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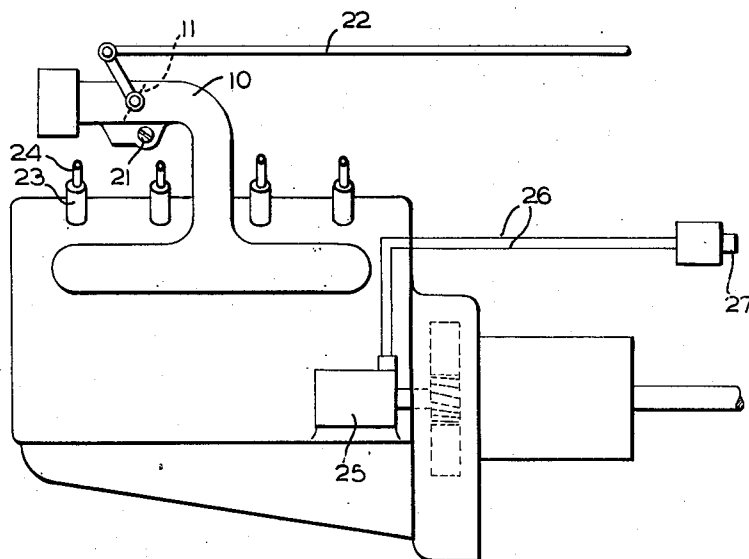
H. R. GRÖZINGER
STARTING MECHANISM

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2 Sheets-Sheet 1

FIG 1.



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Fig. 2

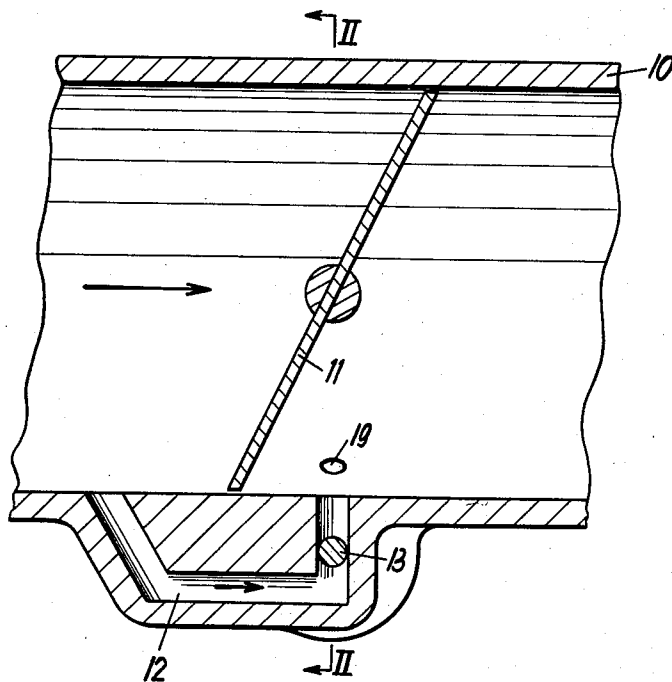
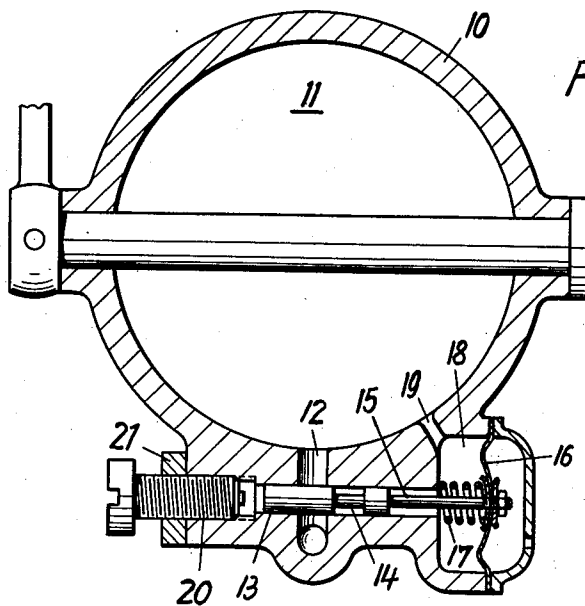


Fig. 3



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STARTING MECHANISM

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5 Claims. (Cl. 123—124)

The present invention relates to a starting mechanism for internal combustion engines and particularly engines operating with fuel injection and mixture compressing means and which fuel mixture are provided with a valve or similar device for regulating the amount of combustion air supplied to the engine.

It is an object of the present invention to provide a very simple automatic control mechanism for shutting off the supply of combustion air to the engine while the engine is at a standstill and while it is initially turned over either manually or by a starter motor so that an initial vacuum is built up within the intake pipe which improves the atomization of the fuel and facilitates the starting of the engine, and which vacuum is increased as soon as the engine runs of its own accord and thereby automatically acts upon the control mechanism to admit a supply of air to the engine adequate for proper idling thereof.

Although the invention is also applicable directly to the automatic control of a normal accelerator valve or similar device for regulating the admission of air during starting, it is preferably applied to an engine, the intake pipe of which is provided with a by-pass around the accelerator for admitting sufficient air to flow past the closed accelerator so that the engine will idle properly.

According to the invention, an automatic valve is provided within the idling channel or by-pass leading around the normal accelerator or similar device in the intake pipe of the engine. This automatic valve preferably consists of a slide valve within the by-pass which closes off the by-pass when the engine is at a standstill, as well as when it is first turned over either manually or by a starter motor. The slide valve is connected to a diaphragm which closes off a chamber which communicates with the intake pipe at a point intermediate the accelerator and the engine cylinders. A spring or similar means normally retains the slide valve in a closed position, and its strength is so determined that it will be stronger than the initial vacuum produced in the intake pipe when the engine turns over only slowly, that is, when it is started either manually or by a starter motor, but weaker than the full vacuum produced in the intake pipe when the engine has started to run of its own accord and idles.

It is another object of the invention to provide the new automatic control mechanism also as a means for adjusting the idling speed of the engine.

This object is attained by the mere provision of a set-screw which adjusts the size to which the slide valve may open the valve opening in the by-pass when the engine is running.

Further objects, features, and advantages of the present invention will be apparent from the following detailed description thereof, particularly when read with reference to the accompanying drawings, in which—

Figure 1 shows an internal combustion engine with the improved valve structure installed therein.

Fig. 2 shows a longitudinal section through the intake pipe of an internal combustion engine, taken at the area of the accelerator, and

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Fig. 3 shows a cross section taken along line II—II of Fig. 2.

Applicant's improved valve structure is shown installed in intake manifold 10 of the internal combustion engine shown in Figure 1, the valve being actuated by more or less conventional valve linkage 22. The engine shown further comprises a plurality of injection nozzles and injection lines, one each of these being designated by the reference numerals 23 and 24. The engine is further provided with a starting motor 25 controlled as shown by a circuit including wiring 26 and push button 27.

Referring to Figures 2 and 3, the main intake pipe 10 of the combustion engine contains an accelerator valve 11 which when closed shuts off the intake pipe 10 completely. Valve 11 is by-passed by an idling-air intake line 12. A slide valve 13 crosses by-pass 12 and either closes the same entirely or opens it either partly or entirely by means of a portion 14 thereon of a diameter smaller than the other diameter of slide valve 13. At its front end, slide valve 13 carries a rod 15 which is secured to a diaphragm 16 closing a chamber 18 and acted upon at the inside thereof both by a spring 17 and the suction in chamber 18. Chamber 18 communicates with the main intake pipe 10 through a channel 19 which terminates therein behind accelerator valve 11, as seen in the direction of flow of the combustion air. A set-screw 20 is further provided for adjusting the degree to which slide valve 13 may open so as to regulate the amount of air needed for proper idling of the engine. A check nut 21 secures setscrew 20 in the respective adjusted position.

The operation of the starting mechanism is as follows:

When the engine is at a standstill, slide member 13 is forced by spring 17 into the position as shown in Figs. 2 and 3 in which by-pass 12 is completely shut off. If the starter is then actuated it slowly turns over the engine, producing a considerable vacuum in the cylinders since no air can reach them due to the fact that both the main intake pipe 10 and the by-pass 12 are shut off completely, one by accelerator valve 11 and the other by slide valve 13. Since the fuel injected into the engine is more highly atomized due to such vacuum, the engine will start much more easily. As soon as the engine runs of its own accord, it requires the usual amount of air for idling, so that by-pass 12 must now be opened. According to the invention, this is done automatically. Since after starting, the engine runs more quickly, the vacuum in the main intake pipe between valve 11 and the cylinders is considerably increased. Through channel 19 this vacuum also prevails in chamber 18 so that diaphragm 16 is moved toward the left against the action of spring 17. This, in turn, moves slide valve 13 toward the left, thus opening by-pass 12. By selecting a spring 17 of suitable size and strength and by making slide valve 13 of suitable length, and possibly also by giving spring 17 a certain initial tension so that slide valve 13 will abut at the right side against a stop, not shown, it is possible to determine the degree of the vacuum in intake pipe 10 at which by-pass 12 will open. The effective size to which by-pass 12 may be opened depends upon the adjustment of setscrew 20 which abuts against the outer end of slide member 13. The same mechanism thus also serves to regulate the proper idling of the engine.

Slide member 13 may also be provided with a suitable damping device, if desired, so as to retard the movement thereof.

Although my invention has been illustrated and described with reference to the preferred embodiments thereof, I wish to have it understood that it is in no way limited to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims.

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Having thus fully disclosed my invention, what I claim is:

1. In combination with an internal combustion engine having an air intake pipe, a valve member in said intake pipe for automatically regulating the supply of combustion air to the cylinders of said engine, resilient means for normally maintaining said valve member in a closed position, means for starting said engine and for thus producing an initial vacuum in said intake pipe, said resilient means having a strength greater than said initial vacuum so as to prevent said valve member from opening during the starting of said engine but having a strength smaller than the full vacuum produced in said intake pipe when said engine runs of its own accord so as then to open said valve member.

2. In combination with an internal combustion engine having an air intake pipe, a valve member in said intake pipe for regulating the supply of combustion air to the cylinders of said engine during the effective operation thereof, a by-pass around said valve member, a second valve member in said by-pass, resilient means for normally maintaining said second valve member in a closed position, means for starting said engine when said first valve member is closed and for thus producing an initial vacuum in said intake pipe, said resilient means having a strength greater than said initial vacuum so as to prevent said second valve member from opening during the starting of said engine but having a strength smaller than the full vacuum produced in said intake pipe when said engine runs of its own accord so as then to open said valve member to permit said engine to idle.

3. In combination with an internal combustion engine having an air intake pipe, a valve member in said intake pipe for regulating the supply of combustion air to the cylinders of said engine during the effective operation

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thereof, a by-pass around said valve member, a second valve member comprising a slide member in said by-pass, a chamber communicating with said intake pipe intermediate said first valve member and said cylinders, a diaphragm closing said chamber toward the outside and connected to said slide member, and a spring acting upon said diaphragm for maintaining said slide member normally in a position to close said by-pass, means for turning over said engine when said first valve member is closed and for thus producing an initial vacuum in said intake pipe and said chamber, said spring having a strength greater than said initial vacuum so as to prevent said slide member from opening said by-pass during the starting of said engine so as to facilitate said starting, but having a strength smaller than the full vacuum produced in said intake pipe between said first valve member and said cylinders when said engine has started and runs of its own accord so as then to open said slide member so that sufficient air can flow through said by-pass to permit said engine to idle.

4. In a combination as defined in claim 3, further comprising a setscrew adjustable from the outside for adjusting the maximum size of the valve opening in said by-pass when freed by said slide member and for thus regulating the idling of said engine.

5. In a combination as defined in claim 3, further comprising damping means connected to said slide member for retarding the operation thereof.

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