Aug. 3, 1965 G. NASTAS 3,198,185

AUTOMATIC CHOKE

Filed March 14, 1963

FIG. 1

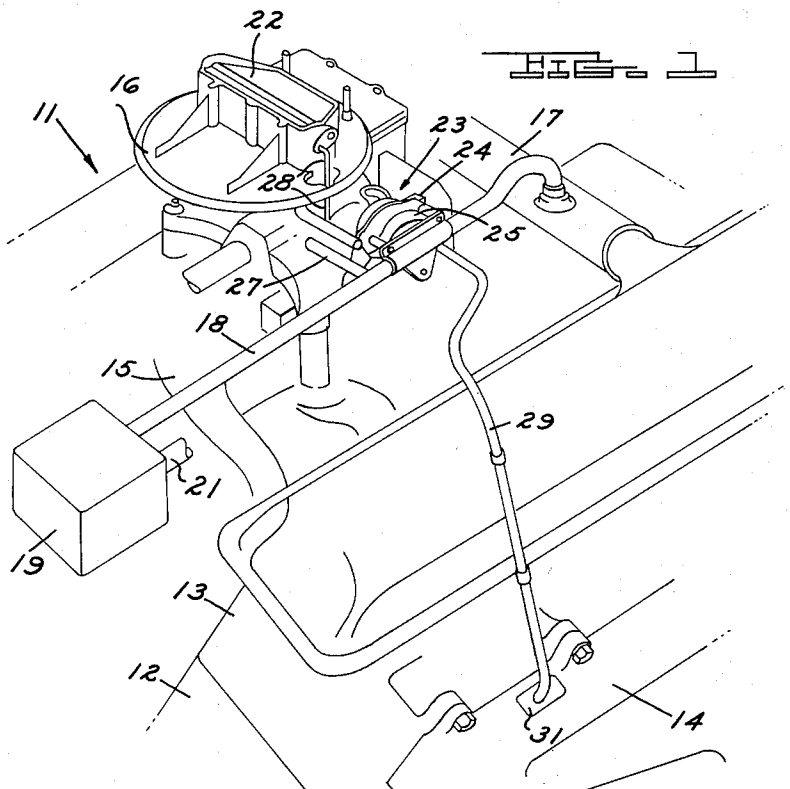
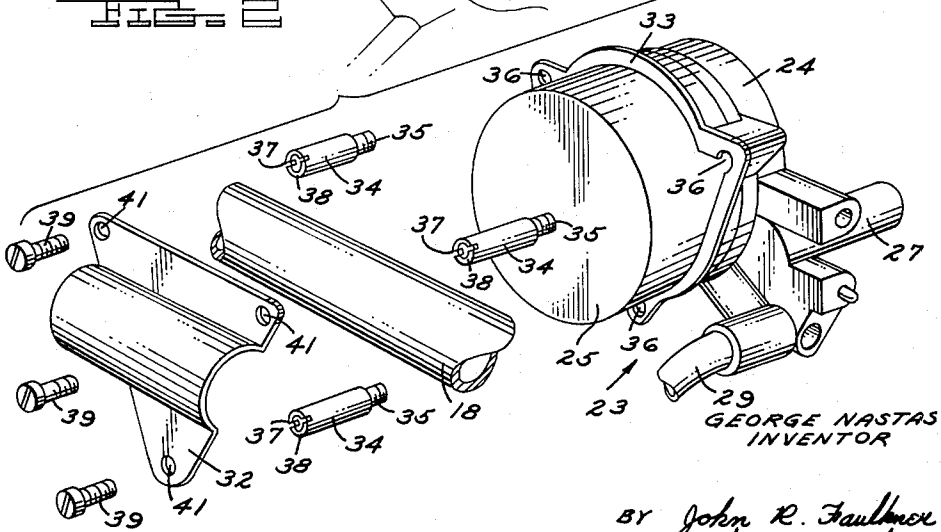


FIG. 2



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United States Patent Office 3,198,185 Patented Aug. 3, 1965

3,198,185

AUTOMATIC CHOKE

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Filed Mar. 14, 1963, Ser. No. 265,123
9 Claims. (Cl. 123—119)

This invention relates to an automatic choke for the charge forming device of an internal combustion engine and more particularly to an improved mechanism for heating the thermally responsive element of an automatic choke.

The choke valve of an automatic choke is moved between its opened and closed positions in response to temperature changes by a thermally responsive element. The temperature of the thermally responsive element should bear sufficient relation to the temperature of the engine's induction system to position the choke valve in accordance with the engine's actual requirements. The thermally responsive element is generally heated during the engine's operation to insure conformity between the temperatures of the engine and the thermally responsive element. Although several methods of heating the thermally responsive element have been employed, none has been completely satisfactory.

In one heating method, the thermally responsive element is positioned in direct heat exchanging relation with the exhaust system of the engine, or the thermally responsive element is surrounded with air heated by contact with the exhaust system. The exhaust system of an engine heats rapidly after a cold engine is started. An exhaust heated choke, therefore, has the very desirable characteristic of causing the choke valve to open or "come off" rapidly in cold weather.

An exhaust heated choke also has an undesirable characteristic. When the engine is stopped, the exhaust system cools more rapidly than the remainder of the engine. The attendant cooling of the thermally responsive element causes the choke valve to close or "come on" even though the engine may be thoroughly warm. The premature closing of the choke valve results in an unnecessarily rich mixture and decreased fuel economy. This condition is most prevalent when the thermally responsive element is supported upon the charge forming device and is heated indirectly. Although it is common to insulate the thermally responsive element, the condition nevertheless occurs.

The undesirable rapid "come-on" time of an exhaust heated choke may be alleviated by employing the engine's liquid coolant to heat the thermally responsive element. Liquid heating of the choke may be accomplished by placing the thermally responsive element in direct heat exchanging relation with a portion of the engine's cooling jacket or by positioning a liquid jacket around the thermally responsive element when the latter is supported upon the charge forming device. The engine's liquid coolant retains its heat much longer after stopping a thoroughly warmed engine and a liquid heated choke provides the desired delayed "come-on" time.

Although a liquid heated choke provides the desired deferred "come-on" time, it has an undesirably long "come-off" time. Under low ambient temperatures, there is a considerable time lag before the liquid in the cooling system reaches its operating temperature. Under these conditions, the coolant temperature is not truly representative of the engine's fuel-air mixture requirements and the choke valve remains closed longer than is necessary.

It is, therefore, the principal object of this invention to provide an improved automatic choke assembly that combines the desirable features of both exhaust and liquid heat.

Although it has previously been proposed to combine the use of exhaust and liquid heat, an acceptable choke mechanism for accomplishing this purpose has not evolved. The absence of a successful liquid and exhaust heated choke can be explained by the difficulty in properly locating all of the required components. It is most desirable to position the thermally responsive element directly upon the charge forming device so that the automatic choke and the charge forming device can form a single unit. This positioning of the thermally responsive element also eliminates the use of extensive linkage systems which require constant attention to maintain the correct adjustment. It has been difficult in the past to satisfactorily heat a thermally responsive element that is positioned upon the charge forming device with the liquid coolant. As has been noted, a liquid heating jacket must be positioned around the thermally responsive element. Hoses and hose connections are required, therefore, to transport the liquid from the cooling jacket of the engine to the heating jacket of the thermally responsive element.

It is a further object of this invention to provide an improved mechanism for using the engine's coolant to the thermally responsive element of an automatic choke.

It is a still further object of this invention to provide a simplified mechanism for heating a thermally responsive element of an automatic choke that is supported directly upon the charge forming device.

The automatic choke that comprises this invention is adapted for use with an internal combustion engine having a liquid cooling system and an exhaust system. The automatic choke is positioned upon the charge forming device of the engine's induction system. Actuating means including a thermally responsive element are provided to position a choke valve in response to temperature changes. An air conduit conveys air heated by a portion of the exhaust system from the exhaust system to the thermally responsive element. A liquid conduit conveys liquid from the cooling system to a point contiguous to the thermally responsive element.

As a further distinctive feature of this invention, a flexible conduit that carries liquid heated in the cooling jacket of the engine is affixed to a housing that encloses the thermally responsive element. The contact between the flexible conduit and the housing provides the necessary heat transfer to the thermally responsive element.

Further objects and advantages of this invention will become more apparent when considered in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a partial perspective view of an internal combustion engine embodying this invention.

FIGURE 2 is an exploded view of the thermally responsive portion of the automatic choke mechanism shown in FIGURE 1.

Referring now in detail to the drawings and in particular to FIGURE 1, an internal combustion engine is depicted generally at 11. As illustrated, the internal combustion engine 11 is installed in a motor vehicle, where the use of automatic chokes is most prevalent. The engine 11 comprises a cylinder block 12 and cylinder heads 13 (only one of which is shown). An exhaust manifold 14 is affixed to each of the cylinder heads 13 at one side thereof. The engine 11 also comprises an induction system comprising an intake manifold 15 and a charge forming device 16.

The engine 11 is liquid cooled and accordingly has cooling jackets formed internally within the cylinder block 12 and cylinder heads 13. A liquid coolant is circulated through the cooling jackets of a cylinder block 12 and cylinder heads 13 by a coolant pump (not shown). Liquid heated by the engine is passed from a coolant manifold 17 that interconnects the cooling jackets of the

cylinder heads 13 through a radiator (not shown) for cooling before recirculation through the engine 11. Heated liquid from the coolant manifold 17 may be circulated by a flexible hose 18 through a heater 19 for heating the interior of the vehicle. A return hose 21 carries the liquid from the heater 19 back to the cooling system of the engine. All of the components heretofore described are conventional.

A choke valve 22 is positioned in the induction passage of the charge forming device 16. The choke valve 22 is adjusted in response to temperature changes by an automatic choke actuating mechanism, indicated generally at 23 and shown in greater detail in FIGURE 2. The automatic choke actuating mechanism 23 comprises a housing having a body portion 24 and a cover 25. The body portion 24 is affixed to the charge forming device 16 by a plurality of transversely extending bosses 27. Positioned within the housing is a thermally responsive element which has one end thereof affixed to the cover 25. The other end of the thermally responsive element is connected by links 28 to the choke valve 22 to move the choke valve between an opened and a closed position in response to temperature changes. The thermally responsive element and the actuating mechanism for the choke valve 22 is conventional and is not shown in detail.

The interior of the automatic choke housing is connected by an air conduit 29 to an exhaust manifold heat stove 31. Air passed across the heat stove 31 is circulated through the conduit 29 into the housing. The air circulation is established by venting the interior of the body portion 24 to the induction system of the engine 11. The decreased pressure in the housing causes the flow of heated air in the well-known manner.

Although the exhaust heat provided by the exhaust heat stove 31 rapidly heats the thermally responsive element when the engine is started, the thermally responsive element will also cool rapidly when the engine is stopped. To preclude the cooling of the thermally responsive element, heat is applied from the liquid coolant in the manner now to be described. As has been earlier noted, liquid heated in the cooling jacket of the engine is circulated to the heater 19 by a flexible hose 18. The heated liquid flowing through the flexible hose 18 is employed to heat the thermally responsive element by positioning a portion of the hose 18 against the cover 25. Since one end of the thermally responsive element is fixed to the cover, a heat transfer is readily established.

A sheet metal clamp 32 having an arcuate intermediate portion encircles the hose 18. The fastening means shown in greater detail in FIGURE 2 secure the sheet metal clamp 32 and hose 18 against the cover 25 and secure the cover 25 to the body portion 24. The fastening means comprise a sheet metal clamp 33 that encircles the cover 25 and bears against a flange formed on its periphery. Securing elements 34 having threaded ends 35 pass through apertures 36 formed in the sheet metal clamp 33. The threaded ends 35 of the elements 34 are received in tapped openings formed around the periphery of the body portion 24. Shoulders formed at the outer termination of the threaded ends 35 abut the sheet metal clamp 33 to urge the cover 25 against the body portion 24. The securing elements 34 are threaded into place by turning a flat bladed tool that is inserted into slots 37 formed in the outer ends of the securing elements 34. The outer ends of the elements 34 also have tapped holes 38. Screws 39 pass through apertures 41 formed in the sheet metal clamp 32 and are threaded into the tapped holes 38 to affix the clamp 32 and hose 18 against the cover 25.

It has been found that the heated liquid in the flexible hose 18 transmits sufficient heat through the cover 25 to raise the temperature of the thermally responsive element to a point that maintains the choke valve 22 in an opened position until the engine cools sufficiently to require choking. The thermo syphon action set up in the engine's cooling system also causes heated liquid to flow through the hose 18 even after the engine has been stopped for a considerable period of time.

It is to be understood that the invention is not limited to the exact construction shown and described but that various changes and modifications may be made without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. An automatic choke mechanism for the charge forming device of a liquid cooled internal combustion engine comprising a choke valve supported in an induction passage of the charge forming device, a housing affixed to the charge forming device, a thermally responsive element supported in said housing, actuating means operatively connecting said thermally responsive element to said choke valve for moving said choke valve between an opened and a closed position in response to temperature changes, a flexible tube adapted to carry liquid heated in the cooling system of the engine, and means affixing a sufficient length of said tube against said housing to promote a heat exchanging relationship between the coolant in said tube and said thermally responsive element.

2. An automatic choke mechanism for the charge forming device of a liquid cooled internal combustion engine comprising a choke valve supported in an induction passage of the charge forming device, a housing affixed to the charge forming device, said housing comprising a body portion and a cover, a thermally responsive element supported in said housing, actuating means operatively connecting said thermally responsive element to said choke valve for moving said choke valve between an opened and a closed position in response to temperature changes, a flexible tube adapted to carry liquid heated in the cooling system of the engine, and means for affixing a sufficient length of said tube against said cover to promote a heat exchanging relationship between the coolant in said tube and said thermally responsive element.

3. An automatic choke mechanism for the charge forming device of a liquid cooled internal combustion engine comprising a choke valve supported in an induction passage of the charge forming device, a housing having a body portion affixed to the charge forming device and a cover, a thermally responsive element having one end affixed to said cover, actuating means operatively connecting the other end of said thermally responsive element to said choke valve for moving said choke valve between an opened and a closed position in response to temperature changes, a flexible tube adapted to carry liquid heated in the cooling system of the engine, and fastening means affixing a portion of said tube against said cover and said cover to said body portion, a sufficient length of said tube being affixed against said cover to promote a heat exchanging relationship between the coolant in said tube and said thermally responsive element.

4. An internal combustion engine having a liquid cooling jacket, a heat exchanger, a liquid tube for conveying liquid between said cooling jacket and said heat exchanger, and an induction system, said induction system comprising a charge forming device having a choke valve, a choke valve actuating mechanism including a thermally responsive element, means operatively connecting said thermally responsive element to said choke valve for moving said choke valve between an opened and a closed position in response to temperature changes, and means affixing a sufficient length of said tube contiguous to said thermally responsive element mechanism for promoting a heat exchanging relationship between the coolant in said tube and said thermally responsive element.

5. An internal combustion engine having a liquid cooling jacket, a heat exchanger, a liquid tube for conveying liquid between said cooling jacket and said heat exchanger, and an induction system, said induction system comprising a charge forming device having a choke valve, a choke valve actuating mechanism including a housing affixed to said charge forming device, a thermally respon-

sive element contained in said housing, means operatively connecting said thermally responsive element to said choke valve for moving said choke valve between an opened and a closed position in response to temperature changes, and means affixing a sufficient length of said tube against said housing to promote a heat exchanging relationship between the coolant in said tube and said thermally responsive element.

6. An internal combustion engine having a liquid cooling jacket, a heat exchanger, a liquid tube for conveying liquid between said cooling jacket and said heat exchanger, and an induction system, said induction system comprising a charge forming device having a choke valve, a housing having a body portion affixed to said charge forming device and a cover, a thermally responsive element contained within said housing and having one end affixed to said cover, means operatively connecting the other end of said thermally responsive element to said choke valve for moving said choke valve between an opened and a closed position in response to temperature changes, and fastening means affixing a sufficient length of said tube against said cover and said cover to said body portion for establishing heat exchanging relationship between the coolant in said tube and said thermally responsive element.

7. An internal combustion engine having an exhaust system, a liquid cooling jacket, a heat exchanger, a flexible tube for conveying liquid between said cooling jacket and said heat exchanger, and an induction system, said induction system comprising a charge forming device having a choke valve, a choke valve actuating mechanism including a housing affixed to said charge forming device, a thermally responsive element supported in said housing, means operably connecting said thermally responsive element to said choke valve for moving said choke valve between an opened and a closed position in response to temperature changes, an air heating device positioned contiguous to a portion of said exhaust system, air conduit means for conveying heated air from said air heating device to the interior of said housing for heating said thermally responsive element, and means affixing a sufficient length of said flexible tube to said housing for promoting heat exchanging relationship between the coolant in said tube and said thermally responsive element.

8. An internal combustion engine having an exhaust system, a liquid cooling jacket, a heat exchanger, a flexible tube for conveying liquid between said cooling jacket and said heat exchanger, and an induction system, said induction system comprising a charge forming device having a choke valve, a housing having a body portion affixed to said charge forming device and a cover, a thermally responsive element contained within said housing and having one end affixed to said cover, means operably connecting the other end of said thermally responsive element to said choke valve for moving said choke valve between an opened and a closed position in response to temperature changes, an air heating device positioned contiguous to a portion of said exhaust system, air conduit means for conveying heated air from said air heating device to the interior of said housing for heating said thermally responsive element, and fastening means affixing a sufficient length of said flexible tube against said cover to promote a heat exchanging relationship between the coolant in said tube and said thermally responsive element and affixing said cover to said body portion.

9. An automatic choke assembly for the charge forming device of an internal combustion engine comprising a housing having a body portion affixed to the charge forming device, a cover, fastening means engaging said cover and having first ends threaded into apertures in said housing, internally threaded apertures in the other end of said fastening means, a flexible hose, a clamp having a portion in engagement with said flexible hose, externally threaded fastening means engaging said clamp and threaded into the internally threaded apertures of said first fastening means for securing said clamp and said hose against said cover.

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