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2,799,455

AUTOMATIC CHOKE MECHANISM

Filed April 11, 1951

2 Sheets-Sheet 1

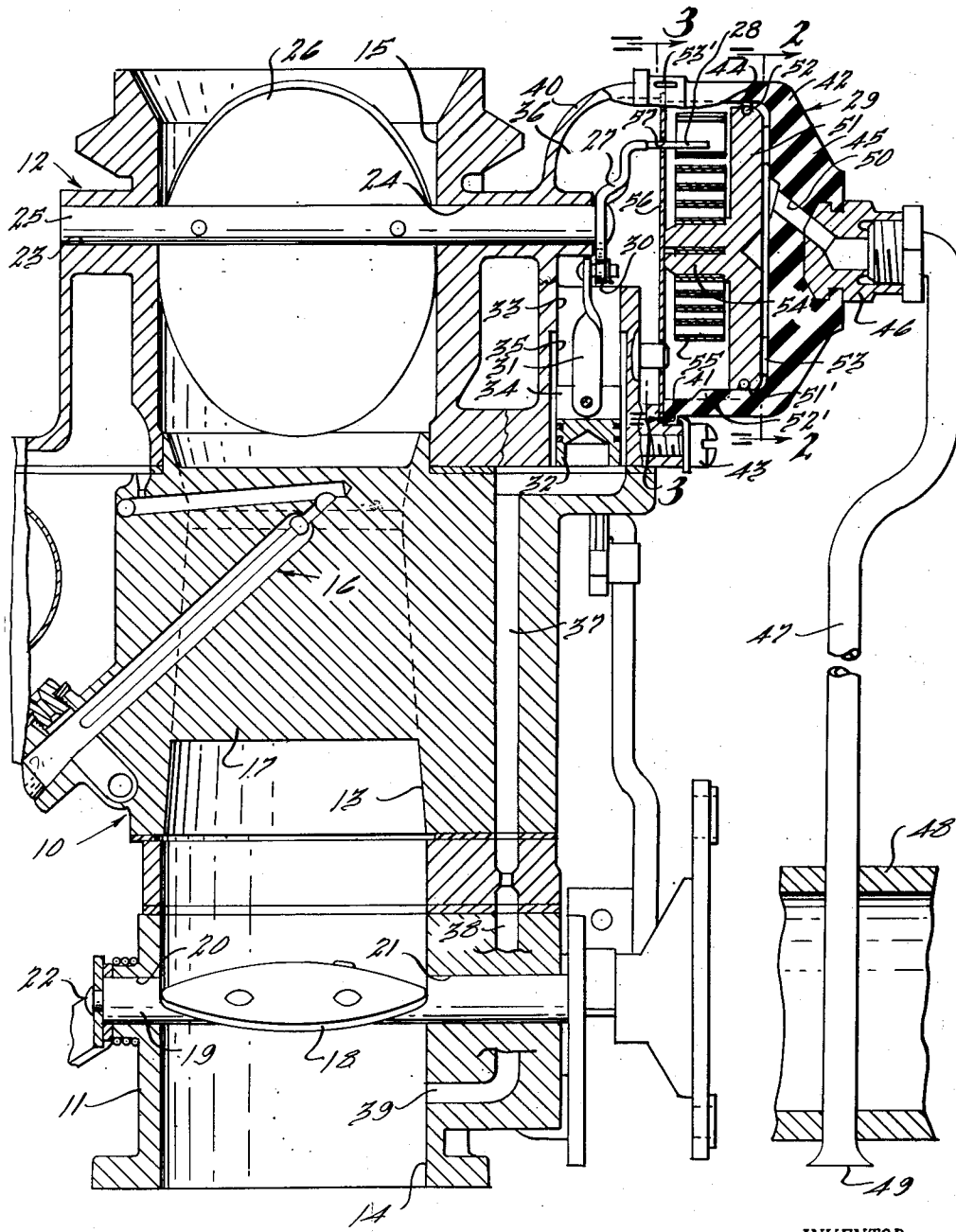


FIG. 1.

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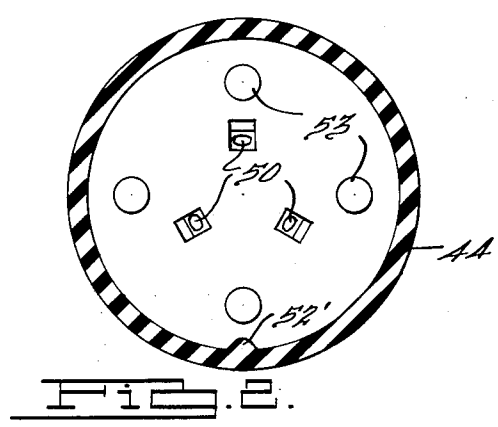


FIG. 2.

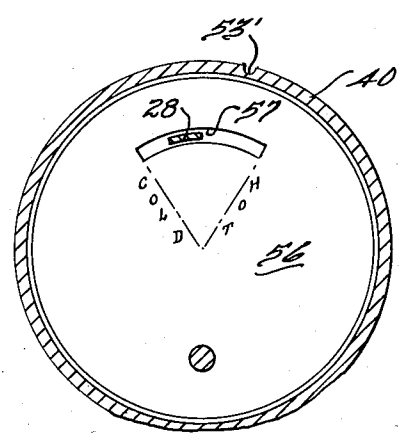


FIG. 3.

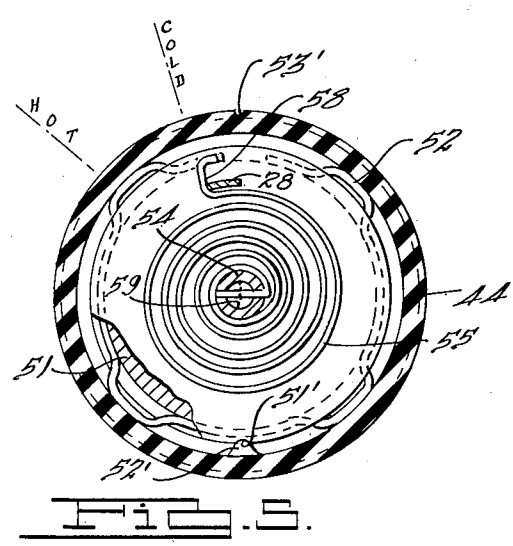


FIG. 4.

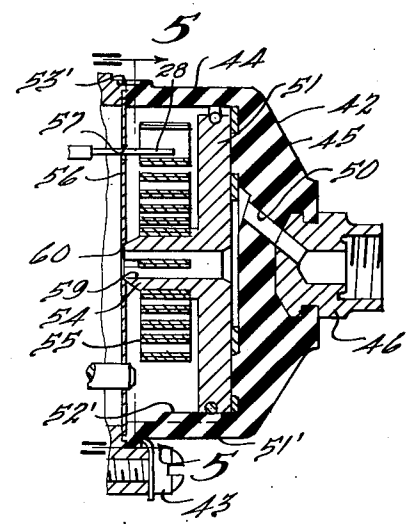


FIG. 5.

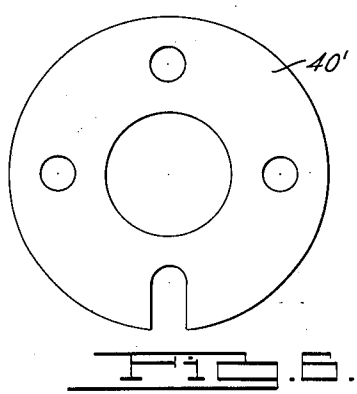


FIG. 6.

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AUTOMATIC CHOKE MECHANISM

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3 Claims. (Cl. 236—101)

This invention relates to an improved automatic choke device for internal combustion engine carburetors.

More particularly, the invention relates to a unitary carburetor and choke valve controlling apparatus that is substantially entirely built into the carburetor as a unit.

One of the main objects of the invention is to provide in a carburetor, an improved automatic choke device which is effectively responsive to changes in engine temperature even while located at a substantial distance from rapidly heated portions of the engine.

Another object of the invention is to provide improved means in an automatic choke device for subjecting the thermostatic element thereof to changing temperatures in response to changes in the temperature of an engine.

Automatic choke controlling apparatus is required to substantially close the choke valve of a carburetor when the engine with which the carburetor is associated is at a predetermined low temperature and to gradually open the choke valve as the engine warms to a predetermined high temperature at which the choke valve is retained in open position. When, as in a carburetor having built in choke valve control apparatus, the temperature responsive element of such apparatus is placed at a remote location from heated portions of an engine, it becomes necessary to provide means for conducting heat to the temperature responsive element.

It is one of the main objects of the invention to provide improved means for so conducting and applying engine heat to the temperature responsive element of an automatic built in choke valve controlling device as to cause it to delay opening of a closed or partially closed choke valve until the engine has warmed throughout to a desired temperature, and retard it from closing after the engine has warmed up until the engine has cooled to a predetermined low value and which so applies engine heat to the temperature responsive element as to permit utilization of a relatively sensitive thermostatic element.

Further objects of the invention are to provide an improved housing for the thermostatic element of choke apparatus of this kind which includes a plastic wall structure that serves to insulate the thermostatic element and interior of its housing against rapid loss of heat; to provide a metal body in a housing of this kind which is adapted to absorb considerable heat during warming up of an engine and to thus guard against premature choke valve opening action of the thermostatic element; and to provide a heat absorbing body of this kind which imparts heat to the thermostatic element during the period an engine cools down after stopping so as to avoid premature choke valve closing action of the thermostatic element and thus to avoid the occurrence of a closed choke valve upon restarting of the engine after it has been stopped for an insufficient length of time to cool to a temperature requiring a closed choke valve.

Additional objects of the invention are to provide improved means for conducting engine heated air through the housing of the thermostatic element of an automatic

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choke device without applying it directly to the thermostatic element.

An illustrative embodiment of the invention is shown in the accompanying drawings in which:

Fig. 1 is a vertical sectional view of an internal combustion engine carburetor which is provided with automatic choke valve controlling apparatus embodying the invention;

Fig. 2 is a transverse sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a vertical sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a vertical sectional view of a choke valve unit similar to that shown in Fig. 1 but embodying a different form of the invention;

Fig. 5 is a transverse sectional view taken on the line 5—5 of Fig. 4; and

Fig. 6 is an elevational view of a gasket which is employed to form a fluid seal between portions of the choke valve control unit shown in Fig. 4.

In the forms of the invention illustrated in the drawings, the improved automatic choke apparatus constitutes a substantially integral part of an internal combustion engine carburetor which includes a main body portion, a throttle body and a choke valve body generally designated by the numerals 10, 11 and 12 which are secured together in vertical alignment and provided with vertically registering passage sections 13, 14 and 15, respectively. The passage section 15 provided in the choke valve body 12 serves as the air inlet of the carburetor and the passage sections 13 and 14 of the main body portion and throttle body 10 and 11, respectively, serve as a fuel mixture passage. The liquid fuel nozzle structure, generally designated by the numeral 16, is provided in a bridge 17 that extends transversely of the passage section 13 in the main body portion 10 of the carburetor. A throttle valve 18 is fixed to a shaft 19 which is journaled in apertures 20 and 21 formed in the wall of the throttle body 11. The throttle valve shaft 19 is provided with suitable valve operating mechanism, a fragment of which is shown at 22 in Fig. 1.

Journalled in horizontally registering apertures 23 and 24 which are provided in the wall of the choke valve body 12 is a choke valve shaft 25 on which is fixed an offset choke valve element 26. The choke valve element 26 is so offset on the shaft 25 as to tend to swing towards an open position in response to the flow of air through the passage 15 of the choke valve body 12. Mounted on the right end of the choke valve shaft 25, as viewed in Fig. 1, is a crank 27 having a rightwardly extending horizontally disposed crank element 28 which is adapted to engage with a thermostatic choke valve regulating unit generally designated by the numeral 29 and more specifically described hereinafter. The crank 27 has an opposite end portion 30 to which is pivotally attached a piston rod 31 that is operatively connected to a piston 32 reciprocally mounted in a cylinder 33 formed in the wall structure of the choke valve body 12 as shown in Fig. 1. This piston is provided with an enlarged head portion in which is formed a slot 34 that is adapted to register with a slot 35 formed in the wall of the cylinder 33. When the piston 32 is in its uppermost position, that is, at the opposite end of its stroke to that shown in Fig. 1, the slot 34 in the enlarged head of the piston does not register with the slot 35 in the cylinder and the flow of air from above to below the cylinder is not accommodated. The upper end of the cylinder 33 communicates with the left section of a chamber 36 and the lower end of the cylinder 33 is communicatively connected by passages 37 and 38 formed in the main body portion 10 and throttle body 11. The passage section 38 of the

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throttle body communicates at 39 with the fuel mixture passage 14 formed in the throttle body 11 and at a location on the suction side of the throttle valve 18. Thus, during normal operation of an engine which is equipped with the carburetor embodying my improved choke valve structure, air is drawn from the chamber 36 through the cylinder 33, slots 34 and 35 and passages 37 and 38 by engine suction when the piston 32 is below its uppermost position. When the piston 32 is in its uppermost position, engine suction is not applied on the chamber 36 because the slots 34 and 35 of the piston and cylinder, respectively, do not communicate with each other.

The air which is drawn by engine suction through the cylinder and passages 37 and 38 is supplied in a manner hereinafter set forth from the vicinity of a heated portion of the engine.

The chamber 36 is enclosed mainly within a wall structure 40 which comprises an integral die cast part of the choke valve body 12 and this wall has a circular opening in its right side as viewed in Fig. 1 which is bounded by a peripheral edge portion 41. Attached to the edge portion 41 of the wall 40 of the chamber 36 is a non-metallic cap structure 42 in which is mounted the temperature responsive unit of the choke valve regulating mechanism. The cap 42 preferably comprises plastic material which has a relatively low heat conducting property and it is removably secured by cap screws 43 to the choke valve body 12 as shown in Fig. 1.

The cap 42 has a cylindrical body portion 44 which registers with the edge portions 41 surrounding the open end of the chamber 36 and it also includes a thickened end wall 45 which is provided at its central portion with a metal fitting element or nipple 46. A conduit 47 is connected to the fitting 46 and leads to a location remote from the carburetor, preferably to the vicinity of the exhaust manifold of the engine with which the carburetor is associated. In the form of the invention shown in the drawings, the tube 47 is extended through a section of the exhaust manifold 48 and is provided at its lower end with an open extremity 49 through which air may be drawn in order to heat the air as it passes through that section of the pipe 47 which is disposed within the exhaust manifold 48. The air thus flowing through the tube 47 passes from the interior of the fitting 46 to the interior of the cap 42 through a port 50 provided in the end wall 45 of the cap.

Mounted in the cylindrical portion of the cap 42 is a metallic heat storing body preferably comprising a metal disc 51 which is located adjacent the end wall 45 of the cap and releasably held, preferably frictionally, against displacement from the cap by an expansion wire lock ring 52 that is mounted in part in a groove formed in the periphery of the heat storing member 51. The disc shaped heat storing element 51 is retained in spaced relation to the internal surface of the end wall 45 by spacing lugs 53 which are preferably formed on the end wall 45 of the cap. The disc 51 is provided with a notch 51' for receiving an indexing rib 52' extending from the inner periphery of the cap wall 44.

The heat storing member 51 is provided with a leftwardly extending split projection 54 on which is mounted a coil bimetallic temperature responsive element 55. The projection 54 which is preferably integral with the heat storing disc 51 is relied upon to support the thermostatic element. The indexing notch and rib 51' and 52', respectively, serve to locate the anchored end of the coil 55 relative to the cap 42. Registering indexing notches shown at 53' in Fig. 1 serve to locate the cap 42 relative to the wall 40 of the chamber 36. A partition 56 is provided between the chamber 36 and the adjacent chamber within the cap 42. This partition is provided with an aperture 57 through which extends the crank element 28 of the crank 27. The crank element 28 is arranged to engage a hooked end 58 which is formed on the outer end of the bimetallic temperature responsive element 55.

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In this form of the invention, when the piston 32 is spaced downwardly from its uppermost position, engine suction is applied on the chamber 36 and interior of the cap which are in communication with each other through the opening 57 in the partition 56. The engine suction draws air from the atmosphere through the conduit 47 and fitting 46, passage 50 and into the space within the cap between the heat storing element 51 and the end wall 45 of the cap. From this space the air which is at a temperature that reflects the temperature of the engine flows around the periphery of the heat storing element 51 and between it and the periphery 44 of the cap to the space on the left side of the heat storing element 51 in which the temperature responsive element 55 is accommodated. The temperature responsive element is thus subjected to the air flow through the device which has been heated by the engine.

In the form of the invention shown in Figs. 4, 5 and 6, the carburetor to which the automatic choke regulating apparatus is applied is identical to that shown in Fig. 1 and corresponding parts of the choke valve mechanism are designated by the same numerals as those used in Figs. 1, 2 and 3. In this form of the invention, however, a gasket 40', best shown in Fig. 6, is provided between the outermost portions of the disc shaped heat storing element 51 and the end wall 45 of the cap 42 in order to provide a seal for preventing the flow of air between the periphery of the heat storing element and the periphery 44 of the cap. In this form of the invention, the projection 54 of the disc is provided with an axially extending passage 59 which also extends through the center of the disc 51 to accommodate the direct flow of air from the space between the innermost portion of the end wall 45 and the disc 51. The air which thus flows from the fitting 46 through the passage 50 enters the space between the end wall 45 of the cap 42 and the heat storing element 51 and then flows outwardly from the interior of the cap through the passage 59 and through a hole 60 formed in the central portion of the partition 56. From this location, as in the form of the invention shown in Figs. 1 to 3, the air then flows through the chamber 36, cylinder 33, passages 37 and 38 and into the fuel mixture passage 14.

In the operation of both forms of the invention, the thermostatic element 55 tends to close the choke valve 26 against the action of the air flow through the passage 15 which normally tends to open the choke valve. The suction on the piston 32 also tends to open the choke valve 26. However, when the engine is not operating and at a predetermined low temperature, the thermostat completely closes the choke valve and on starting the choke valve is thus held closed until the effect of the air flow through the passage 15 and the suction on the piston 32 open it to permit the flow of air to mix with liquid fuel supplied by the nozzle 16. When the engine is turned over at a cranking speed, the choke valve opens enough to bring the slot 34 in the piston 32 into registration with the slot 35 in the cylinder. This establishes a circulation of air through the tube 47 and through the interior of the automatic choke valve regulating device. As the engine is warmed up by its continued operation, the air supplied to the interior of the cap 42 conducts heat to the thermostatic element 55 and heats it to a temperature which corresponds to the temperature of a selected location in the engine. In this case, the selected location is some point in the exhaust manifold. Heating of the temperature responsive element 55 causes it to wind up and removes its closing action upon the choke valve so as to allow the choke valve to become gradually more further opened by the force of the air flowing through the passage 15. After the engine reaches a predetermined high temperature, the choke valve remains fully open.

In order to guard against premature opening of the choke valve during cold starting operations, the heat storing element 51 is provided. This element stores up

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heat supplied by the air flowing from the conduit 47 and thus delays heating of the thermostatic element 55 sufficiently to maintain the choke valve 36 partially closed until the engine has had an opportunity to warm to a satisfactory operating temperature.

The heat stored in the element 51 also serves a useful purpose when the engine with which improved choke valve regulating mechanism is employed is stopped and then restarted before the engine has cooled down. Since the thermostatic element and choke regulating mechanism is spaced a substantial distance from a heated portion of the engine, it tends to cool down faster than the engine and without the precaution of storing heat, such as in the heat storing element 51, the thermostatic element would be cooled sufficiently to produce a closed choke valve condition when the engine was warm enough to start with an open choke valve setting. The heat stored in the element 51 keeps the thermostatic element 55 heated for a time following discontinuation of engine operation sufficient to guard against restarting of the engine with a closed choke valve while the engine is still warm.

In each form of the invention, the heat storing member 51 also serves as a shield to prevent the direct impingement of incoming air upon the thermostatic element 55. This also contributes to guarding against premature heating of the thermostatic element 55 and opening of the choke valve before the engine has warmed up sufficiently to operate with an open choke valve. The non-metallic low heat conductive material of the cap serves as insulation to prevent rapid dissipation of heat after the choke valve has been allowed by the thermostatic element 55 to open. The fitting 46 by which the tube 47 is connected to the cap 42 is also insulated by the thick non-metallic wall 45 of the cap from the thermostatic element 55 and the heat storing element 51. This prevents either rapid heating or cooling by direct metal conductivity of heat from the engine to the thermostatic element 55.

In the form of the invention shown in Figs. 4, 5, and 6, the operation is substantially identical to that disclosed above except a further precaution is taken to prevent excessively rapid heating of the thermostatic element. In this case, the heated air which is supplied to the interior of the cap 42 is discharged into the space between the end wall 45 and the heat storing element 51 and then flows directly centrally through the passage 59 in the projection 54 and through the opening 60 in the partition 56. With this construction, the heated air is conveyed through the interior of the cap in which the thermostatic element 55 is located but without allowing it to directly contact the thermostatic element.

Although but several specific embodiments of the invention are herein shown and described, it will be understood that various changes in the sequence of operations, steps and materials employed may be made without departing from the spirit of the invention.

I claim:

1. Apparatus for automatically controlling the choke valve of an internal combustion engine including a casing having a main wall portion comprising non-metallic low heat conductive material, a metallic heat storing member in said casing, means removably mounting said heat storing member on a non-metallic wall portion of said casing including a snap ring element, said heat storing member having a hollow mounting boss projecting therefrom, a thermostat choke valve regulating member mounted on said boss and in direct heat conductive relationship with respect to said heat storing member, and means defining a conduit communicating with said

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casing for supplying a heated fluid medium from a heated portion of said engine to said thermostatic and heat storing members, said conduit being defined in part by said hollow boss, said means defining a conduit and said heat storing member being thermally insulated from each other by said non-metallic material of said casing.

2. Apparatus for automatically controlling the choke valve of an internal combustion engine including a casing having a peripheral portion defining in part an enclosed chamber and an end wall portion formed of a non-metallic material having low heat conductivity, a metallic heat storing member disposed within said chamber with the periphery thereof situated in close proximity to the peripheral portion of said casing, a groove formed about the periphery of said heat storing member, an extension joined to a central portion of said heat storing member on one side thereof, a temperature responsive choke valve regulating element carried by said extension, means operatively connecting said temperature responsive element and said choke valve, a conduit communicating with said chamber for conducting a heated fluid medium from a heated portion of said engine to said chamber on the other side of said heat storing member, and a locking spring wire substantially encircling said heat storing member with spaced parts thereof disposed in said groove and with other parts thereof engaging the peripheral portion of said casing, said latter parts being spring urged into engagement with said casing thereby retaining said heat storing member in a stationary position.

3. Apparatus for automatically controlling the choke valve of an internal combustion engine including a casing having a peripheral portion defining in part an enclosed chamber and an end wall portion formed of a non-metallic material having low heat conductivity, a metallic heat storing member disposed within said chamber with the periphery thereof situated in close proximity to the peripheral portion of said casing, a groove formed about the periphery of said heat storing member, an extension joined to a central portion of said heat storing member on one side thereof, a temperature responsive choke valve regulating element carried by said extension, means operatively connecting said temperature responsive element and said choke valve, a conduit communicating with said chamber for conducting a heated fluid medium from a heated portion of said engine to said chamber on the other side of said heat storing member, a locking spring wire substantially encircling said heat storing member with spaced parts thereof disposed in said groove and with other parts thereof engaging the peripheral portion of said casing, said latter parts being spring urged into engagement with said casing thereby retaining said heat storing member in a stationary position, and an opening extending through said extension from said other side of said heat storing member to said one side thereof, said conduit being adapted to conduct said heated fluid medium into said chamber on the other side of said heat storing member at a location spaced from said opening thereby causing direct contact between said heat storing member and said heated medium over a relatively large portion of the former.

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