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CHOKE CONTROL FOR CARBURETOR

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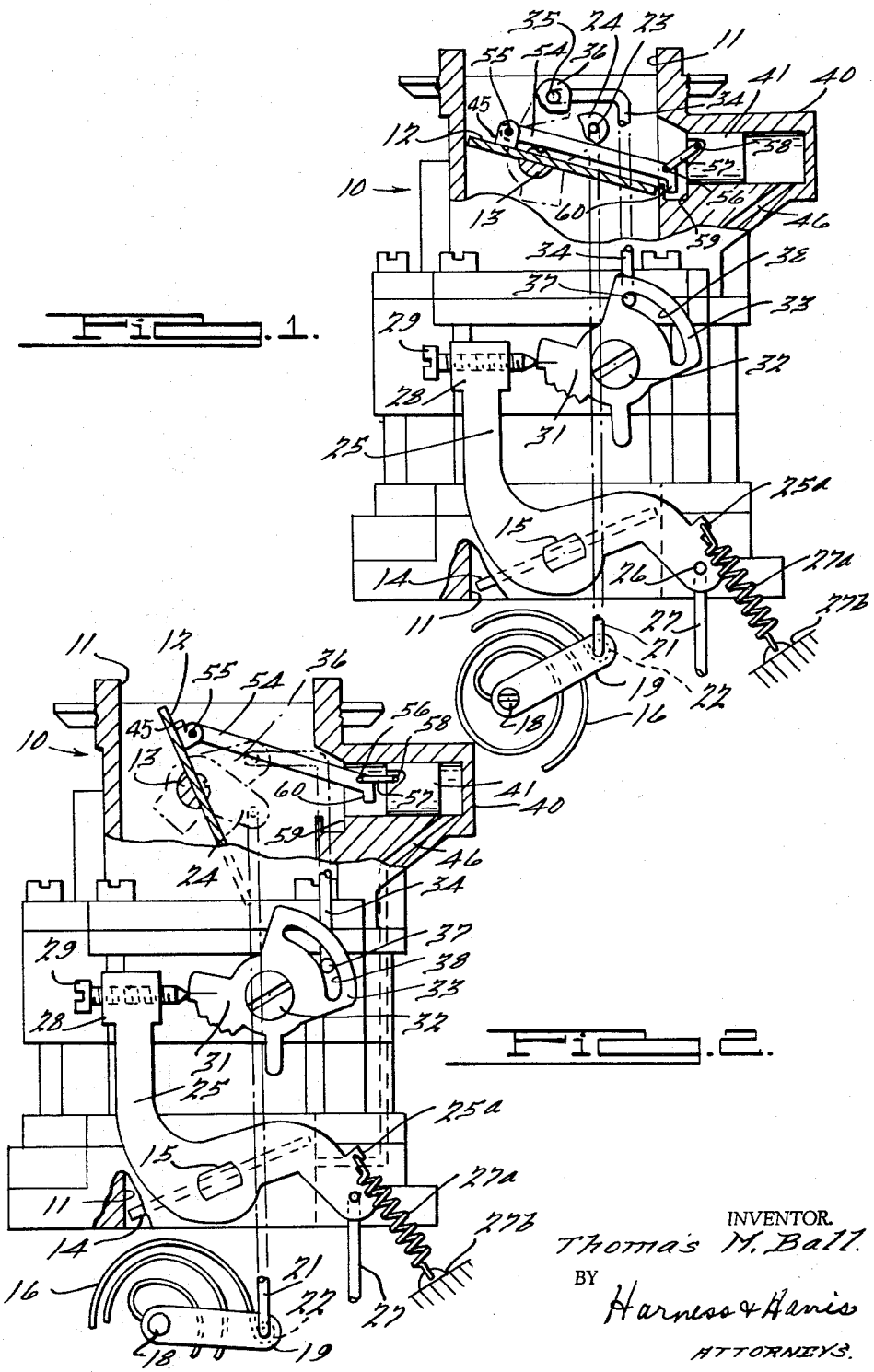

Fig. 1.

Fig. 2.

INVENTOR.
Thomas M. Ball
BY
Harness & Harris
ATTORNEYS.

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CHOKE CONTROL FOR CARBURETOR

Thomas M. Ball, Bloomfield Hills, Mich., assignor to Chrysler Corporation, Highland Park, Mich., a corporation of Delaware

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4 Claims. (Cl. 261—39)

This application is a division of my copending application, Serial No. 161,189, filed December 21, 1961.

This invention relates to improvements in the automatic control of a carburetor for an internal combustion engine and has for an important object the provision of improved control means for the conventional unbalanced choke blade effective to prevent stalling of the engine immediately after it has been started.

Occasionally when an automatic engine is initially started, a rush of inlet air blows the choke blade open sufficiently to cause the engine to stall, particularly during unfavorable weather conditions. It is accordingly another object of the invention to provide improved simple and economical means which is highly effective to enable limited opening of the choke during starting only, so as to prevent stalling, and which allows normal choke operation after the engine has been started and the throttle has once been opened beyond the idle operating condition.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

FIGURE 1 is a fragmentary and generally schematic view of a carburetor embodying the present invention, portions being broken away to illustrate details of construction, the choke blade being shown in the starting position.

FIGURE 2 is a view similar to FIGURE 1, showing the choke blade in an idle operating position.

It is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring to the drawings, an embodiment of the present invention is illustrated by way of example comprising a carburetor for an automobile engine, the carburetor including a body **10** having the customary air inlet induction conduit **11**. An unbalanced choke blade or valve **12** is secured to a rotatable shaft **13** journalled at opposite ends in the body **10**. The blade **12** is pivotal with shaft **13** and is located in the upper portion of conduit **11** in accordance with conventional practice. A throttle valve **14** secured to a rotatable shaft **15** journalled at opposite ends in the body **10** is provided at a downstream location of the conduit **11**.

Suitably located within a portion of the engine so as to be responsive to an operating temperature thereof is a spiral bi-metallic thermostat spring **16** having a fixed end secured to a fixed spindle **18**. A swinging arm **19** pivotal on spindle **18** has an outer swinging end pivotally connected to the lower end of an operating link **21**. A free end **22** of thermostat **16** is engaged with arm **19** to urge arm **19** counterclockwise with progressively increasing force as the temperature decreases. The upper end of link **21** is pivotally connected at **23** to the swinging end of a crank arm **24** keyed to the choke shaft **13**.

Keyed to the throttle shaft **15** is a throttle control lever **25** having one swinging end pivotally connected at **26** with a personally actuated throttle link **27**. The other end of lever **25** is provided with a threaded boss **28** having an adjustable idle control screw or cam follower **29** screwed therein. The inner end of screw **29** is adapted to engage a stepped cam surface of a fast idle cam **31** when the latter is in a predetermined cold idle operating position as described below. The cam **31** is keyed to a rotatable axial stub **32** journalled on the body **10** and is provided with a counterweight portion **33** effective to urge clockwise rotation of cam **31** by gravity force toward a warm operating position.

Throttle lever **25** is normally urged clockwise toward the closed or idle position illustrated in FIGURES 1 and 2 by a customary throttle return spring **27***a* schematically illustrated under tension between a projection **25***a* of lever **25** and a fixed portion **27***b* of the engine. Foot pedal actuation of shaft **27** is effective to swing lever **25** counterclockwise to open the throttle **14**.

Upon closing movement of choke valve **12**, the fast idle cam **31** is swung counterclockwise to the cold position by means of a link **34** having an upper end pivotally connected at **35** to a crank arm **36** keyed to shaft **13**. The lower end of link **34** terminates in an extension **37** which projects in a direction parallel to the pivot axis of cam **31** through a lost motion slot **38** to complete a lost motion pivotal connection between link **34** and cam **31**. Slot **38** is formed arcuately within the counterweight portion **33** concentrically with the pivot axis of cam **31** to enable opening movement of choke valve **12** independently of movement of cam **31**, as described below, by virtue of extension **37** riding within groove **38**.

In order to render the position of choke valve **12** responsive to the pressure in conduit **11** downstream of throttle valve **14**, a vacuum cylinder **40** formed integrally with body **10** contains a reciprocable piston **41** therein. A link **54** is provided with an upper end pivotally connected at **55** to the outer end of a projection **45** secured to valve **12** so as to swing the latter in a clockwise opening movement upon rightward movement of link **54**. The opposite end of link **54** is pivotally connected at **56** to one end of a short connecting link **57**, the other end of the latter link being pivotally connected at **58** to piston **41** to complete a toggle connection. A notch **59** is provided in the inner sidewall of cylinder **40** adjacent the latter's left end to receive a depending projection **60** of link **54**, FIGURE 1. The notch **59** is dimensioned so that immediately after starting the engine with the throttle **14** open, opening of choke valve **12** will be limited by engagement between projection **60** and the right edge of notch **59** to prevent stalling of the engine as described above. The right end of cylinder **40** is connected by means of duct **46** with induction conduit **11** at a location downstream of throttle valve **14**, FIGURE 2, thereby to urge opening of choke **12** against the force of thermostat spring **16** when the pressure downstream of throttle valve **14** is low, i.e. during engine idling.

In the operation of the structure illustrated, throttle **14** is preferably open during starting. When the cold engine is initially started and while the throttle **14** is still open, limited opening of choke **12**, as for example approximately 10° to a starting position, is enabled by the lost motion of projection **60** in notch **59**. When the throttle **14** is subsequently returned to the idle position in FIGURE 1, the low pressure induced downstream of throttle **14** and conducted to the right side of piston **41** will exert sufficient force on the latter piston to pull projection **60** upwardly from notch **59** and enable operation of choke valve **12** in the customary manner. When the engine is operated under load, the downward flow of air through conduit **11** will be sufficient when the throttle **14** is open

to maintain choke **12** open sufficiently to prevent extension **60** from re-entering notch **59**, regardless of the temperature condition of thermostat **16**. By this time, the danger of engine stalling will have passed, because the stalling tendency described occurs only in the first two or three seconds of engine operation.

When screw **29** is in contact with the stepped cam surface, the frictional contact between screw **29** and cam **31** resulting from the tension of spring **27***a* is sufficient to prevent pivotal movement of cam **31** in consequence of the normal forces acting thereon, such as the forces resulting from counterweight **33**, thermostat coil **16**, piston **41**, or the downwardly flowing air in conduit **11** acting on the unbalanced blade **12**. In consequence, when the carburetor parts are in the cold position illustrated in FIGURE 1 and the engine is idling, the throttle **14** will be maintained in a fast idle position by reason of screw **29** engaging the fast idle step of the cam surface of cam **31**. At the fast idle position, throttle **14** is cracked slightly open as illustrated in FIGURE 1, so that the engine will idle effectively in the cold condition. Thereafter, when throttle valve **14** is opened from the fast idle position to accelerate the engine, the frictional engagement between screw **29** and cam **31** will be released to enable opening of choke valve **12** to the usual operating condition.

If the throttle **14** is then returned to a cold idle position so as to engage one of the lesser steps of the cam surface of cam **31**, the latter will be locked against swinging movement as aforesaid by virtue of its frictional contact with screw **29**. However, the cam **31** will receive extension **37** within slot **38**. Thus if the engine is allowed to run at idle for sufficient time to relax the closing force of thermostat spring **16** as a result of warming of the engine, throttle valve **12** will be free to open by virtue of movement of extension **37** along slot **38**, FIGURE 2.

If the engine is operated in the warm condition under load and is then turned off and allowed to cool, choke valve **12** will be locked against return movement to the closed position by contact between fast idle cam **31** and screw **29**. Accordingly, in order to return the carburetor mechanism to the position illustrated in FIGURE 1, throttle **14** must first be opened to release the engagement between cam **31** and screw **29** thereby to enable thermostat spring **16** to return choke valve **12** and cam **31** to the position of FIGURE 1. Thereafter upon closing of throttle **14**, screw **29** will engage the cold starting step of cam **31** as illustrated in FIGURE 1.

I claim:

1. In a fuel charging device for an internal combustion engine, air inlet conduit means, a choke valve in said conduit means having an unbalanced pivotal blade adapted to be urged to an open position by the air flow in said conduit means impinging on said blade, thermostatic means responsive to decreasing temperature for yieldingly closing said choke valve, a throttle valve in said conduit means movable between open and idle position, means to enable limited air flow induced opening of said choke blade to a starting position and to block further opening thereof to prevent a sudden flow of inlet air in said conduit means sufficient to stall said engine immediately after the latter has begun to operate under its own power with said throttle valve at its open position comprising pressure actuated means responsive to the pressure in said conduit means downstream of said throttle valve and operatively coupled with said choke valve to open the latter in opposition to said thermostatic means when said throttle valve is at said idle position and to release said choke valve for closing when said throttle valve is at its open position, operable movement limiting means cooperable with said pressure actuated means and choke valve to block air flow induced opening of the latter beyond said starting position when said throttle valve is at its open position and to release said choke valve for opening when said throttle valve is at said idle position.

2. In a fuel charging device for an internal combustion engine, air inlet conduit means, a choke valve in said conduit means having an unbalanced blade adapted to be urged to an open position by the air flow in said inlet conduit means impinging on said blade, a throttle valve in said conduit means movable between idle and open positions, means to enable limited air flow induced opening of said blade to a starting position and to block further opening thereof to prevent a sudden flow of inlet air in said conduit means sufficient to stall said engine immediately after the latter has begun to operate under its own power with said throttle valve at an open position comprising a fixed stop, toggle means including a pair of links having inner ends pivotally connected and having outer ends relatively movable toward and from each other to fold and unfold said toggle means respectively, said choke valve being connected to one of said outer ends to move the same toward the other of said outer ends and fold said toggle means upon air flow induced opening of said choke blade from its closed position when said throttle is open, movement limiting means movable with said toggle means into engagement with said stop on folding of said toggle means to limit said folding and said air flow induced opening of said choke valve blade to said starting position and being movable out of engagement with said stop to free said choke valve for opening upon unfolding of said toggle means, piston means connected with said other end and responsive to the pressure in said conduit means downstream of said throttle valve when the latter is in an idle operating condition to move said other end in said direction away from said one end, thereby to unfold said toggle means and open said choke valve.

3. In a fuel charging device for an internal combustion engine, air inlet conduit means, a choke valve in said conduit means having an unbalanced blade adapted to be urged to an open position by the air flow in said inlet conduit means impinging on said blade, thermostatic means responsive to decreasing temperature for yieldingly closing said valve, a throttle valve in said conduit means movable between idle and open positions, a fixed abutment, means to enable limited opening of said blade to a starting position and to block further opening thereof to prevent a sudden flow of inlet air in said conduit means sufficient to stall said engine immediately after the latter has begun to operate under its own power with said throttle valve at an open position comprising an operating member connected with said choke valve for actuation conjointly therewith and having a movement limiting portion engageable with said fixed abutment upon said limited opening of said choke valve blade to said starting position, piston means operably connected with said operating member and responsive to the pressure in said conduit means downstream of said throttle valve when the latter is in an idle operating condition to move said movement limiting portion out of engagement with said abutment and urge said choke valve blade toward an open position in opposition to the force of said thermostatic means.

4. In a fuel charging device for an internal combustion engine, air inlet conduit means, a choke valve in said conduit means having an unbalanced blade adapted to be urged to an open position by the air flow in said inlet conduit means impinging on said blade, fast idle cam means pivotal between cold and warm positions, means yieldingly urging said cam means toward said warm position, means operatively connecting said valve and cam means to pivot the latter to said cold position upon closing of said valve, a throttle valve in said conduit means movable between idle and open positions, idle control means movable with said throttle valve and engageable with said cam means at the cold position to limit closing movement of said throttle valve to a fast idle position, said idle control means engaging said cam means to prevent pivoting of said cam means until said throttle valve is opened from said fast idle position, means to enable

limited air flow induced opening of said blade to a starting position and to block further opening thereof to prevent a sudden flow of inlet air in said conduit means sufficient to stall said engine immediately after the latter has begun to operate under its own power with said throttle valve at an open position comprising a fixed stop, toggle means having one of opposite ends connected to said choke valve to move toward the other of said ends and fold said toggle means upon air flow induced opening of said choke valve from its closed position and adapted to unfold and pull said one end to open said choke valve upon movement of said other end in the direction away from one end, movement limiting means movable with said toggle means into engagement with said stop on folding of said toggle means to limit said folding and said air flow induced opening of said choke valve blade to said starting position and being movable out of engagement with said stop to free said choke valve for opening upon

unfolding of said toggle means, piston means connected with said other end and responsive to the pressure in said conduit means downstream of said throttle valve when the latter is in an idle operating condition to move said other end in said direction away from said one end, thereby to unfold said toggle means and open said choke valve.

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HARRY B. THORNTON, *Primary Examiner.*

RONALD R. WEAVER, *Assistant Examiner.*