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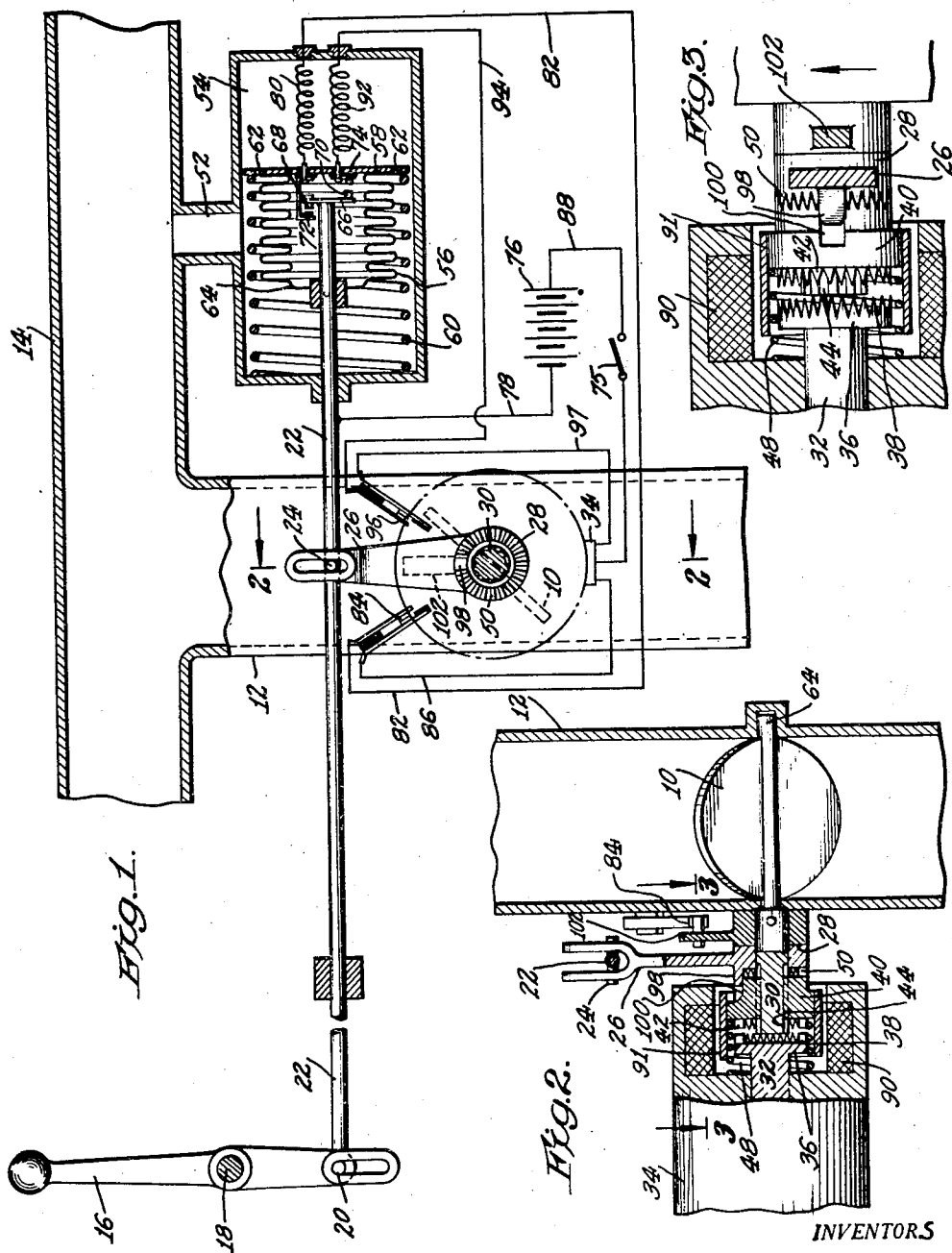
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2,438,690

THROTTLE CONTROL SYSTEM

Filed Oct. 16, 1943

2 Sheets-Sheet 1



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Fig. 4.

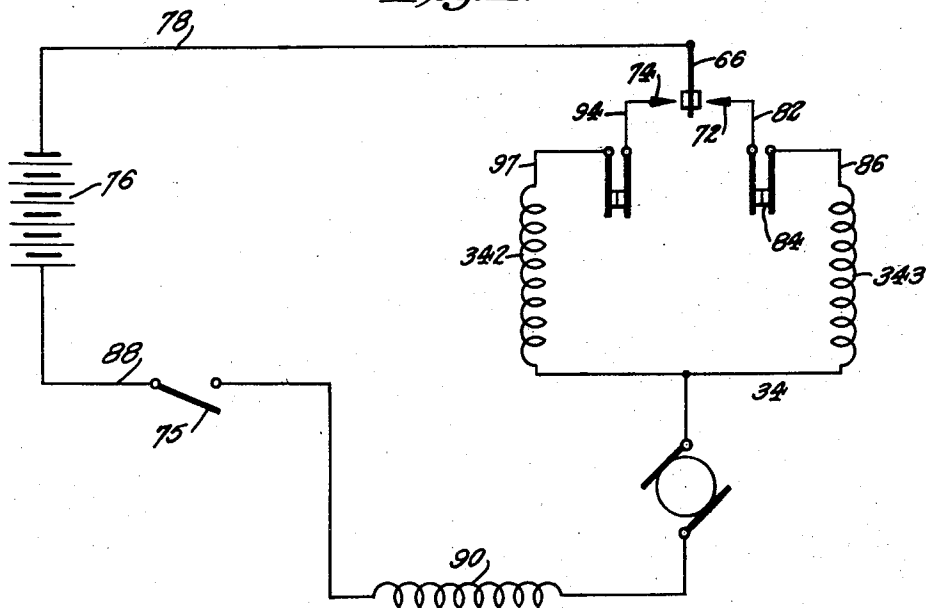
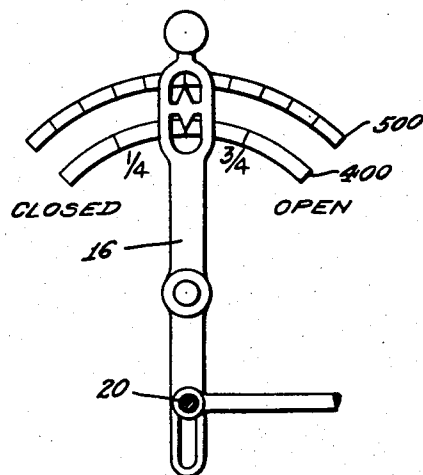


Fig. 5.



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THROTTLE CONTROL SYSTEM

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4 Claims. (Cl. 137—139)

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This invention pertains to throttle control systems for engines, especially engines of the internal combustion type.

An object of the invention is to provide a system in which the throttle may be controlled manually or automatically, at the will of the operator.

Another object is to provide a device in which the throttle may be set manually to a desired manifold pressure, after which the desired pressure is maintained automatically.

Further and other objects and advantages will be apparent from the specification and claims, and from the accompanying drawing which illustrates what is now considered a preferred embodiment of the invention.

In the drawings:

Figure 1 is a schematic view of the device;

Fig. 2 is a detail view on line 2—2 of Fig. 1;

Fig. 3 is a detail view on line 3—3 of Fig. 2;

Fig. 4 is a wiring diagram showing the electrical connections in greater detail; and

Fig. 5 is a detail view showing indicating scales that may be provided.

The device maintains constant manifold pressure by means of a reversible electric motor once it is set manually to the pressure desired. Manual control is restored automatically whenever the electric circuit is broken. In the illustrated embodiment of the invention an evacuated bellows under influence of the manifold pressure is effective to control the motor.

As illustrated, throttle 10 is in pipe 12 leading to manifold 14. The throttle may be controlled manually by hand lever 16, pivoted at 18 and connected at its lower end, by pin 20, to one end of rod 22, which in turn is connected by pin 24 to the upper end of arm 26 having at its lower end a hub 28 surrounding throttle shaft 30, which is in axial alignment with shaft 32 of electric motor 34.

The end of motor shaft 32 is in the form of a flange 36 having a ring of serrations 38 extending axially. Throttle shaft 30 carries a collar 40 provided with a ring of serrations 42 similar to ring 38 on the motor shaft. Collar 40 is slidable axially on splines 44 in shaft 30, to place its serrations 42 into or out of engagement with serrations 38 on flange 36.

The right-hand end of collar 40 is also provided with a ring of serrations 50 adapted to engage cooperating serrations on hub 28 of manual control arm 26. Collar 40 is constantly urged to the right by spring 48. Throttle shaft 30 is normally connected for manual control

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through splines 44, slidable collar 40, serrations 50, hub 28, arm 26, rod 22 and lever 16, which, as indicated, opens the throttle when moved to the right and closes it when moved to the left.

5 Connected to manifold 14 by a passage 52 is a chamber 54 containing an evacuated bellows 56, the right-hand end of which has a disk-like head 58 constantly urged towards the right by a spring 60. The rim of the disk is perforated outside the bellows, as at 62, in order to avoid air cushion during movement of head 58.

The other (left) head 64 of the bellows is sealed to control rod 22 which enters the bellows and has at its end a disk 66, provided with points 15 68, 70 adapted for contact with points 72, 74 (mounted on head 58) respectively, upon movement of head 58 to the right or left.

From the above it will be appreciated that after the manifold pressure has been set by the operator at the point desired, head 64 of bellows 56 remains fixed until it is moved manually. However, the position of the other head 58, depends on the forces acting on the bellows, i. e., manifold pressure, internal bellows pressure, spring force of the bellows itself, and the force of spring 60. The bellows and spring are so designed that for any setting of manifold pressure, which means a certain compression of spring 60, the equilibrium position of the bellows is such that 20 points 68, 72 and 70, 74 are out of contact. Should the manifold pressure change a predetermined amount above or below the setting, contact will be made by one or the other pair of points and the throttle will be restored to desired position by the motor, as will now be described, whereupon contact is broken and the motor stops.

Whenever automatic control is desired, switch 75 is closed, and while it is closed if pressure in chamber 56 changes to cause bellows head 58 to move to the right sufficiently to place point 72 in contact with point 68 current will flow from source 76 through wire 78, rod 22, disk 66, points 68, 72, wires 80, 82, limit switch 84, wire 86, motor 34 and wire 88.

45 Whenever current flows through the motor solenoid 90 is energized and withdraws slidable collar 40 to the left against the resistance of spring 48, causing serrations 38, 42 to inter-engage, while simultaneously disengaging serrations 50 at the other end of collar 40. This means that throttle 10 through its shaft 30 and collar 40 is now under control of motor 34, and out of control of arm 26 and manual lever 16. The motor will rotate in proper direction to correct the manifold pressure, and when that has been

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done points 68, 72, are separated and the motor stops, solenoid 90 is deenergized, and spring 48 moves collar 40 to the right again, re-engaging serrations 50, thus restoring manual control. A sleeve 91 of magnetizable material is secured to the collar 40 and, in conjunction therewith, constitutes an effective armature, core, or plunger, for the solenoid winding 90.

Whenever the manifold pressure changes to permit contact between points 70, 74, current flows from source 76, through wires 78, rod 22, points 70, 74, wires 92, 94, limit switch 96, wire 97, motor 34 and wire 88, solenoid 90 is energized and the parts will act as above described, except that the motor is reversed and the throttle will move in the opposite direction until the manifold pressure causes points 70, 74 to separate, thus stopping the motor.

The electrical connections are shown diagrammatically in greater detail in Fig. 4. There it will be seen that the motor 34 comprises an armature 341 and two field windings 342, 343, which latter are reversely wound or connected so that when the winding 342 is energized the armature 341 will rotate in one direction, and when the winding 343 is energized the armature 341 will rotate in the opposite direction. The clutch magnet is preferably connected in series with the armature 341 as shown in full lines at 90 in Fig. 4. So connected, the clutch magnet is energized only when the motor 34 is energized.

An upstanding arm 102 secured to the throttle shaft 30 cooperates with the normally closed limit switches 84, 96 to limit the movement of the throttle shaft to a desired range and prevent injury to the apparatus. In one limit of movement the arm 102 opens the contacts 84 and in the opposite limit it opens the contacts 96, to deenergize the motor 34 and prevent over-running in either case.

Whenever collar 40 is drawn to the left by solenoid 90 upon energization of the motor and solenoid, serrations 50 are disengaged, whereby throttle shaft 30 and manually-controlled arm 26 may change their relative angular positions, with the result that when the motor is de-energized and collar 40 returned to the right again, serrations 50 may not re-engage the same notches as they engaged previously, and therefore manual lever 16 can no longer be depended upon to serve as an indicator of throttle position. To obviate that condition, serrations 50 may be supplemented or replaced by a one-position clutch in the form of a single tooth 98 on arm 26 and adapted to enter a notch 100 in collar 40. A slight movement of lever 16 by the operator after collar 40 returns to the right will bring the tooth and notch into alignment whereupon spring 48 will force them into engagement and the manual lever will again act as an indicator of throttle position.

It will be understood, in view of the foregoing disclosures, that the system is operative and useful in the absence of the tooth 98 and notch 100. In that case the operation is as follows.

With the switch 75 open, the automatic control is disabled, the clutch magnet 90 is deenergized, the collar 40 is in its right hand position in which it is disengaged from the toothed flange 36 of the motor shaft, the teeth or serrations 50 are in mesh, and the control of the throttle is solely manual, i. e. by operation of the handle or lever 16. To place the system under the automatic control, the lever 16 is so adjusted as to place the contact disk 66 in a selected position corresponding to any particular manifold pressure

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which is desired to be maintained. Closure of the switch 75 will then render the automatic system operative to maintain constant the particular manifold pressure which has been selected. The clutch magnet 90, when energized, causes the teeth 50 to disengage and causes the collar 40 to be coupled to the motor shaft. When the motor 34 is disabled, either by opening the switch 75 or by failure of the source of supply to the motor, the clutch magnet 90 is deenergized, the collar 40 is disconnected from the motor shaft, and the teeth 50 are operatively engaged to restore the throttle 10 to direct mechanical control by operation of the lever 16. It will be noted that the lever 16, through its associated instrumentalities, serves a dual function, i. e. (1) with the automatic system disabled either deliberately as by opening the switch 75, or accidentally as, for example, by failure of the source of supply, movement of the lever 16 causes movement of the throttle 10 through the interposed mechanical connections, and (2) to adjust the position of the contact disk 66 and thereby to select the particular manifold pressure which is desired to be maintained constant by the automatic system. It will be noted that when the tooth 98 and notch 100 are not employed and the control passes from automatic to manual by deenergization of the clutch magnet or solenoid 90, the resumption of manual control by re-meshing of the teeth 50 may, and most likely will, result in causing the relative position of the throttle 10 and the lever 16 to be different from that which existed before automatic control was effected. This does not defeat utility of the apparatus but simply means that during repeated and extended operation of the system the lever 16 is not always in the same relative position with respect to the throttle 10.

The advantage of providing the single tooth 98 and notch 100, or equivalent means, in place of or in supplement to the teeth or serrations 50, is that when the clutch magnet or solenoid 90 becomes deenergized the throttle lever 16 may be readily aligned to its desired relative position with respect to the throttle 10 by moving the throttle lever until the single tooth 90 clicks into the notch 100.

As shown in Fig. 5, the throttle lever 16 may be provided with two stationary scales 400 and 500. The scale 400 indicates throttle position when the control of the throttle 10 is solely manual, i. e. when the automatic system is not in operation. Having in mind that the lever 16 serves also to select the position of the contact disk 66 corresponding to the particular manifold pressure desired to be maintained constant, the scale 500 may be calibrated to indicate the desired range of manifold pressures. By positioning the lever 16 with respect to any selected pressure indicated on the scale 500, the contact disk 66 will be placed in such position that the automatic system will maintain the manifold pressure constant at the desired particular value indicated by the lever 16 on the scale 500.

It is to be understood that the invention is not limited to the specific embodiment herein illustrated and described, but may be used in other ways without departure from its spirit as defined by the following claims.

We claim:

1. A throttle control system comprising, in combination, manual and electric means for moving said throttle to provide a desired manifold pressure, a single clutch member movable to interconnect either said manual moving means or

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said electric moving means with said throttle, said clutch being so constructed as to be effective upon disconnection of said electric moving means and connection of said manual moving means with said throttle for causing said manual moving means to indicate the position of said throttle.

2. The invention set forth in claim 1, in which either of said moving means is effective for moving said throttle in either direction.

3. A throttle control system for regulating manifold pressures comprising, in combination, a manual means and an electric means for adjusting the throttle, a single solenoid, a clutch controlled by the solenoid comprising a member movable in one direction when the solenoid is energized to connect the electric means to the throttle and in the opposite direction when the solenoid is deenergized to disconnect the motor and connect the manual means to the throttle, and means effective when the manual means is connected to the throttle to cause the manual means to indicate visibly the position of the throttle.

4. The invention set forth in claim 3 in which

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the manual means is operable to change the adjustment of the throttle while the solenoid is deenergized.

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