L. YOST.

STARTING MECHANISM FOR INTERNAL COMBUSTION ENGINES.

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964,138. Patented July 12, 1910.

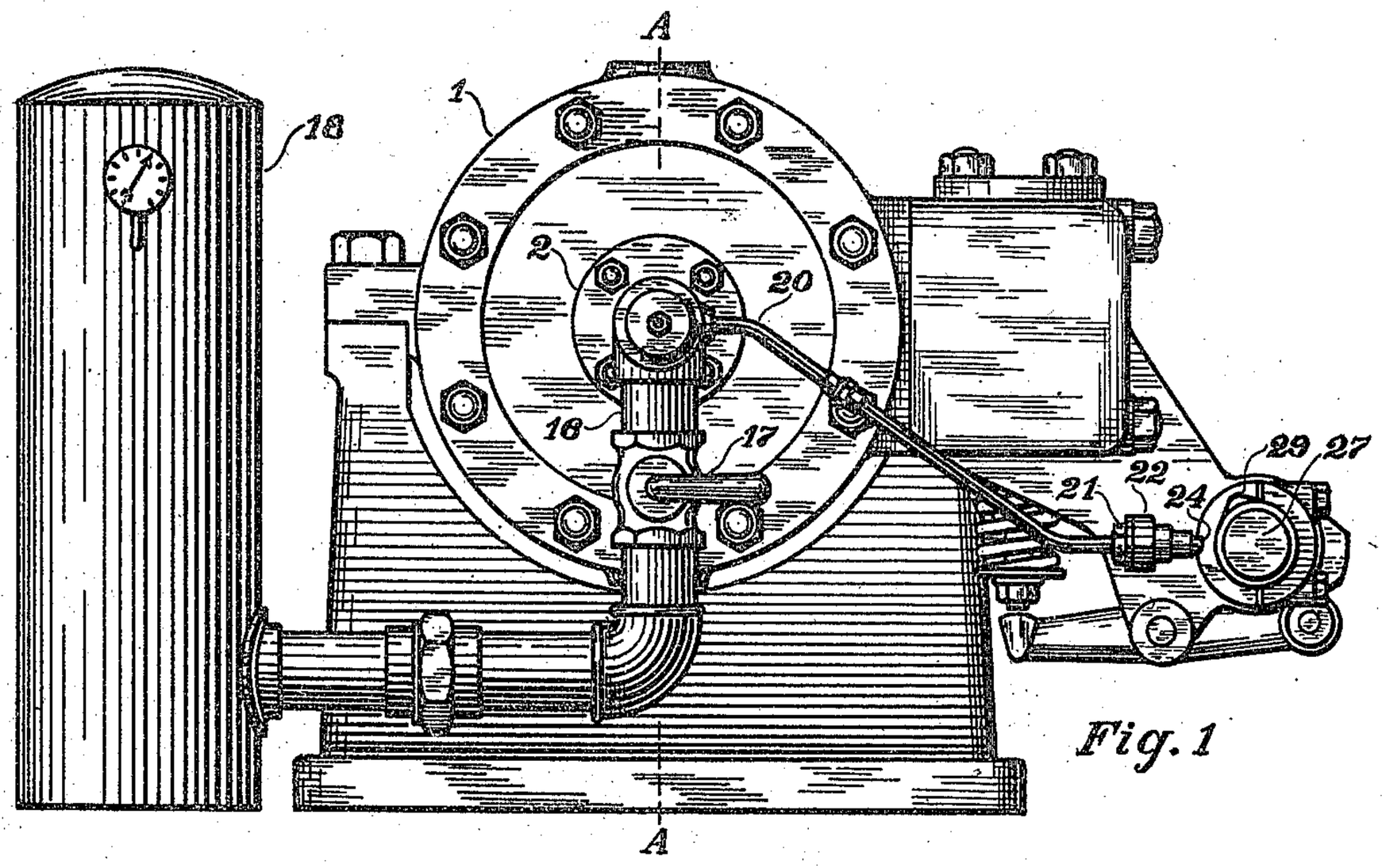


Fig. 1

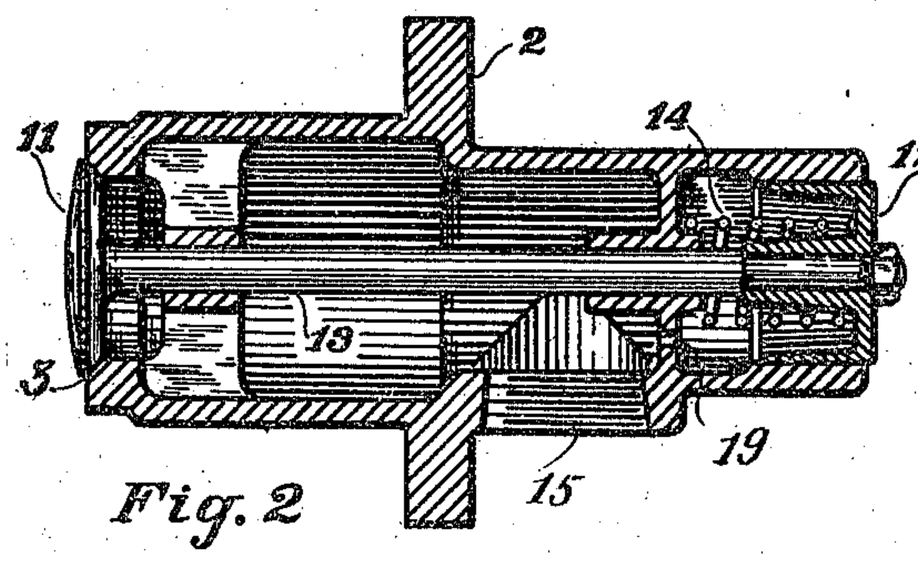


Fig. 2

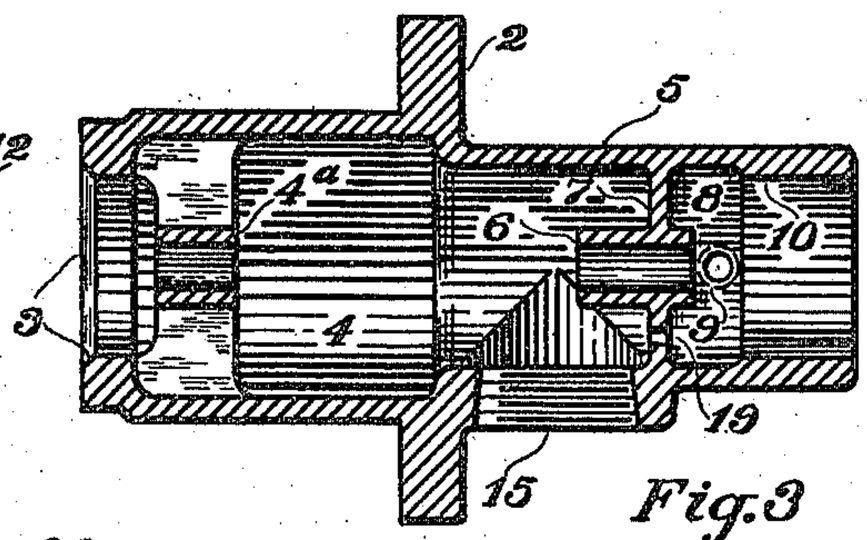


Fig. 3

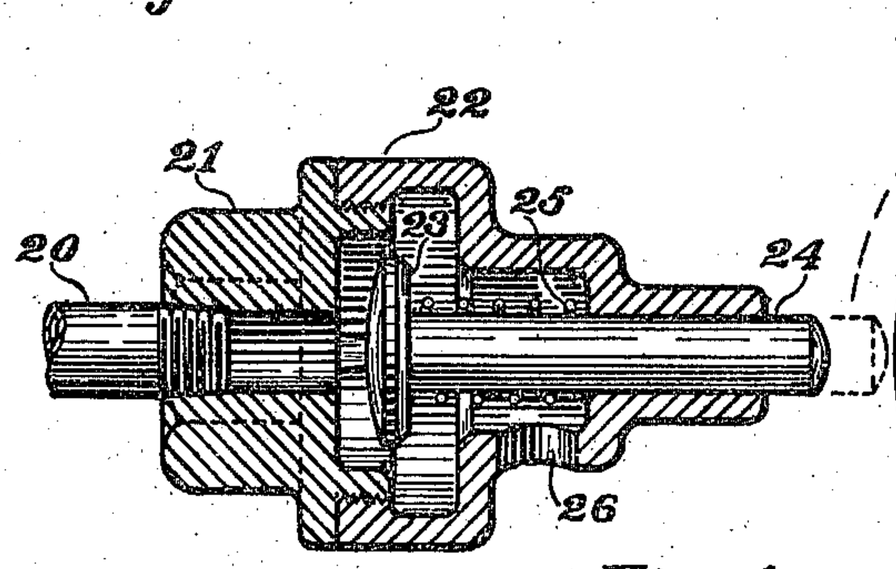
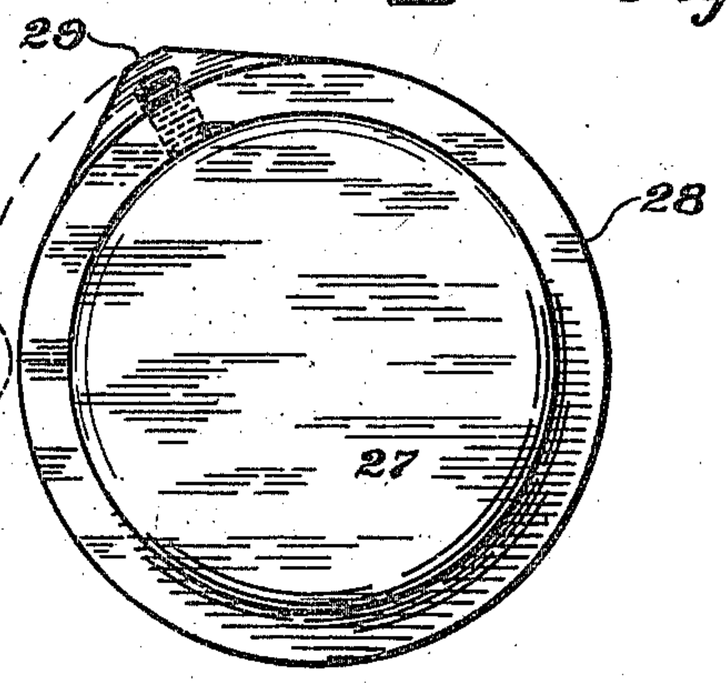


Fig. 4



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STARTING MECHANISM FOR INTERNAL-COMBUSTION ENGINES.

964,138. Specification of Letters Patent. Patented July 12, 1910.

Application filed August 31, 1908. Serial No. 450,970.

To all whom it may concern:

Be it known that I, LLOYD YOST, a citizen of the United States, residing at St. Marys, in the county of Auglaize and State of Ohio, have invented certain new and useful Improvements in Starting Mechanism for Internal-Combustion Engines, of which the following is a specification.

This invention relates to mechanism for automatically starting an internal combustion engine through the medium of a pneumatically operated admission valve.

The object of my invention is to provide mechanism of simple and economical construction, adapted for starting an internal combustion engine by simply opening a cock in the pipe conveying compressed air or other aeriform fluid from a tank, and thereby operating an auxiliary controlling valve located adjacent to the lay shaft, which carries a cam serving to open said controlling valve, permitting escape of air from the auxiliary valve casing and consequently automatic opening of the main admission and check-valve, which serves to admit compressed air to the cylinder of the engine.

Another object is to prevent injurious heating of the compressed air inlet pipe in the starting mechanism, by means of a check-valve at the inlet opening to the engine cylinder.

Another object is to provide for the use of a very small and inexpensive controlling valve, which may be located in any convenient place near the lay shaft and connected to the cage of the main admission and check-valve by a very small pipe,—a single size of controlling valve serving for all sizes and types of engines.

The matter constituting my invention will be defined in the claims.

I will now describe the details of construction of my improved mechanism by reference to the accompanying drawings, in which—

Figure 1 represents a rear elevation of an internal-combustion engine provided with my apparatus. Fig. 2 represents a vertical longitudinal section of the main valve cage, taken on the line A—A of Fig. 1. Fig. 3 represents a vertical longitudinal section of the cage, similar to Fig. 2, the valve and balancing piston being removed. Fig. 4 represents a vertical section of the auxiliary valve casing, on enlarged scale, with the auxiliary valve in place, together with an end elevation of the lay shaft and starting cam.

The starting valve cage 2 may be applied to the head of the gas engine cylinder 1 and in a single acting engine is preferably so located as to be co-axial with the cylinder. This cage is provided with an opening 3, at its front end, which is beveled to form a valve seat. This cage is made with a large forward air chamber 4 and with a web and guide-way 4^a for the valve stem. The cage is also provided with a rear central extension 5 provided with a transverse plate 7, having a central tubular guide-way 6 and having a rear air chamber 8, the wall of which is provided with a tapped opening 9 for connecting the outlet air tube 20. The rear end of the extension 5 is open and is internally provided with a cylindrical bore 10 for receiving the balancing piston 12. The main admission and check-valve 11 is arranged to be seated on the beveled seat 3 and is provided with a long stem 13 passing through the guide-ways 4^a and 6. The outer end of the stem 13 is reduced and has secured to it the balancing piston 12 by means of an outer nut. The piston 12 is internally cup-shaped and serves as a bearing for the coiled spring 14 which also bears upon the transverse partition 7. The wall of the extension 5 is provided with a comparatively large tapped opening 15 for receiving the main air pipe 16 which is provided with a plug-cock 17, and connects with the compressed fluid tank 18 which may contain air under about 200 pounds pressure. The partition 7 is provided with a small vent opening 19 connecting the main air chamber 4 with the rear air chamber 8. A small pipe 20 connects chamber 8 with the auxiliary controlling valve-casing 22 which is fixed in any convenient location adjacent to the lay shaft 27. This shell or casing is provided with a screw-head 21 into which is connected the pipe 20. An elongation of this shell is provided with a rear central opening for receiving the stem 24 of the valve 23. A small coiled spring 25 around the stem 24 is arranged to bear upon the valve 23 and upon an annular shoulder of the casing for normally holding the valve off from its seat. The casing is provided with an air outlet opening 26 to the rear of valve 23. To the lay shaft 27 is secured a cam 28, having a cam projection 29, embrac-

ing about 50 degrées of its circumference, equal to about 100 degrees on the crank shaft.

Under ordinary operating conditions the spring 14 in chamber 8 will be under sufficient tension to keep the valve 11 to its seat with a pressure of about 12 pounds per square inch of valve area, which is higher than the vacuum which will be attained in the engine cylinder during the suction stroke. If the air cock 17 be opened, the valve 11 will remain on its seat for the reason that the air will immediately pass through the vent opening 19 into the rear air chamber 8 and will exert an outward pressure upon the balancing piston 12 as great as that exerted in the opposite direction upon the valve. This condition will remain constant so long as the chambers and joints remain tight. The air under pressure will pass from chamber 8 through the small pipe 20 and force the valve 23 to its seat, so that the stem 24 will be forced outward in position to be acted upon by the cam 29. The valve cage and the auxiliary valve casing and connecting pipe will still be tight, holding air under pressure, but if the starting cam 29 be turned to bear upon the valve-stem 24, the valve will be lifted from its seat, and that instant the compressed air will nearly all escape from the rear chamber 8 through the small pipe 20, and the vent opening 26 in casing 22. Since the air is no longer under pressure in chamber 8 and the starting valve 11 no longer balanced, it will in consequence, open inward to the main cylinder, allowing the compressed air to give an impulse to the piston. As soon as the cam 29 moves off from the controlling valve stem 24, the valve will be closed by air under pressure, the chamber 8 at once filling with air under pressure and the starting valve 11 being again balanced, closes.

So long as the auxiliary valve 23 is open, there will be a small flow of air through the vent opening 19 into the rear chamber 8, but this flow is of no practical consequence, since the pipe 20 is many times the cross sectional area of the opening 19 and therefore the air pressure in chamber 8 cannot rise to any appreciable amount.

In actual practice, the engine will be barred over into the starting position, in which position the cam 29 will bear upon the stem 24. The air being now turned on will at once pass through the valve opening 3 as the valve 11 will, at this time, be unbalanced. The engine being now in motion from the force of the compressed air, the operation of the cam on the stem 24 will be repeated automatically until air is shut off by closing the plug-cock 17. It will be evident therefore, that the operation is very simple, there being but one thing to do, viz; turn on the air by opening the plug-cock 17. The small auxiliary valve-stem is kept out of contact with the starter cam 29 when the air pressure is shut off. There being no cams or levers to throw in or out, the operation is very simple, and practically automatic.

The auxiliary valve 22 can be made very small and the same size will answer for any and all sizes of engines and may be located in any convenient and out-of-the-way position adjacent to the lay shaft. It will not be necessary to connect the relatively large size of pipe 16 for compressed air directly to the controlling valve casing and from there to the cylinder, but such pipe need only be connected directly to the cage 2, since the small pipe 20 connects the cage with the controlling valve-casing 22, thus simplifying the construction.

In the above specification I have described the admission and check-valve 11 as being located in a cage which is distinct from the cylinder or cylinder head of the engine. While I prefer this construction for convenience in assembling and dismounting, yet I do not wish to limit myself to the use of the valve in such a cage, as this cage portion can easily be made integral with the cylinder or cylinder-head, having chambers equivalent to 4 and 8, with all other parts functioning in exactly the manner described; this being a cheaper construction which can be used on small engines.

Having described my invention, what I claim and desire to secure by Letters Patent, is—

1. In starting valve mechanism for internal combustion engines, the combination with a balanced admission and check valve for admitting non-explosive fluid under pressure to the engine cylinder, of an auxiliary controlling valve, a passage for fluid connecting said admission valve with the auxiliary valve, means whereby said auxiliary valve is adapted to be thrown into operative position by fluid under pressure, an outlet communicating with the passage controlled by said auxiliary valve, means for operating said auxiliary valve, whereby the said admission valve will be balanced and unbalanced at the proper time to permit the opening and closing thereof, and means for controlling the flow of fluid under pressure to the admission and check valve.

2. The combination with an internal combustion engine, of starting valve mechanism, comprising a cage portion having two air chambers and a connecting vent opening, a balanced admission and check valve therein, an auxiliary controlling valve adapted to be thrown into operative position by fluid admitted under pressure, the lay-shaft and the cam thereon adapted to operate said auxiliary valve, a pipe connection between one of the air chambers in the cage portion and

the casing of said auxiliary valve, and a pipe and valve connection admitting air under pressure into the other air chamber of the cage portion.

3. The combination with an internal combustion engine, of a cage or chamber for admitting compressed air thereto, a check-valve in the opening from said cage into the engine cylinder, a second compressed air chamber communicating with the first through a small aperture, a balanced piston on the stem of said check-valve in said second chamber, an auxiliary controlling valve adapted to be thrown into operative position by fluid under pressure, the casing of said valve having an air outlet opening, means for bearing on the stem of the auxiliary valve to open the same, a pipe connection from the second air chamber to the auxiliary valve casing and means for admitting compressed air to the chamber of the cage.

4. The combination with an internal combustion engine, of a cage having a main and a secondary chamber for compressed air and communicating by a small aperture, a check and admission valve having a stem passing through the air chambers and provided at its outer end with a balancing piston, a spring bearing on said piston, a supply pipe and valve for compressed air connecting with the main air chamber, an auxiliary valve adjacent to the lay shaft, having an air outlet opening in its casing, an operating cam on the lay shaft adapted to bear upon the stem of said auxiliary valve, a pipe connection between the secondary air chamber and the casing of said auxiliary valve, whereby air under pressure may be allowed to escape from the secondary chamber for permitting air under pressure to open the check valve and flow from the main chamber into the engine cylinder.

5. The combination with an internal combustion engine, of starting valve mechanism comprising a casing and a valve serving as admission and check valve for admitting non-explosive fluid under pressure to the engine cylinder, an auxiliary controlling valve and its casing having a vent opening, a passage from the casing of the admission valve to the auxiliary valve casing, whereby the latter may be thrown into operative position by fluid under pressure, means for operating said auxiliary valve and thereby controlling the opening and closing of said admission and check-valve, and means for controlling the flow of fluid under pressure to the casing of the admission and check valve.

In testimony whereof I affix my signature in presence of two witnesses.

LLOYD YOST.

Witnesses:
H. E. HENDERSON,
FRANK SIBERT.