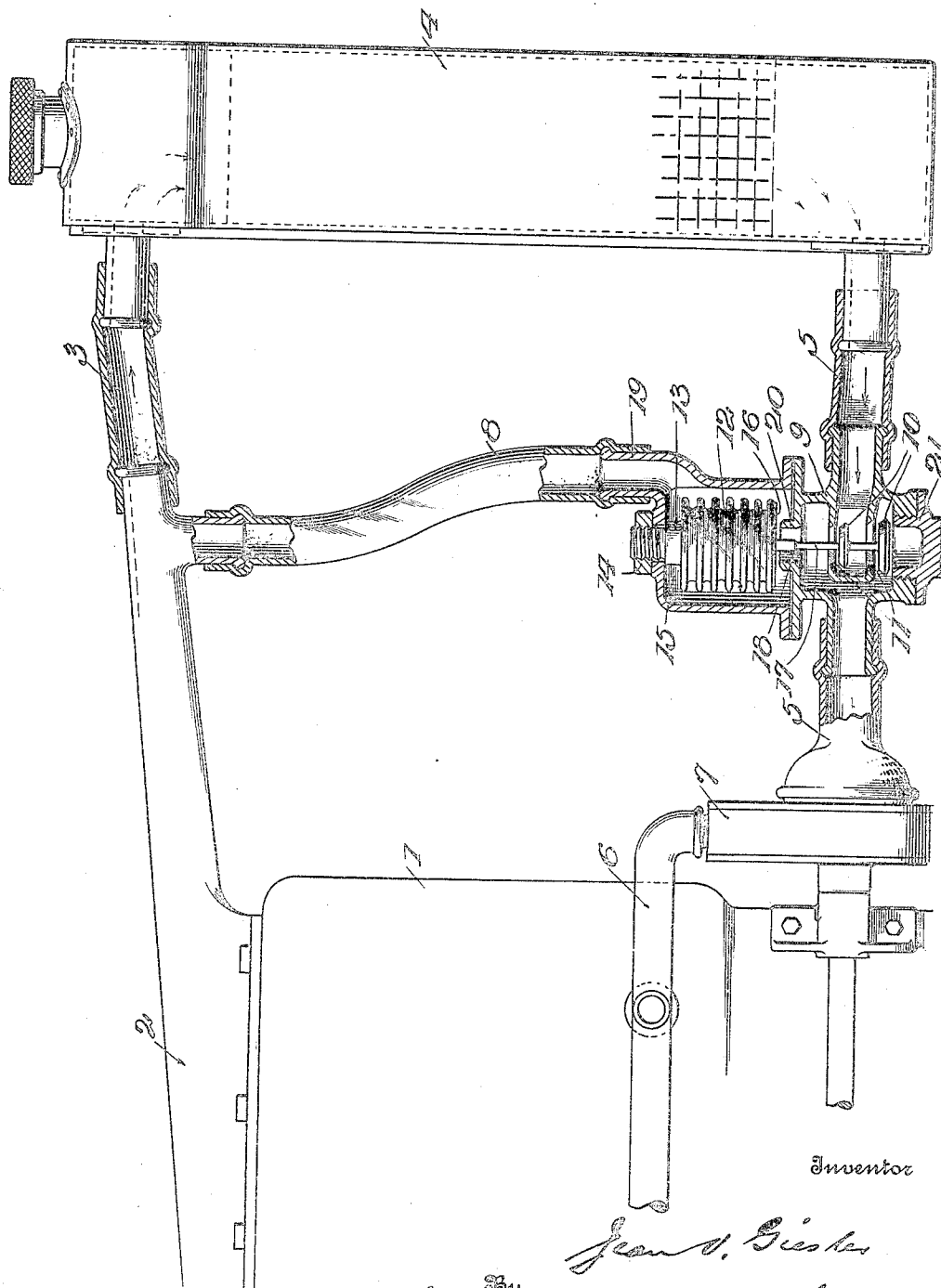


J. V. GIESLER.  
 COOLING SYSTEM FOR INTERNAL COMBUSTION ENGINES.  
 APPLICATION FILED MAY 12, 1917.

1,382,498.

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# UNITED STATES PATENT OFFICE.

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COOLING SYSTEM FOR INTERNAL-COMBUSTION ENGINES.

1,382,498.

Specification of Letters Patent. Patented June 21, 1921.

Application filed May 12, 1917. Serial No. 168,238.

*To all whom it may concern:*

Be it known that I, JEAN V. GIESLER, a citizen of the United States of America, and a resident of Knoxville, Tennessee, have invented a new and useful Improvement in Cooling Systems for Internal-Combustion Engines, which invention is fully set forth in the following specification.

This invention relates to cooling systems for internal combustion engines and, while capable of use with a wide variety of engines of this type, has particular utility when applied to the cooling of automobile engines.

Under some conditions it is desirable to govern the temperature of the cooling medium flowing through the system from the temperature of such medium as it leaves the engine jacket. To this end it has been proposed to subject a thermostatic vessel to the cooling medium in the outlet manifold. A thermostatic element so positioned, however, may be seriously affected by the pressure built up around the same by the circulating pump, as the thermostatic element has to expand against this pressure, which varies under different conditions, and therefore does not properly respond to temperature changes to maintain the desired temperature in the system.

It is an object of this invention to provide an improved cooling system for internal combustion engines wherein the thermostatic element is subjected to cooling medium at substantially the temperature at which it leaves the engine jacket, while minimizing the interference with the proper operation of such element by changes of pressure in the system due to the circulating pump.

It has also been suggested, in certain forms of systems for cooling internal combustion engines, to subject the thermostatic element to cooling medium flowing through an always-open by-pass around the radiator. Such systems, however, offer the objection that, under high temperature conditions, the cooled part of the medium flowing from the radiator may be insufficient to offset the high temperature existing in that part of the medium which does not pass through the radiator, whereby the engine may become overheated. Furthermore, such an always-open by-pass has been unsatisfactory in cooling systems wherein the quantity of cooling me-

dium flowing through the radiator is automatically varied, since, if the by-pass be made of sufficient size to take care of the circulation of the cooling medium when the passage through the radiator is closed, not only is the pump subjected to adverse conditions because of the varying quantities of cooling medium flowing through the system during different positions of the valve mechanism controlling flow through the radiator, but also the engine may be overheated under high temperature conditions because of the large proportion of cooling medium not subjected to the cooling influence of the radiator.

A further object of this invention is to provide a cooling system for internal combustion engines wherein the thermostatic element is subjected to the cooling medium flowing through an always-open by-pass around the radiator without danger of the engine becoming overheated and without subjecting the circulating pump to adverse operating conditions.

It has also been suggested, as in the British Patent to Shields No. 26,080 of 1905, to provide a cooling system, comprising a by-pass around the radiator, wherein a constant circulation is maintained through the radiator, together with a thermostat for regulating the flow of the cooling medium through the by-pass and radiator. Such a system, however, is open to the objection that not only is the thermostatic element not subjected to such medium at the temperature in the outlet manifold but also, owing to the constant circulation maintained through the radiator, it may be subjected to the medium at too low a temperature for the maintenance of a proper operating temperature in the engine jacket. Furthermore, as a considerable proportion of cooling medium is always subjected to the cooling effect of the radiator, such a system becomes incapable of maintaining the cooling medium at that temperature at which the engine operates most efficiently under low temperature conditions outside of the engine.

It is a still further object of this invention to provide a cooling system for internal combustion engines comprising a by-pass around the radiator wherein a substantially constant volume circulation is maintained through the system while the thermostatic element is subjected to cooling me-

dium at substantially the temperature in the outlet manifold and the cooling medium maintained at that temperature at which the engine operates most efficiently and without  
 5 subjecting the pump to adverse operating conditions, even under adverse temperature conditions outside of the engine.

Another object of this invention is to provide a cooling system for internal combustion engines wherein the proper operating  
 10 temperature of the cooling medium will be maintained for a longer time after the engine has stopped than in systems heretofore known, whereby the engine may resume operation under conditions of increased efficiency if it has been stopped but a short  
 15 time.

Other objects relate to the provision of a cooling system for internal combustion engines which is simple in construction, inexpensive to manufacture, easy to install, and efficient in operation.

Stated broadly, the invention comprises, in a cooling system for internal combustion  
 25 engines, the combination of an engine jacket, a radiator connected to such jacket, valve mechanism for regulating the circulation of cooling medium through the radiator, and thermosensitive means for controlling said  
 30 valve mechanism, said thermosensitive means being subjected to cooling medium flowing through an always-open by-pass but varied in quantity as the quantity of cooling medium flowing through the radiator is varied,  
 35 said by-pass being preferably heat-insulated so that the medium flowing there-through shall have substantially the same temperature as that existing in the outlet manifold. In the preferred embodiment of  
 40 this invention, a second valve mechanism is interposed in the by-pass and is also under the control of the thermosensitive means, which valve mechanism, while always open to permit a circulation of cooling medium  
 45 through said by-pass, is operated to vary the effective opening through the by-pass whereby the quantity of cooling medium flowing therethrough is increased and decreased as the quantity of cooling medium  
 50 flowing through the radiator is respectively decreased and increased.

The invention is capable of receiving a variety of mechanical expressions, one of which is shown on the accompanying drawing,  
 55 ing, but it is to be expressly understood that such drawing is for purposes of illustration only and is not to be construed as a definition of the limits of the invention, reference being had to the appended claims for that  
 60 purpose.

The drawing shows somewhat diagrammatically an elevation, partly in section, of an internal combustion engine provided with a cooling system embodying the present  
 65 invention,

In the form shown, 1 is an internal combustion engine. While but one cylinder has been illustrated on the drawing, it is to be expressly understood that any desired number of cylinders may be employed. Said  
 70 cylinder or cylinders are provided with the usual jacket through which it is designed a cooling medium shall be circulated, said jacket opening adjacent its upper end into the outlet manifold 2 which communicates  
 75 through suitable connections 3 with any suitable form of radiator 4. From radiator 4 the cooling medium is returned to the engine jacket through suitable connections 5 and the inlet manifold 6. A pump is diagrammatically illustrated at 7 for maintaining the circulation through the system, but it is to be expressly understood that, as respects certain features of this invention, the thermo-siphon system of maintaining a circulation through the engine jacket may be employed if desired.

In accordance with the present invention, a by-pass 8 is provided around the radiator, the same communicating adjacent its upper  
 90 end with the connections 3 between the engine jacket and radiator, preferably at a point such that the cooling medium flowing through the by-pass will have substantially the same temperature as that existing in the  
 95 outlet manifold 2. That the by-pass may not operate as a radiator, it is also preferably heat-insulated, being shown as constructed of non-heat-conducting material such as rubber.

To control the circulation of cooling medium through the radiator, a valve housing 9 is interposed in the connections 5 between the radiator and the engine jacket, said  
 105 housing, when a circulating pump is used, being positioned on the suction side of said pump as shown. Within said valve housing 9 is suitable primary valve mechanism for opening and closing the passage there-through. While a wide variety of valve  
 110 mechanisms may be employed, that shown comprises a pair of seating valves 10 adapted to open and close ports 11 provided in walls positioned interiorly of said housing 9.

Thermosensitive means are provided for  
 115 operating said valve mechanism, the same being subjected to the cooling medium flowing through the by-pass 8. While a wide variety of thermosensitive means may be employed, the construction shown on the  
 120 drawing comprises an expansible and collapsible corrugated resilient vessel 12 having one end wall 13 fixedly secured in any suitable way, as by a nut 14, to the thermostat housing 15 and having its opposite end wall  
 125 16 connected by a stem 17 to the valves 10, said stem operating through an aperture 18 provided in the valve housing. Thermostat housing 15 is shown as suitably connected at one end to the valve housing 9, and adja- 130

cent its opposite end, is provided with a nipple 19 to which is connected the by-pass conduit 8.

Valve mechanism is also provided to control the quantity of cooling medium flowing through the by-pass. In the form shown the aperture 18 is made larger than the stem 17 and is surrounded by a collar 20 toward and from which the movable end wall 16 of the thermosensitive vessel 12 approaches and recedes as the valves 10 are opened and closed respectively. To provide a positive stop for the valve stem 17 so as to prevent movable wall 16 ever engaging collar 20 and therefore stopping the circulation of cooling medium through the by-pass 8, the thimble 21 closing one side of the valve housing 9 may be brought into such relation to the lower valve member 10 as to be engaged by the latter before wall 16 comes into engagement with collar 20. To prevent dangerous conditions arising in the cooling system in case of failure of the temperature control as by leakage of the thermostatic vessel 12, said vessel is preferably charged with a thermosensitive fluid at a pressure below that existing in the medium surrounding the same, whereby said vessel is normally collapsed against a suitably provided elastic force which, when the vessel is constructed of resilient material, is inherent in the walls thereof. Upon failure of the temperature control, as by leakage of the thermosensitive fluid from said vessel, the equalization of the internal and external pressures acting on the vessel unbalances the elastic force against which the vessel is normally collapsed, whereby said vessel thereupon expands, moving the valves 10 to a position of safety, *i. e.*, to an open position, wherein the maximum flow of cooling medium through the radiator is permitted.

When the engine is started, the cooling medium is cold, vessel 12 is collapsed, valve members 10 are in engagement with ports 11, and wall 16 is at its most remote position from collar 20. The circulation of cooling medium is now from the engine jacket to outlet manifold 2, through by-pass 8, pump 7, and inlet manifold 6, back to the jacket. As no cooling medium is being circulated through the radiator, such medium is quickly heated to that temperature at which the engine operates most efficiently. Upon further increase in temperature, vessel 12, which, it is to be assumed, has been suitably designed or adjusted to begin expansion at this temperature, starts to open valve members 10 and permit a circulation of the cooling medium through the radiator. Expansion of the vessel 12 brings wall 16 closer to the collar 20, thereby reducing the effective opening in the by-pass and proportionately decreasing the quantity of cooling medium flowing therethrough. Upon a further in-

crease in temperature of the cooling medium, valve members 10 are opened still further, permitting an increased flow of cooling medium through the radiator. Wall 16 also more nearly approaches collar 20 and correspondingly decreases the circulation through the by-pass. When the valve members are moved to their extreme open position, permitting a maximum flow of cooling medium through the radiator, the lower member 10 engages the thimble 21, preventing a further expansion of the vessel 12 and therefore preventing wall 16 from engaging the collar 20. Consequently, while the quantity of cooling medium flowing through the by-pass is decreased to a comparatively small quantity, the opening through the by-pass is never closed and therefore the thermostatic element is always subjected to medium that has not passed through the radiator. Furthermore, by making the by-pass heat-insulated, the medium to which the thermostatic element is subjected has practically the temperature existing in the outlet manifold. Upon stopping the engine, the colder medium in the radiator tends to rise in the thermostat housing 15 because the hotter medium in the by-pass 8 tends to rise into the upper connections 3 and flow into the radiator. Vessel 12 is therefore promptly subjected to the colder medium, whereupon it contracts, closing the valve members 10 and stopping further circulation through the radiator. The cooling medium in the jacket consequently remains for a longer period at the proper operating temperature, whereby, if the engine be again started in a short time, it will begin to operate under conditions of high efficiency.

It will therefore be perceived that the thermostatic element is subjected to cooling medium at substantially the temperature existing in the outlet manifold while said element, by being positioned on the inlet side of the pump, is not materially affected by pressure changes due to the circulating pump. Furthermore, while the thermostatic element is subjected to cooling medium in an always-open by-pass, the circulation therethrough is varied in substantially inverse proportion to the quantity of cooling medium flowing through the radiator, so that when the cooling medium is at a high temperature the larger part thereof is subjected to the cooling influence of the radiator and therefore danger of the engine overheating is entirely eliminated. Moreover, the variation of the effective area through an always-open conduit constitutes a very effective method of controlling circulation of a cooling medium without stopping said circulation, whereby the thermosensitive means is continuously subjected to fresh medium at a temperature representative of the condition in the cooling system.

Additionally, a substantially constant volume circulation of cooling medium is maintained through the system, and the thermostatic element is subjected to medium at substantially the temperature existing in the outlet manifold without subjecting the pump to adverse operating conditions while, under low temperature conditions, the circulation through the radiator is stopped and the medium maintained at substantially that temperature at which the engine operates most efficiently.

While the embodiment of the invention illustrated on the drawing has been described with considerable particularity, it is to be expressly understood that the invention is not to be restricted to the form there shown for it is capable of receiving a variety of mechanical expressions, some of which will readily suggest themselves to those skilled in the art, while certain features thereof are capable of use without other features thereof. Reference is therefore to be had to the claims hereto appended for a definition of the invention.

What is claimed:—

1. In a cooling system for internal combustion engines, the combination of an engine jacket, a radiator, connections therebetween, valve mechanism for regulating the circulation of cooling medium through said radiator, thermosensitive means for controlling said valve mechanism, an always-open by-pass around said radiator, said thermosensitive means being subjected to the cooling medium flowing through said by-pass, and means whereby the quantity of cooling medium flowing through said radiator is respectively decreased and increased.

2. In a cooling system for internal combustion engines, the combination of an engine jacket, a radiator, connections therebetween, valve mechanism for regulating the circulation of cooling medium through said radiator, thermosensitive means for controlling said valve mechanism, an always-open by-pass around said radiator, said thermosensitive means being subjected to the cooling medium flowing through said by-pass, and valve mechanism for varying the flow of the cooling medium through said by-pass as said first-mentioned valve mechanism is opened and closed.

3. In a cooling system for internal combustion engines, the combination of an engine jacket, a radiator, connections therebetween, valve mechanism for regulating the circulation of cooling medium through said radiator, thermosensitive means for controlling said valve mechanism, an always-open by-pass around said radiator, said thermosensitive means being subjected

to the cooling medium flowing through said by-pass, and valve mechanism operated by said thermosensitive means for varying the effective opening through said by-pass.

4. In a cooling system for internal combustion engines, the combination of an engine jacket, a radiator, connections therebetween, valve mechanism for regulating the circulation of cooling medium through said radiator, thermosensitive means for controlling said valve mechanism, an always-open by-pass around said radiator, said thermostatic means being subjected to the cooling medium flowing through said by-pass, and valve mechanism operated by said thermosensitive means for proportioning the flow of cooling medium through said by-pass substantially inversely to the flow of cooling medium through said radiator.

5. In a cooling system for internal combustion engines, the combination of an engine jacket, a radiator, connections therebetween, valve mechanism for regulating the circulation of cooling medium through said radiator, thermosensitive means comprising an expansible and collapsible vessel for controlling said valve mechanism, an always-open by-pass around said radiator in which said vessel is positioned, and a valve port in said by-pass to and from which the movable wall of said vessel approaches and recedes to vary the effective opening through said port.

6. In a cooling system for internal combustion engines, the combination of an engine jacket, a radiator, connections therebetween, an always-open by-pass around said radiator, thermosensitive means subjected to the cooling medium flowing through said by-pass, primary valve mechanism controlled by said thermosensitive means, and means for varying the flow of cooling medium through said by-pass as said first-mentioned valve mechanism is opened and closed.

7. In a cooling system for internal combustion engines, the combination of an engine jacket, a radiator, connections therebetween, an always-open by-pass around said radiator, thermosensitive means subjected to the cooling medium flowing through said by-pass, primary valve mechanism controlled by said thermosensitive means, and other valve mechanism operated by said thermosensitive means for varying the effective opening through said by-pass.

8. In a cooling system for internal combustion engines, the combination of an engine jacket, a radiator, connections therebetween, an always-open by-pass around said radiator, valve mechanism in the connection between said jacket and radiator through which the cooling medium returns to said jacket, thermosensitive means for control-

ling said valve mechanism subjected to the cooling medium flowing through said by-pass, and means for varying the effective opening through said by-pass.

9. In a cooling system for internal combustion engines, the combination of an engine jacket, a radiator, connections therebetween, an always-open by-pass around said radiator, valve mechanism in the connection between said jacket and radiator through which the cooling medium returns to said jacket, thermosensitive means for controlling said valve mechanism subjected to the cooling medium flowing through said by-pass, means for varying the effective opening through said by-pass, and a pump in the connection between said valve mechanism and said jacket.

10. In a cooling system for internal combustion engines, the combination of an engine jacket, a radiator, connections therebetween, an always-open by-pass around said radiator, valve mechanism in the connection between said radiator and jacket through which the cooling medium returns to said jacket, thermosensitive means subjected to the cooling medium flowing through said by-pass for controlling said valve mechanism, said by-pass being heat-insulated whereby said thermosensitive means is always subjected to cooling medium at substantially the temperature at which it leaves the engine jacket, and means for varying the effective area through said by-pass as said valve mechanism is opened and closed.

11. In a cooling system for internal combustion engines, the combination of an engine jacket, a radiator, connections therebetween, an always-open by-pass around said radiator, valve mechanism in the connection between said radiator and jacket through which the cooling medium returns to said jacket, thermosensitive means subjected to the cooling medium flowing through said by-pass for controlling said valve mechanism, said by-pass being heat-insulated whereby said thermosensitive means is always subjected to cooling medium at substantially the temperature at which it leaves the engine jacket, and valve mechanism operated by said thermosensitive means for decreasing and increasing the flow of cooling medium through said by-pass as the flow of cooling medium through said radiator is increased and decreased respectively.

12. In a cooling system for internal combustion engines, the combination of an engine jacket, a radiator, connections therebetween, an always-open by-pass around said radiator, thermosensitive means subjected to the cooling medium flowing through said by-pass, said by-pass being heat-insulated whereby said thermosensitive means is always subjected to cooling medium at sub-

stantially the temperature at which it leaves the engine jacket, valve mechanism controlled by said thermosensitive means for regulating the circulation of cooling medium through said radiator, and means controlled by said thermosensitive means for inversely proportioning the circulation of cooling medium through said by-pass.

13. In a cooling system for internal combustion engines, the combination of an engine jacket, a radiator, connections therebetween, an always-open by-pass around said radiator, thermosensitive means subjected to the cooling medium flowing through said by-pass, said by-pass being heat-insulated whereby said thermosensitive means is always subjected to cooling medium at substantially the temperature at which it leaves the engine jacket, primary valve mechanism controlled by said thermosensitive means, and means operated by said thermosensitive means for varying the effective area through said by-pass.

14. In a cooling system for internal combustion engines, the combination of an engine jacket, a radiator, connections therebetween, an always-open by-pass around said radiator, valve mechanism for regulating the circulation of cooling medium through said radiator, thermosensitive means subjected to the cooling medium flowing through said by-pass for controlling said valve mechanism, said by-pass being heat-insulated whereby the temperature of the cooling medium flowing therethrough has substantially the temperature of the cooling medium flowing from the engine jacket, and means for varying the effective opening through said by-pass.

15. In a system for circulating a cooling medium in heat-interchanging relation with an internal combustion engine and including a radiator, an always-open conduit including a port, and the thermosensitive means having a movable wall which approaches and recedes with respect to said port to control the circulation of cooling medium through said conduit.

16. In a system for circulating a cooling medium in heat-interchanging relation with an internal combustion engine and including a radiator, an always-open conduit, and thermosensitive means provided with a movable wall which varies the effective opening through said conduit.

17. In a system for circulating a cooling medium in heat-interchanging relation with an internal combustion engine and including a radiator, valve mechanism for regulating the circulation of cooling medium through said radiator, thermosensitive means comprising an expansible and collapsible vessel for controlling said valve mechanism, an always-open by-pass around said radiator, and a valve port in said by-pass

with respect to which the movable wall of said vessel moves to vary the effective opening through said by-pass.

18. In a system for circulating a cooling  
5 medium in heat-interchanging relation with an internal combustion engine and including a radiator, an always-open conduit, and thermosensitive means subjected to the temperature of the cooling medium flowing  
10 through said conduit and provided with means for varying the effective opening through said conduit.

19. In a system for circulating a cooling

medium in heat-interchanging relation with an internal combustion engine and including a radiator, an always-open conduit including a port, thermosensitive means subjected to the temperature of the cooling medium flowing through said conduit, and valve means associated with said thermosen-  
20 sitive means for controlling the quantity of cooling medium flowing through said port.

In testimony whereof I have signed this specification.

JEAN V. GIESLER.