April 10, 1951 W. E. ARMSTRONG 2,548,334

AUTOMATIC CHOKE CONTROL FOR
INTERNAL-COMBUSTION ENGINES
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Fig. 1.

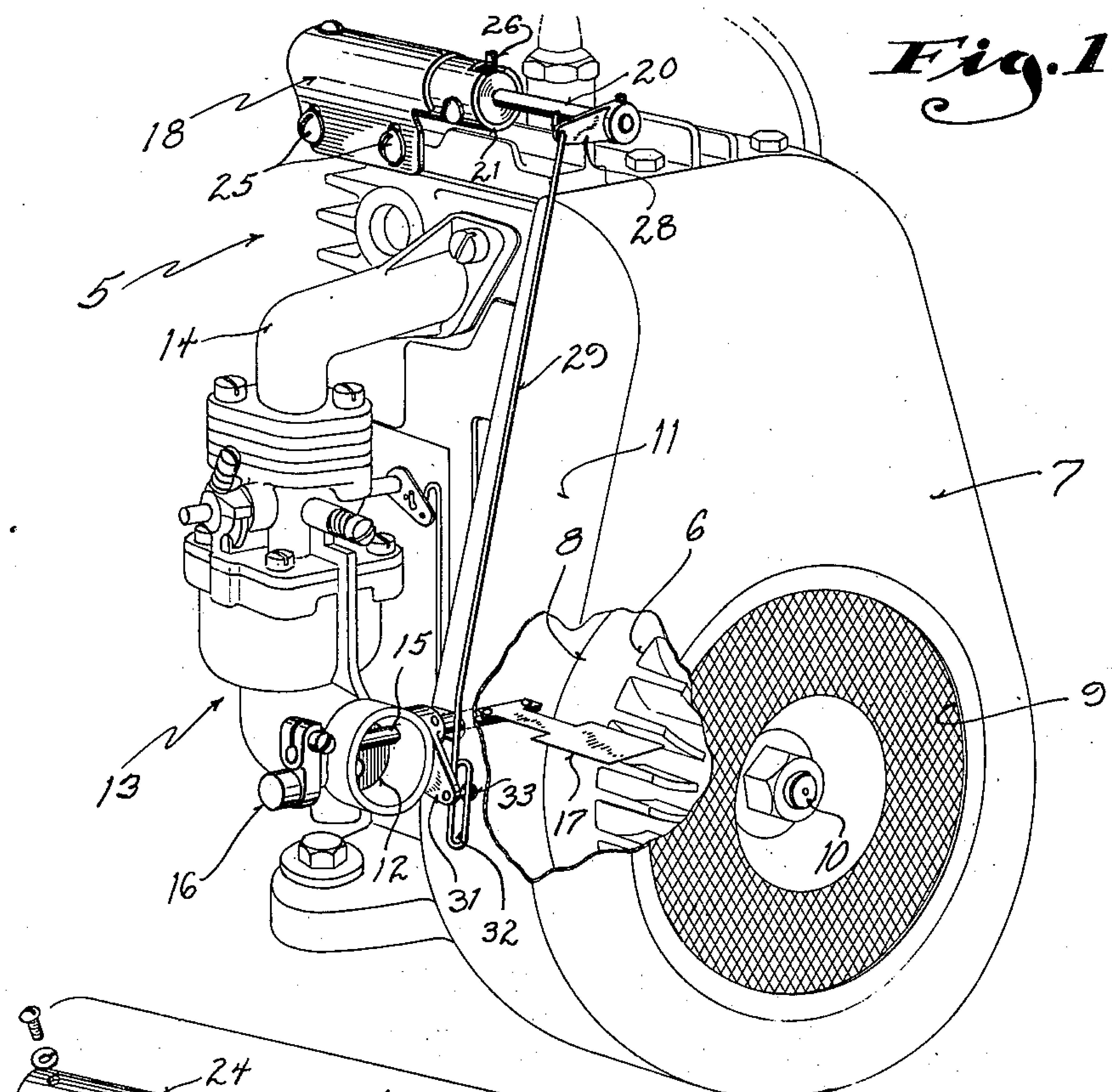


Fig. 2.

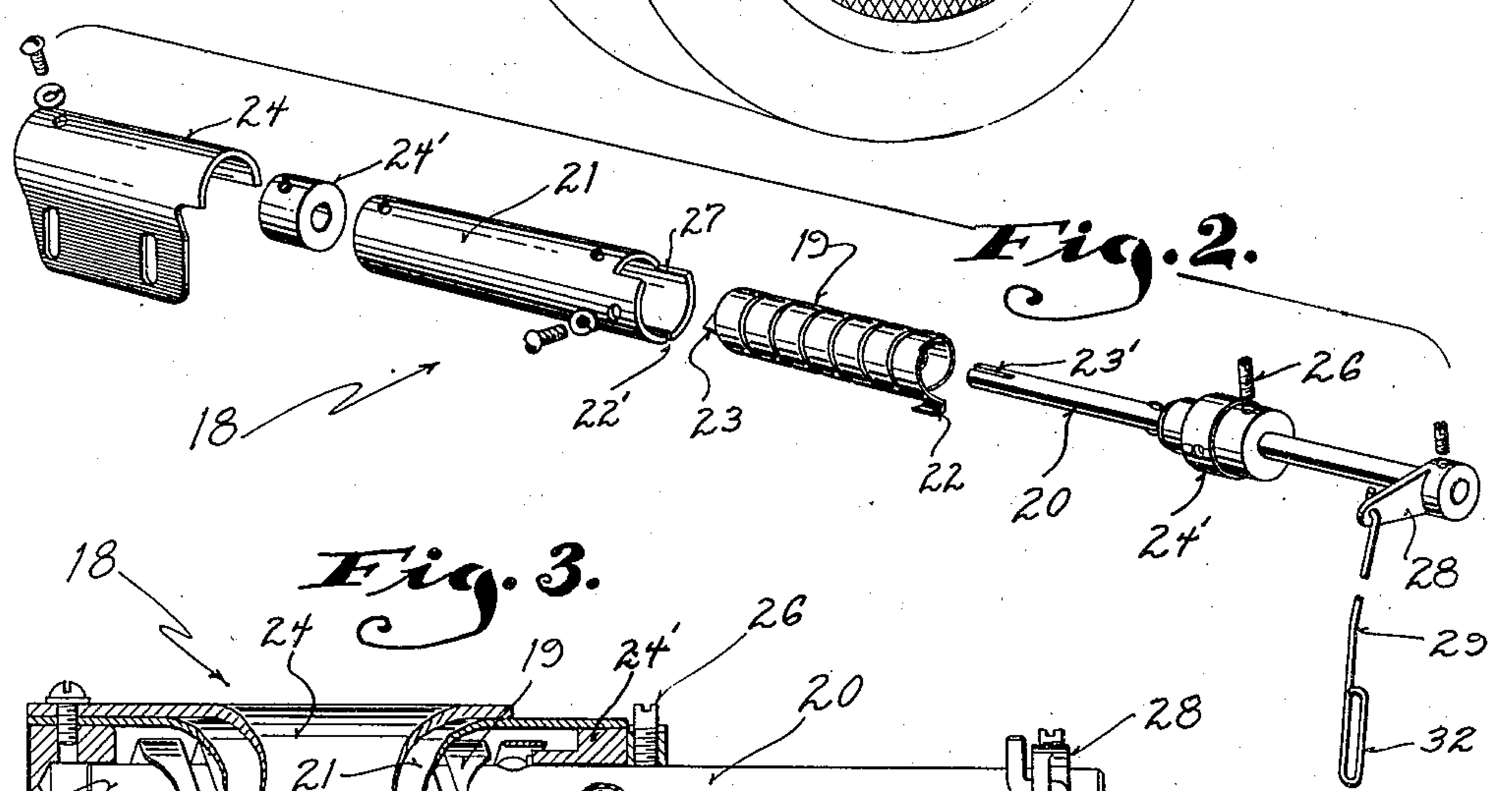
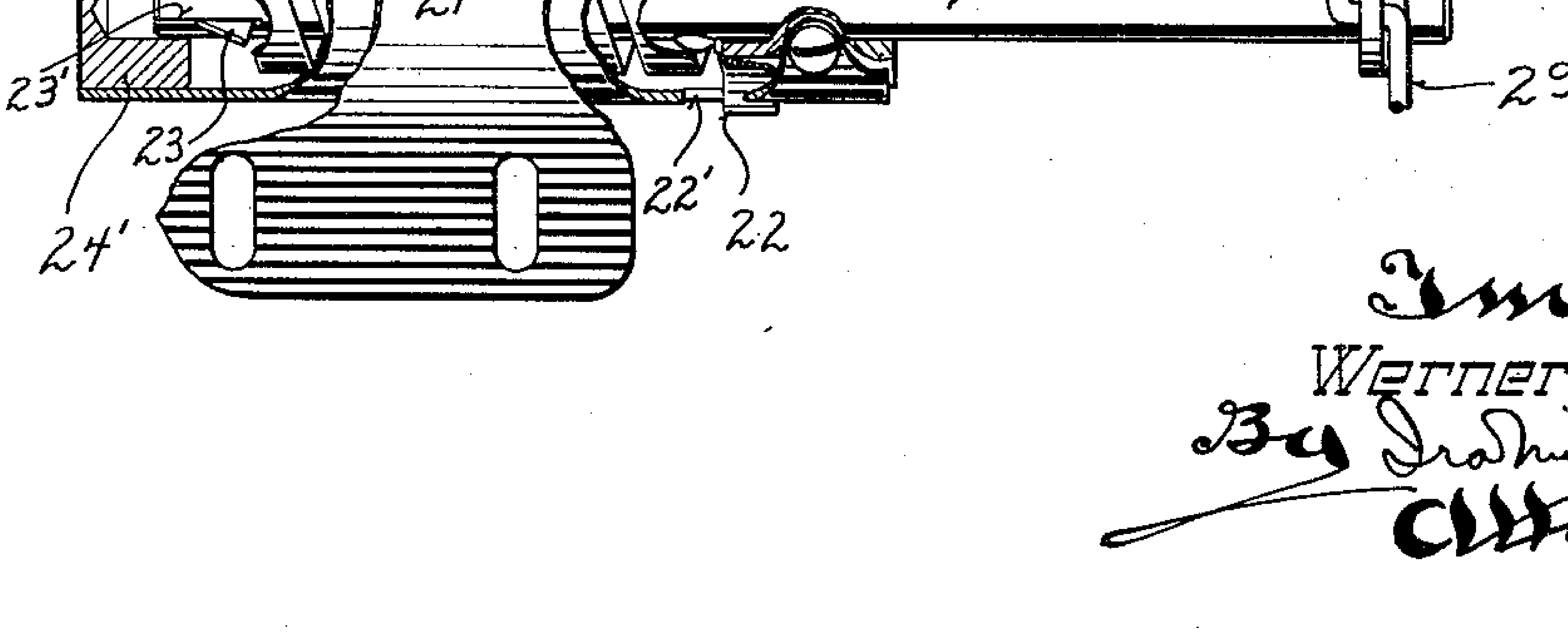


Fig. 3.



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AUTOMATIC CHOKE CONTROL FOR INTERNAL-COMBUSTION ENGINES

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7 Claims. (Cl. 123—119)

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This invention relates to automatic choke controls for internal combustion engines, and refers more particularly to a choke control for use on small portable internal combustion engines. Automatic choke controls of this type are especially desirable on remotely controlled engines, and those which are started and stopped automatically as in lighting plants, pumping systems and the like. When equipped with the automatic choke control of this invention, such engines may be started at any temperature.

While automatic chokes per se are not broadly new all previous choke controls have been rather complicated and not too reliable. It is, therefore, an object of this invention to provide an automatic choke control of the character described which is simple in construction and operation, and which will function reliably under all conditions of use.

More specifically it is an object of this invention to provide an automatic choke control wherein the choke remains closed or partially closed during cranking of the engine, to be opened promptly upon the engine attaining speed, but at a rate determined by the engine temperature, and wherein the choke valve is held from closing if the engine is stopped while hot so that if the engine is restarted while still hot, adequate air will be supplied during the cranking operation.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawing illustrates one complete example of the physical embodiment of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a perspective view of a single cylinder portable internal combustion engine illustrating the application of this invention thereto;

Figure 2 is a perspective view of the several parts of the torque motor shown disassembled but in their proper order of assembly; and

Figure 3 is a longitudinal sectional view through the thermostatic torque motor which forms part of the choke control.

Referring now more particularly to the accompanying drawing in which like numerals indicate like parts, the numeral 5 designates the cylinder

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of a small portable internal combustion engine which, as is customary, has a cooling fan 6 operating within a blower housing 7. The fan 6 is preferably cast integrally with the fly-wheel 8 and draws air into the housing 7 through an inlet opening 9 surrounding the adjacent end of the crank shaft 10 to discharge the same from the upper end of the housing against the side of the cylinder. There is, thus, a well defined upward stream of air flowing along the side wall 11 of the blower housing.

This air-stream which may be said to be a function of the engine while in operation, is utilized to apply opening torque to the choke valve 12 of a carburetor 13 mounted adjacent to the side wall 11 of the blower housing. The carburetor is, of course, connected with the usual intake manifold 14 to supply a fuel mixture to the cylinder.

The choke valve 12 as is customary is of the butterfly type being mounted upon a shaft 15, the inner end of which protrudes into the blower housing through an appropriate opening in its side wall 11. The outer end of this shaft has a weight 16 mounted thereon and so located that the torque applied thereby to the shaft at all times tends to close the choke valve.

The inner end of the shaft 15 has a thin resilient blade-like air vane 17 secured thereto to be positioned in the air-stream flowing along the side wall 11 of the blower housing. Hence the impact pressure applied on the air vane by this air-stream imparts torque to the shaft 15 in opposition to that imposed thereon by the weight 16 to thus tend to open the choke valve.

The balance of this choke assembly is such that at cranking speeds the impact pressure applied on the air vane by the air-stream flowing through the blower housing is not sufficient to open the choke. As the engine accelerates and the velocity of the air-stream through the blower housing increases the air vane is lifted to apply opening torque to the choke valve which thus opens full if the engine is at running temperature.

However, if the engine was cold when started so that it requires an appreciable time before running temperature is achieved, opening of the choke valve is restrained by means of a thermostatic torque motor indicated generally by the numeral 18. This thermostatic torque motor or thermostat is mounted on the cylinder head to be directly influenced by the heat of the engine. It comprises a bi-metallic helical driving coil 19 surrounding a shaft 20 and enclosed within a tube 21. The forward end of this driving coil is bent outwardly as at 22 and passed through a slot 22′ in the tube 21 so as to be anchored thereto. The other end of the driving coil is bent inwardly as at 23 and passed through a slot 23′ in the shaft so as to be drivingly connected therewith. The tube 21 is secured in a housing 24 which in turn is fastened to the cylinder head by screws 25, and bearings 24′ in the opposite ends of the housing support the shaft 20 for rotation on a fixed axis.

The direction in which the bi-metallic driving coil 19 is wound is such that with an increase in ambient temperature, the coil tends to unwind to impart a clock-wise rotation to the shaft 20 as viewed in Figure 1. The limits of such oscillation that can be imparted to the shafts are defined by a stop 26 fixed with respect to the shaft 20 and operating in an arcuate cut-out 27 in the forward end of the tube 21. The collision of the stop 26 with the ends of this arcuate cut-out defines the limits of the oscillation of the shaft 20.

A lever 28 fixed to the outer end of the shaft 20 is connected with the choke valve through a link 29. The upper end of this link has a pivotal connection with the lever 28. The lower end thereof has a lost motion connection with a lever 31 fixed to the shaft 15. While this lost motion connection can be established in any desirable manner, it is conveniently obtained by forming an elongated loop 32 on the end of the link to receive a headed pin 33 fixed to the lever 31.

The adjustment of the parts is such that in operation the torque motor or thermostat restrains the opening of the choke valve in response to air pressure on the vane 17 until the engine reaches its normal running temperature. At this time, the driving coil 19 of the thermostat will have lifted the connecting link far enough to enable complete opening of the choke valve. The opening of the choke thus takes place gradually and in step with the rising engine temperature.

Attention is directed to the fact that inasmuch as the air vane 17 is a thin resilient blade, it will yield and be bent or flexed by the air pressure applied thereto, before it will force the temperature sensitive bimetal element 19 into a permanent set.

In the event the engine is shut down when hot, the thermostatic torque motor or thermostat, acting through its lost motion connection with the choke valve, holds the choke valve against closing. Thus if the engine is restarted while still hot, a proper fuel mixture will be assured. As the engine cools down the thermostat automatically allows the choke valve to be closed by gravity for cold starting.

From the foregoing description taken in connection with the accompanying drawing, it will be readily apparent that this invention provides a simple and reliable automatic choke control especially well adapted for use on small portable internal combustion engines requiring either remote or automatic operation.

What I claim as my invention is:

1. In an internal combustion engine having a carburetor with a choke valve biased to closed position, and a fan for inducing an air stream proportional in velocity to the speed of the engine, the combination of: an air vane mounted in said stream of air to be actuated thereby; a connection between the air vane and the choke valve whereby response of the vane to the impact pressure of the air stream as the engine comes up to speed applies opening force to the choke valve; a thermostat mounted to be influenced by the heat of the engine; and a connection between the thermostat and the choke valve through which the thermostat controls the opening of the choke valve by the air vane to make opening thereof consonant with warming up of the engine.

2. In an internal combustion engine having a carburetor with a choke valve biased to closed position, and a fan for inducing an air stream, the combination of: means drivingly connected with the choke valve and positioned in the air stream to be actuated thereby in a manner to apply opening torque on the choke valve; a thermostat mounted to respond to the heat developed in the engine; and a lost motion connection between the thermostat and the choke valve through which the thermostat acts to control opening of the choke valve by the air stream responsive means and through which closure of the choke valve is limited upon stopping of the engine when hot.

3. In an internal combustion engine having a carburetor with a choke valve biased to closed position, and a fan for inducing an air stream, the combination of: a thermostatic torque motor mounted to be responsive to the heat developed in the engine; a shaft drivingly connected to said torque motor for rotation on the axis of said motor; a lost motion connection between said shaft and the choke valve through which the torque motor acts to restrain opening of the choke valve until a predetermined engine temperature has been reached and through which the torque motor acts to hold the choke valve from closing upon stopping of the engine after said predetermined engine temperature has been reached; and other choke actuating means comprising air pressure responsive means positioned to be actuated by pressure of the air stream and a motion transmitting connection between said air pressure responsive means and the choke valve.

4. In an internal combustion engine having an upright cylinder and a carburetor provided with a choke valve mounted alongside the cylinder, said engine also having a fan operating in a blower housing, the combination of: means biasing the choke valve toward closed position; a shaft drivingly connected with the choke valve and protruding into the blower housing; an air vane secured to the shaft inside the blower housing and so positioned in the stream of the air moving through said housing as to apply opening torque upon the choke valve as the engine comes up to speed; a thermostatic torque motor mounted on top of the cylinder above the carburetor to be responsive to the heat developed in the engine; and a lost motion connection between the movable element of the torque motor and the choke valve for controlling the opening of the choke valve by the air vane and for holding the choke valve against full closure upon stopping of the engine after a predetermined engine temperature has been reached.

5. In an internal combustion engine having a cylinder and a carburetor alongside the cylinder, the carburetor having a choke valve, the combination of: a thermostatic torque motor mounted on the head of the cylinder to be influenced by the heat developed in the engine, said torque motor comprising a bi-metallic coil; a shaft encircled by said coil and connected to

one end thereof so that expansion and contraction of the coil transmits rotation to the shaft in opposite directions; a link connecting the shaft with the choke valve so that the position of the choke valve may be controlled by the thermostatic torque motor; and other choke adusting means acting on the choke valve in opposition to said thermostatic torque motor comprising an air vane positioned so that air pressure resulting from operation of the engine controls the opening of said choke valve as the engine comes to speed, and a motion transmitting connection between said air pressure responsive means and the choke valve.

6. In an internal combustion engine having a carburetor with a choke valve, and having means for inducing a flow of air, the combination of: an air vane movable by said flow of air; means actuated by movemnt of the air vane for adjusting the choke valve; a thermostat having a movable element mounted to be influenced by the heat of the engine; a connection between the movable element of the thermostat and the choke valve whereby the thermostat reacts against the force applied to the choke valve from the air vane and thus controls the adjustment of the choke valve by the air vane; and said air vane being thin and resilient so as to yield to air pressure thereon before force sufficient to cause a permanent set in the thermostat can be applied to the movable element of the thermostat by the air vane.

7. In an internal combustion engine having a cylinder, a fan for inducing a stream of air flowing over the cylinder, and a carburetor alongside the cylinder, the carburetor having a choke valve, the combination of: a thermostatic torque motor mounted on the head of the cylinder to be influenced by the heat developed in the engine; a link connecting the movable element of the torque motor with the choke valve so that the position of the choke valve may be controlled by the thermostatic torque motor; and other choke adjusting means acting on the choke valve, said other choke adjusting means including air pressure responsive means positioned to be actuated by pressure of the air stream and motion transmitting means between said air pressure responsive means and the choke valve, said air pressure responsive means being resiliently yieldable to cushion reaction forces on the thermostatic torque motor resulting from air pressure on said air pressure responsive means to thus preclude giving the thermostatic motor a permanent set.

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