle 11 substantially closed, a small amount of air enters around said auxiliary air valve 22, the construction being such that the small venturi 14 will not admit quite all the air necessary for operating the engine at idling speed without the vacuum in the mixing chamber becoming high enough to cause a slight opening of the auxiliary air valve 22 by means of the suction acting on the piston 24. When the engine speed increases the suction in the mixing chamber increases which causes the auxiliary air valve to open wider and moves the regulator 20 to the left in Fig. 1 and away from the throat of the Venturi tube. The regulator 20 is so shaped that it does not constitute the greatest restriction in the Venturi tube and therefore does not act to change the quantity of air but merely to change the speed of the air at various points in the Venturi tube opposite the regulating device. The area of the tube at the opening 17, of the duct to the top of the float chamber, is enlarged; therefore, the velocity of the air passing the opening 17 is reduced and the suction at opening 17 correspondingly reduced, while the air velocity at the nozzle openings 15 and the consequent suction at such point remains constant. The fuel feeding differential, that is the difference between the suction maintained at the nozzle openings and opening 17, is therefore increased when the suction in the mixing chamber is increased and the regulator device operated as described. It has been assumed for purposes of illustration, that a constant quantity of air is passing through the Venturi tube 14 during the operation of the regulator device as above described. As a matter of fact the quantity of air actually passing through the venturi 14 increases when the suction in the mixing chamber increases and this being true the velocity and the suction at both the openings 15 and 17 increase, but the outward movement of the regulator tends to decrease the velocity at the opening 17 as above set forth and therefore the suction at such point is not increased as rapidly as at the nozzle, thus providing for an increase of fuel feeding differential when the mixing chamber suction increases. In so far as above set forth the operation of the device is exactly the same as that of the device disclosed in my prior application, 168,325, hereinbefore referred to.

When the carbureter of my invention is used upon an automobile, occasions may arise when a vacuum of thirty inches of gasolene in the float chamber is not sufficient to lift the fuel from the low level tank at the rear of the automobile to the carbureter float chamber. With most automobiles a suction of thirty inches in the float chamber is sufficient for lifting the fuel from the rear tank to the carbureter on all grades which can be climbed on high gear. If, however, a grade is encountered which is so steep that the lift from the rear tank to the carbureter is more than thirty inches, means must be provided for increasing the vacuum in the float chamber for lifting the fuel. As previously pointed out the greater the depression in the mixing chamber, the less the ultimate power that can be obtained from the engine. It is therefore ordinarily desirable that the mixing chamber depression be kept as slight as possible so that the greatest possible power can be obtained from the engine. As has been pointed out, however, when such a steep grade is encountered that thirty inches of suction in the float chamber is not sufficient to lift the fuel, it is necessary with most makes of cars to shift the gears so as to obtain a greater speed ratio between the engine and the driving axle. When this is done it is unusual that all the power of the engine will be required so that it is not detrimental to the action of the system that temporarily a greater depression is to be produced in the mixing chamber.

Three different arrangements are illustrated herein and have been previously described for producing temporarily a greater depression in the float chamber to meet the above described emergency occasioned by steep grades. Each of these devices is directed toward holding the auxiliary air

valve 22 more nearly in its closed position, thus restricting the inflow of air through the auxiliary air passage.

When any of the above mentioned devices are employed to cause a closing movement of the auxiliary air valve 22 the fuel feeding differential is not changed so long as the throttle position is unchanged and the same quantity of air is entering the carbureter. This is due to the fact that the small Venturi tube 14 and regulating device 20 are so constructed that the pressure differential between the ports 15 and 17 remains constant as long as the same quantity of air is delivered to the mixing chamber. If, for instance, the valve 22 is partially closed and the throttle is not moved, a greater quantity of air will pass through the small Venturi tube 14 and a lesser quantity around such tube through the auxiliary air passage. The suction at such a time will be increased at the ports 15 and 17 and will be increased through the same degree. For instance, the suction at port 17 will be forty inches of gasolene instead of thirty, and the suction at the nozzle ports 15 will be forty four inches instead of thirty four.

The maintenance of the constant fuel feeding head under the conditions outlined is due to the action of the regulating device 20. When the valve 22 is partially closed the regulating device 20 is moved to the right in Fig. 1, that is, toward the throat of the tube 14. This movement has no effect on the size of the throat of the Venturi tube, but reduces the area of the tube at the port 17. If this movement did not take place an increased quantity of air passing through the tube would cause a greater increase in the suction at the ports 15 than at 17 because of the fact that the ports 15 are at the point of greatest suction in the tube 14. The slight reduction in area at the port 17 produced by the movement of the regulator 20 causes the suction at such port to increase as rapidly as at the ports 15. The regulating device 20 acts therefore to maintain a constant fuel feeding differential regardless of the position the auxiliary valve 22 may be caused to assume by adjustment of the valve 31 or similar device, so long as the quantity of air entering the mixing chamber remains the same.

Although my invention is shown and described with respect to certain details of construction, it is to be understood that I do not wish to be unduly limited thereto, certain modifications being obviously possible without departing from the spirit or scope of my invention.

What I claim is:—

1. In a carbureter for lifting fuel from a low level supply to the level of the carbureter the combination of a float chamber and mixing chamber, an atomizing chamber, an air valve anterior to said mixing chamber, means responsive to the depression in said mixing chamber for controlling said valve, a regulator and a manually controlled means for automatically controlling said last named means and said regulator to control the depression in said float chamber without disturbing the differential pressure between the float chamber and the atomizing chamber.

2. In a carbureter for lifting fuel from a low level supply to the level of the carbureter by suction, the combination of a float chamber and an atomizing chamber, means for maintaining substantially constant suction above the fuel in said float chamber during wide change in engine demand, which is just sufficient for lifting fuel from the low level supply to the carbureter under ordinary conditions of operation, suction controlled means for controlling the degree of suction in said float chamber, comprising a passage, and manually controlled means in said passage for increasing the suction in the carbureter float chamber without materially disturbing the differential fuel pressure between the float chamber and the atomizing chamber.

3. In a carbureter, the combination with a Venturi tube of a regulating device for controlling the velocity of air into said tube a bell-crank lever for regulating said device, an auxiliary air valve, one arm of said bell-crank lever being mechanically connected with said auxiliary air valve and the other arm being mechanically connected with said regulating device whereby the regulating device will be moved proportionately with the movement of the auxiliary air valve.

4. In a carbureter having a float chamber in which a depression is maintained above the level of the fuel therein for lifting fuel from a low-level source to the level of the carbureter, means for automatically varying the fuel-feeding pressure differential to deliver the proper mixture of the fuel and air at different engine speeds, and means controlled by a single manually-operable device for changing the fuel-lifting depression in the float chamber without disturbing the fuel-feeding differential for maintaining proper proportions of air and fuel.

5. In a carbureter having a reservoir in which a depression is maintained for lifting fuel from a low source of supply to said reservoir, means for maintaining a proper mixture of fuel and air for different engine speeds, and means controlled through the operation of a single operable device for changing the fuel-lifting depression in the reservoir without disturbing the proper proportions of fuel and air for different speeds.

6. In a carbureter provided with a mixing chamber and with a fuel reservoir in which a depression is maintained for lifting

fuel thereto from a low-level source of supply, means for maintaining a greater depression upon the fuel in said reservoir than that of the mixing chamber for all engine speeds, means for delivering definite quantities of fuel from the reservoir to the mixing chamber for each of the various engine demands, and manually-controlled means for varying the depression upon the fuel in said fuel reservoir without disturbing the proper proportionality of fuel to air in the mixing chamber for the various different engine demands.

In witness whereof I hereunto subscribe my name this 11th day of June, A. D. 1917.

MILFORD G. CHANDLER.

Witnesses:
ROBERT F. BRACKE,
MARY A. COOK.