Aug. 16, 1932. L. C. FRANK ET AL 1,872,268

TIME LIMIT ENGINE CHOKING DEVICE

Filed Jan. 30, 1930 2 Sheets-Sheet 1

Fig. 1.

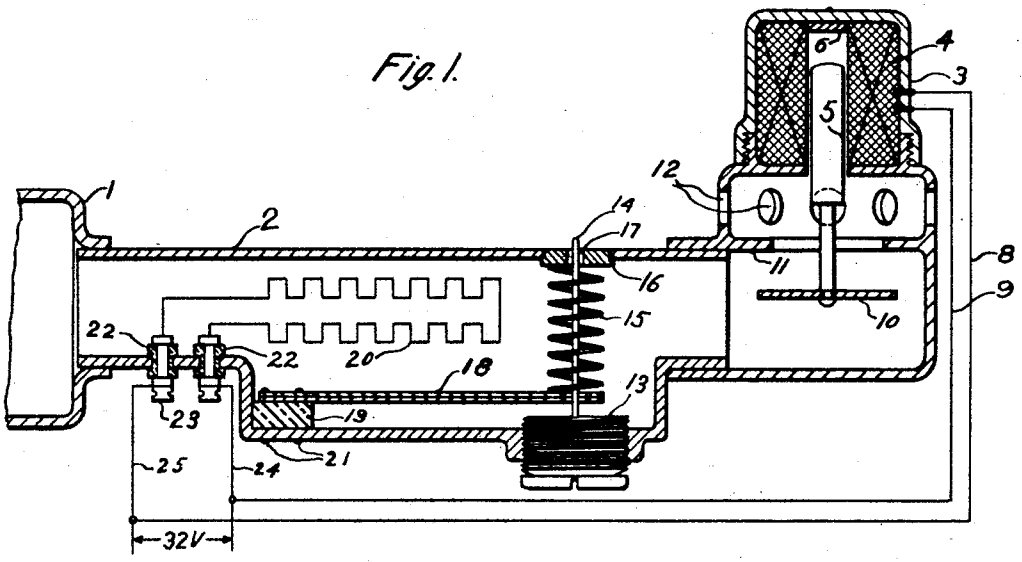
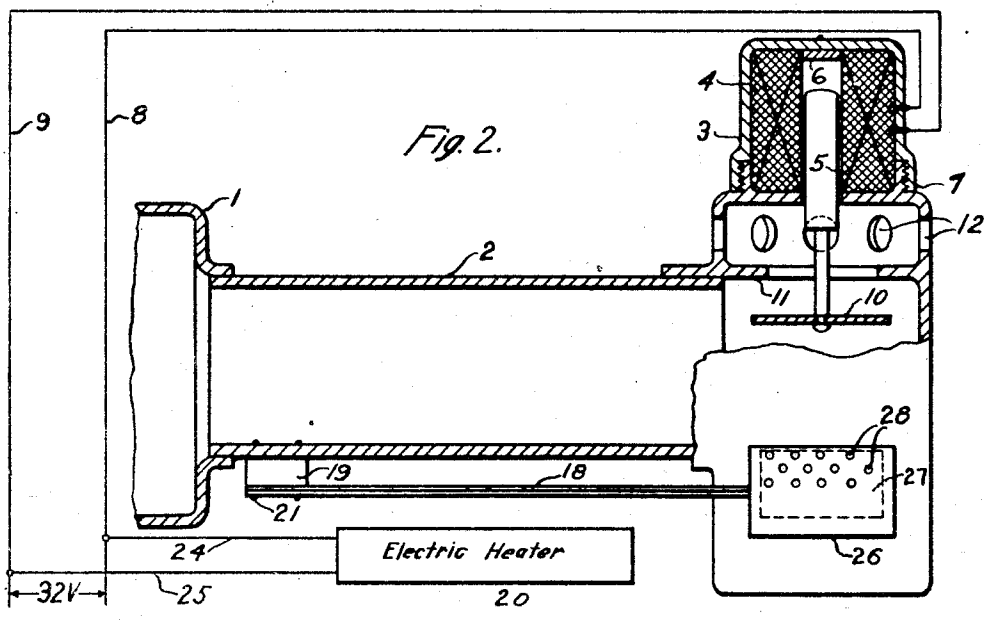


Fig. 2.



INVENTORS:
Leo C. Frank &
David J. Conant
BY
Wesley G. Carr
ATTORNEY

Aug. 16, 1932. L. C. FRANK ET AL 1,872,268

TIME LIMIT ENGINE CHOKING DEVICE

Filed Jan. 30, 1930 2 Sheets-Sheet 2

Fig. 3.

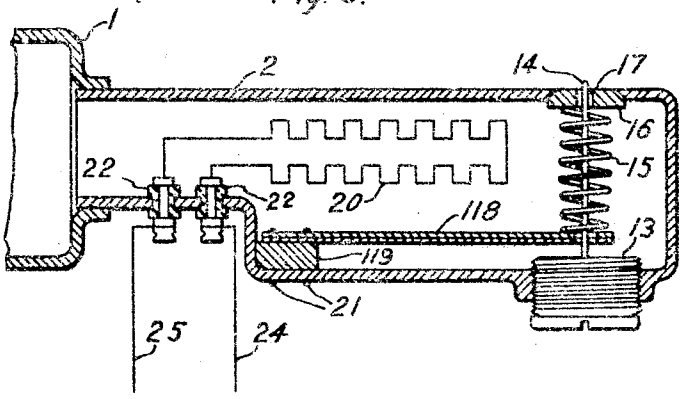
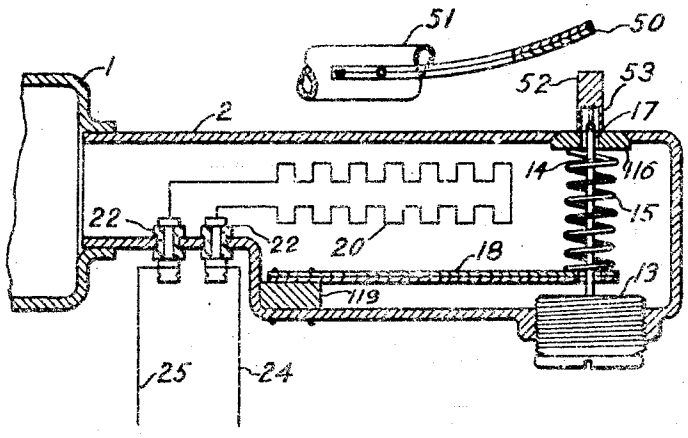


Fig. 4.



WITNESSES:
Arthur J. McMahon
P.E. Friedemann

INVENTORS.
Leo C. Frank &
David J. Conant
BY
W. R. Coley
ATTORNEY

Patented Aug. 16, 1932 1,872,268

UNITED STATES PATENT OFFICE

LEO C. FRANK, OF McKEESPORT, AND DAVID J. CONANT, OF PITTSBURGH, PENNSYLVANIA, ASSIGNORS TO WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

TIME-LIMIT ENGINE-CHOKING DEVICE

Application filed January 30, 1930. Serial No. 424,616.

This invention relates to automatic time-limit choking devices for internal-combustion engines.

More particularly, this invention relates to automatic time-limit choking devices for stationary internal-combustion engines used in connection with electric systems and especially with electric lighting systems or plants adapted for use in isolated places, such as country residences, farm homes, places where the attendant is partially or totally unskilled in the art of managing such plants, or in connection with power plants for airplane beacons, which are often very isolated and where the attendant, whether skilled or unskilled, merely makes periodic inspections of the plants to provide the necessary gasoline and oil.

Automatic choking-devices are known in the art but all these devices depend for their time of operation either on the ambient temperature, the temperature of the exhaust pipe, the engine block or the cooling system of the engine, or a combination of the ambient temperature and the temperature of some engine part. When such choking devices are set in operation, a considerable period of time elapses before the choking operation is discontinued, and, during the choking operation, the engine is not accelerated to the proper running speed. This effect is especially noticeable during cold weather.

Furthermore, during the operation of the starting device and the initial stages of engine operation, cold air is forced against the thermo-responsive element by the engine fan, and the temperature of the thermo-responsive element does not change through a sufficiently great temperature range to cause it to function and stop the choking operation. The engine, with the intermittent aid of the automatic starting device, "sputters" along for a time, making every effort to take up the heavy load which actuated the automatic starting device. In the meantime, the protective device, usually provided, functions to prevent further automatic cranking, and the engine stops. After the protective device has functioned, the plant cannot be started before the apparatus is reset by the attendant.

The object of the invention is to provide for choking an internal-combustion engine to supply a rich fuel mixture for a predetermined interval of time during the starting operations, regardless of ambient temperature or engine temperature.

Another object of this invention is to provide an engine-choking device capable of producing a choking effect on the engine during starting which shall vary from a maximum to a minimum, to cause the feeding of a fuel mixture most suitable for quick starting under the particular temperature prevailing, in the combustion chambers.

A still further object of this invention is the provision of an automatic time-limit choking device for an internal-combustion engine provided with an electrically controlled starting device which shall be easy of manufacture and simple in structure and which may be readily installed.

Other objects and advantages will be more evident from a consideration of the accompanying drawings, when taken in connection with the following description and the claims appended thereto.

In the accompanying drawings, Fig. 1 is a vertical-sectional view of the air-intake tube of a carburetor showing a choking device constructed in accordance with the invention;

Fig. 2 is a sectional view of a modification of the invention applied to the intake tube of a carburetor, and

Figs. 3 and 4 are sectional views of still further modifications of our invention.

Referring more particularly to Fig. 1, reference character 1 designates a portion of a carburetor used with an internal combustion engine and to which is secured, in any convenient manner, the air-intake tube 2. At the end of the intake tube remote from the carburetor, is secured a choker-valve housing 3 consisting of magnetic material. A solenoid 4, having an armature 5 is mounted within the upper portion of the housing. As shown, a stop 6 of non-magnetic material may be provided to prevent sticking of the armature when the solenoid is deenergized.

Obviously, where the design is such that

the disc 10 contacts with ledge 11 before armature 5 is in its extreme upper position, stop 6 need not be used because then an air gap between the housing 3 and armature 5 serves the purpose of stop 6. In the preferred embodiment, stop 6 is not used, and disc 10 seats firmly against ledge 11.

Secured to the lower portion of the armature, is a valve disc 10 which cooperates with the ledge 11 to control the flow of air through the main air-inlet openings 12 to the carburetor 1. The solenoid 4 is energized, under control of the engine-starting device, through conductors 8 and 9 leading from a suitable source of supply.

Within the air-intake tube 2 is disposed a bimetal strip 18 secured, at one end, to the intake tube by means of rivets or screws 21. Positioned intermediate the bimetal strip 18 and the intake tube and held in firm engagement with the tube and the strip by the screws 21, is a block 19 of heat-insulating material. This heat-insulating block 19 helps to fix more definitely the time constant of the electric heater discussed more in detail hereinafter.

Disposed adjacent to the bimetal strip 18 and in the path of the air passing through the air-intake tube, is an electric heater 20. This heater is connected in parallel with the solenoid circuit by conductors 24 and 25. Since the solenoid and the heater are in parallel, their energization must, of necessity, occur at the same time. The conductors 24 and 25 are suitably insulated from the tube by sleeves 22.

The bimetal strip 18 has an aperture at the free end through which extends a guide pin or stem 14 constituting an extension of screw 13. The side-wall of the tube 2 is provided with an auxiliary air-inlet opening within which fits a valve disc 16, having one or more relatively small apertures 17 to always admit some air to the carburetor should both valve discs 10 and 16 be sealed firmly. One of the apertures, in addition to admitting some air, serves as a guide for the valve disc on the stem 14.

Disposed intermediate the valve disc 16 and the free end of the bimetal strip 18, and held in cooperative relation by the stem 14, is positioned a spring 15 which, in cooperation with thermostatic spring action of the bimetal strip, urges the valve disc 16 to seating position. The screw 13 has a relatively large head whereby the spring 15 and the valve disc 16 may be readily replaced without disassembling all the parts.

The bimetal strip 18 deflects downwardly upon energization of the heater 20, thereby reducing the seating pressure of the valve disc and, in consequence, varying the effective size of the auxiliary air-inlet opening for any given engine suction. The heater is supplied with energy from a constant-voltage source, for example, the 32 volt batteries usually employed in farm-lighting plants. Intermediate the source of supply and the parallel circuit of the heater and solenoid, is positioned a thermo-electric time-limit protective cranking device (not shown) for interrupting the supply to the heater 20 and the solenoid 4.

The resistor elements of the heater have constant electrical characteristics and, since the voltage supply is constant and block 19 prevents dissipation of the heat in the strip 18, the strip 18 will, upon energization of the heater 20, be deflected a predetermined extent during a predetermined interval of time, regardless of the temperature of the atmosphere or the temperature of the engine parts.

If, at the instant of starting, the temperature of strip 18 be low, the seating pressure of disc 16 may be higher than would otherwise be the case, but such condition is desirable rather than harmful. A low initial temperature of strip 18, however, does not materially change the time constant, since the temperature of the heater 20, when energized, is relatively high, and the bimetal strip 18 is relatively insensitive to atmospheric temperatures.

During starting of the engine, a solenoid 4 closes off the flow of air through the main ports 12 and, at the same instant, the heater 20 is energized. Heat passes to the strip 18 at a predetermined rate and this strip, in conjunction with the spring 15, decreases the seating pressure of valve 16 over a predetermined range during a predetermined interval of time. The amount of air admitted by valve 16 is thus varied, and that particular proportion of fuel and air most conducive to starting of the engine is ensured by the time-limit engine-choking device.

If the engine should fail to start for want of fuel or some other cause, the protective cranking device referred to above and usually provided with automatic generating plants, would interrupt the circuit to heater 20 and solenoid 4, thus preventing injury to these elements.

The modification shown in Fig. 2 is similar in function and, to some extent, in structure to the structure shown in Fig. 1, however, the heater is shown outside of the tube 2, and the housing 3 is provided with an auxiliary air-inlet opening 27 over which fits a valve plate 26 having one or more apertures 28. During energization of heater 20, strip 18 deflects downwardly, thus gradually increasing the effective size of opening 27.

In the modification shown in Fig. 3, the choke-valve structure shown at the right of both Figs. 1 and 2 is not used, the valve disc 16 or the valve plate 26 being made to serve the function of the choking valve 10, as well

as the choking of the auxiliary opening. In this modification, the block 119 is made of material having very good heat conductivity, and the bimetal strip 118 is designed to be somewhat more sensitive to ambient temperature than bimetal strip 18. The operation of this modification is substantially as follows:

During starting operation, the valve disc 16 will be in closed position and the only air admitted to the carburetor will be through the apertures 17. The engine is thus choked in a desirably excessive manner during starting. During the starting period, heater 20 is energized and causes the deflection of bimetal strip 18 and varies the choking effect of the valve arrangement consisting of the elements 13, 14, 15 and 16. The same time-limit choking is thus produced as with the modifications above discussed.

When the engine starts, the heater 20 will be deenergized but bimetal strip 118 and block 119 retain sufficient heat for a short time to keep valve disc 16 seated rather loosely.

In the meantime, the engine heats up, and the heat of the ingine is readily transmitted from the tube 2, through block 119, to the bimetal strip 118, thus retaining the valve disc 16 seated very loosely or not seated at all. The flow of air to the carburetor is thus not impeded, and the same effect is accomplished as is accomplished in the modification above discussed when the disc 10 is in lowermost position.

In the modification shown in Fig. 4, the choking-valve disc 10 and its operating parts are also not used, and the remaining structure remains exactly as discussed for the modification of Fig. 1, however, an additional bimetal 50 is mounted on the engine exhaust pipe 51, and, through the stem 52 and spider connection 53 attaching the stem to the valve, holds valve disc 116 in open position after this valve has produced its desirable time-limit choking and the engine has started. Valve disc 116, of course, might also be held open, after the engine has started, by a speed responsive device operated from the engine shaft.

While certain preferred embodiments have been illustrated and described, it will be understood that the invention is not to be limited to the specific constructions shown but that other means may be employed to ensure the desired results.

Applicants do believe they are the first to provide thermo-electric time-limit engine-choking devices. Obviously, this device may be employed in the main air-inlet opening, in which case, no auxiliary opening need be used.

Since our invention may be embodied in equivalent apparatus having different structural details, we desire that no limitations shall be imposed except as specifically defined in the appended claims.

We claim as our invention:

1. In combination with the air-intake tube of the carburetor of an internal-combustion engine, an electro-magnetically operated choke for closing the main air-inlet opening to the carburetor, said intake tube being provided with an auxiliary air-inlet opening, a valve disc provided with a plurality of relatively small apertures and seating in said auxiliary opening, a bimetal strip in the intake tube, a spring intermediate one end of the bimetal strip and the valve disc to urge the valve disc to seating position by a force inversely proportional to the temperature of the bimetal strip, a screw-threaded member provided with a stem for holding the spring and valve disc in operative relation to the bimetal strip, and an electric heater having definite electrical characteristics and positioned adjacent to the bimetal strip to heat the air passing to the carburetor and to deflect the strip over a predetermined range during a predetermined interval of time, thereby varying the valve-seating pressure.

2. In combination with a carburetor air-intake tube having a valve-controlled air-inlet opening a valve disc having a plurality of relatively small apertures and seating in said opening, a bimetal strip associated with the intake tube, a spring actuated by said strip to urge the valve disc to seating position by a force inversely proportional to the temperature of the strip, means for holding the valve disc, the strip and the spring in operative relation, and an electric heater positioned adjacent to the strip to heat the air passing to the carburetor and to deflect the strip over a predetermined range during a predetermined interval of time to vary the valve-seating pressure.

3. In combination with the carburetor of an internal-combustion engine, an air-intake tube for the carburetor having a main and an auxiliary air-inlet opening, an electro-magnetically operated choke for completely closing the main air-inlet opening during starting of the engine, a valve disc having a relatively small aperture and seating in said auxiliary opening, a temperature-responsive element in the intake tube for biasing said valve disc to seating position by a force inversely proportional to the temperature of the temperature-responsive element, and an electric heater adjacent to the temperature-responsive element and energized during the energization of said electro-magnetically operated choke to cause a variation of the valve-seating pressure over a definite range during a predetermined interval of time.

4. In combination with a carburetor air-intake tube having a main air-inlet opening

and an auxiliary air-inlet opening, a valve member for controlling the effective size of the auxiliary opening, a temperature-responsive element unaffected by atmospheric temperatures for effecting the controlling operation of the valve member, and an electric heater adjacent to the temperature-responsive element to cause operation of the temperature-responsive element over a predetermined range in a predetermined interval of time.

5. In combination with the air-intake tube of the carburetor of an internal-combustion engine, said intake tube having a main and an auxiliary air-inlet opening, an electromagnetically operated choke for completely closing the main opening during starting of the engine, an electric heater energized during the operation of the choke, and a thermostatic element adjacent to the heater for controlling the amount of air passing through the auxiliary opening during a predetermined interval of time.

6. In combination, a carburetor for an internal-combustion engine, an air-intake tube for the carburetor having a pair of openings, a solenoid, an armature operated by the solenoid, a valve disc for closing one of said openings and secured to the armature, and thermo-electric time-limit means for varying the air passing through the other of said openings over a predetermined range during a predetermined interval of time.

7. In combination, a carburetor for an internal-combustion engine, an air-intake tube for the carburetor having a pair of openings, a solenoid adapted to be energized for a predetermined interval of time during starting of the engine, an armature operated by the solenoid, a valve disc for closing one of said openings and secured to the armature, an electric heater energized simultaneously with the energization of the solenoid, a temperature-responsive device adjacent to the heater, a valve plate having at least one relatively small opening and actuated by the temperature-responsive element and associated with the other of said openings, whereby, upon energization of the solenoid and the heater, the passing of air through the first opening is prevented and the passing of air through the second opening is varied over a predetermined range during a predetermined interval of time.

8. In combination with an internal-combustion engine, a carburetor, an air-intake tube for the carburetor having a main and an auxiliary air-inlet opening, a choke for closing the main opening for a predetermined interval of time during starting of the engine, a temperature-responsive device secured to the intake tube, a valve for normally closing the auxiliary opening and operated by said temperature-responsive device, said valve having a relatively small aperture to admit air to the carburetor, and an electric heater having definite heating characteristics and located adjacent to the temperature-responsive device, whereby the effective size of the auxiliary opening is varied over a predetermined range during a predetermined interval of time.

9. In combination with an internal-combustion engine, a carburetor, an air-intake tube for the carburetor having a main and an auxiliary air-inlet opening, a choke for completely closing the main opening for a predetermined interval of time during starting of the engine, a temperature-responsive device secured at one end to the intake tube, a valve plate provided with at least one relatively small aperture to always admit some air to the carburetor and secured to the free end of the temperature-responsive device and fitting over the auxiliary opening, and an electric heater having definite electrical characteristics and located adjacent to the temperature-responsive device, whereby the effective size of the auxiliary opening is varied over a predetermined range during a predetermined interval of time.

10. In combination with an internal-combustion engine, a carburetor, an air-intake tube for the carburetor having an air-inlet opening, a valve disc having a relatively small aperture and closing the opening, a temperature-responsive element urging the valve disc to seating position, and an electric heater having a definite heating rate and disposed adjacent to the temperature-responsive element, whereby the effective size of the air-inlet opening is varied over a predetermined range during a predetermined interval of time.

11. In combination with an internal-combustion engine provided with a starter, a carburetor, an air-intake tube for the carburetor having an air-inlet opening, a valve disc having a plurality of relatively small apertures and seating in the opening, a temperature-responsive element urging the valve disc to seating position, and an electric heater having a definite heating rate and disposed adjacent to the temperature-responsive element and energized during the operation of the starter, whereby the effective size of the air-inlet opening is varied over a predetermined range during a predetermined interval of time.

12. In combination with an internal-combustion engine provided with a starter, a carburetor, an air-intake tube for the carburetor having an air-inlet opening, a valve disc seating in the opening, a bimetal strip secured at one end and mounted in the tube, a spring disposed intermediate the free end of the strip and the valve disc, and an electric heater energized during the operation of the starter and disposed in the tube adjacent to the bimetal strip, whereby the ef-

fective size of the opening is varied over a predetermined range during a predetermined interval of time.

In testimony whereof, we have hereunto subscribed our names this 21st day of January, 1930.

LEO C. FRANK.
DAVID J. CONANT.