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H. A. JOHNSTON.

STARTING MECHANISM FOR INTERNAL COMBUSTION ENGINES.

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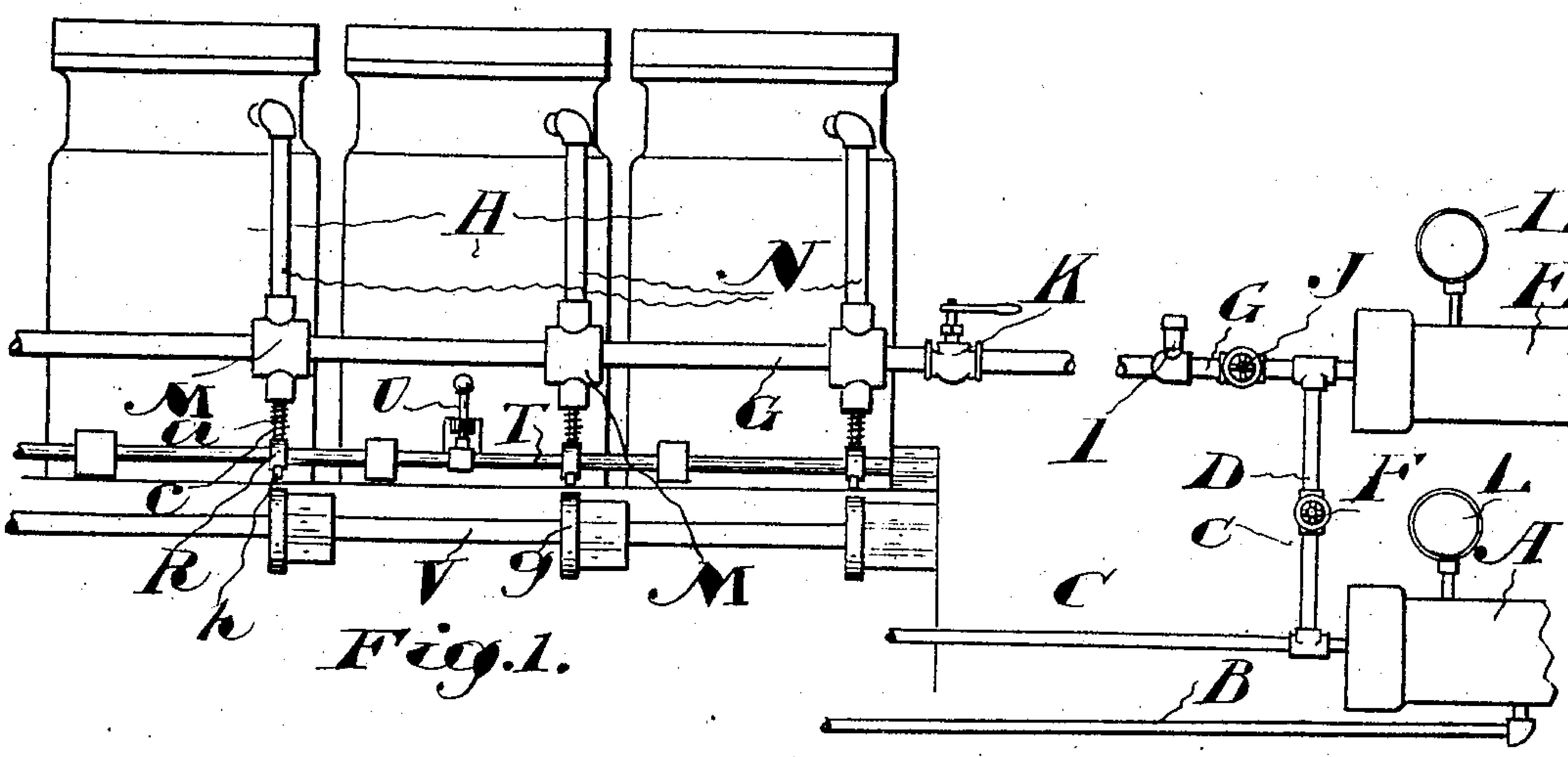

Fig.1.

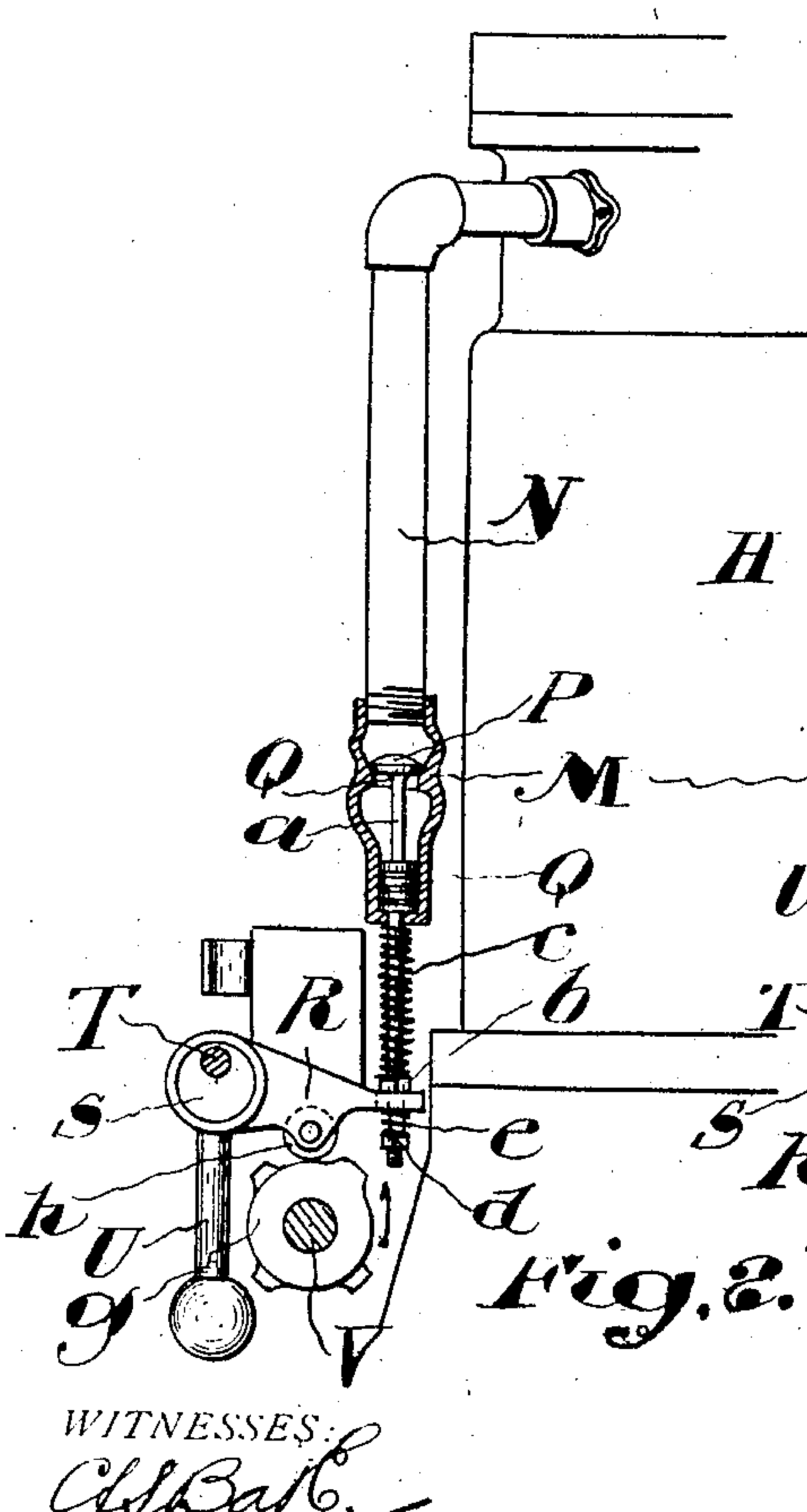

Fig.2.

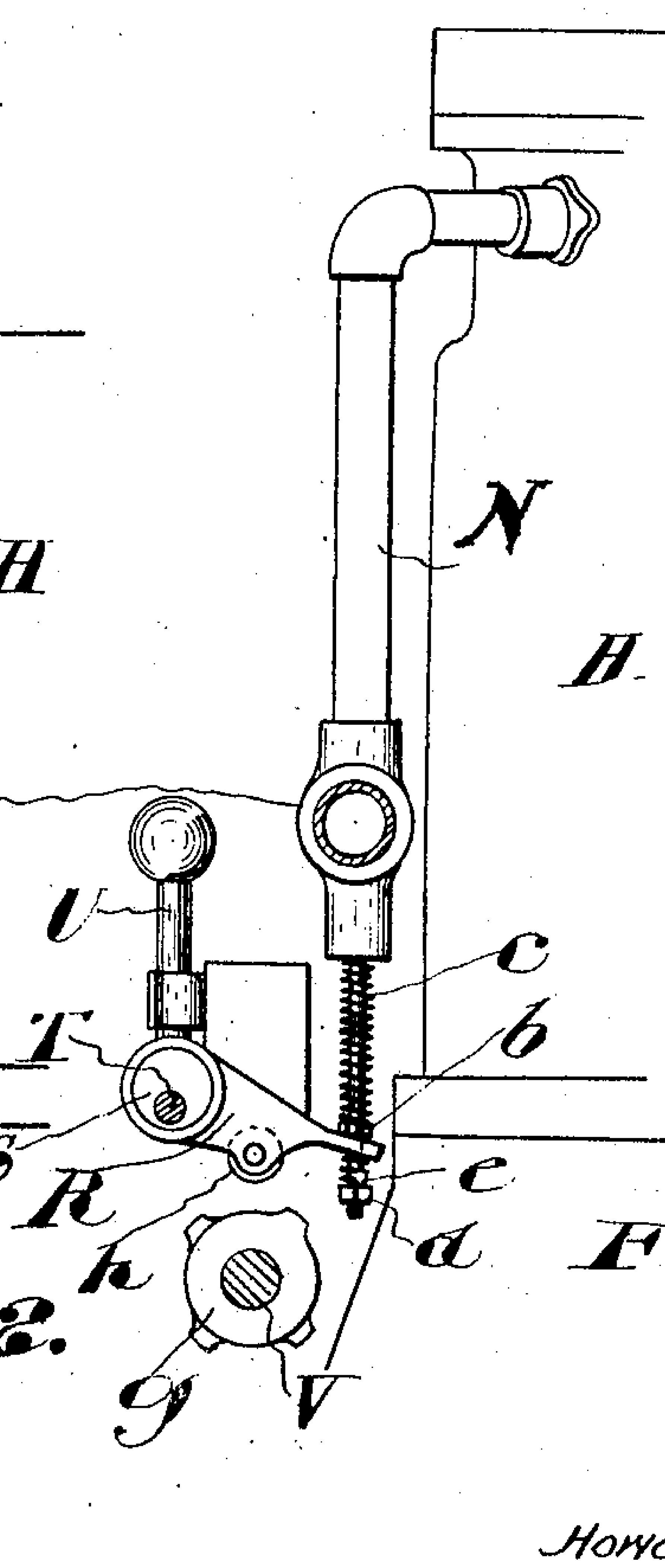

Fig.3.

WITNESSES:

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STARTING MECHANISM FOR INTERNAL-COMBUSTION ENGINES.

No. 876,460. Specification of Letters Patent. Patented Jan. 14, 1908.

Application filed February 11, 1907. Serial No. 356,739.

To all whom it may concern:

Be it known that I, Howard A. Johnston, of the city of Toronto, in the Province of Ontario, Canada, have invented certain new and useful Improvements in Starting Mechanism for Internal-Combustion Motors, of which the following is a specification.

My object is to provide simple, effective and safe means for starting an internal combustion motor by means of compressed air, and my invention relates particularly to the means whereby the compressed air is regularly and automatically admitted to the engine for starting, and to means whereby air may be stored at a high pressure and used at a lower pressure to start the engine, substantially as hereinafter more specifically described, and then definitely claimed.

Figure 1 is a view showing part of an internal combustion motor and the starting mechanism therefor. Figs. 2 and 3 are side elevations, partly in section, showing the arrangement of starting cams and valves in different positions.

In the drawings like letters of reference indicate corresponding parts in the different figures.

Referring particularly to Fig. 1, A is the main storage tank. With this tank communicates a pipe B through which it may be supplied with air, usually from a pump driven by the engine itself.

C is the outlet pipe through which air may be taken to supply air pressure for fuel spraying devices. With this pipe is connected a pipe D leading to the second tank E. In this pipe is located the stop cock F. From the second tank E leads the pipe G provided with branches N to communicate with the individual cylinders H of the multi-cylinder engine. In this pipe is located a safety valve I of any suitable type, or other pressure limiting valve. Between the safety valve and the tank is a stop cock J, and between the safety valve and the cylinder connections is a stop cock K. Each tank is provided with a pressure gage L.

I have found that for spraying purposes it is necessary to maintain a comparatively high pressure in the main storage tank, say 550 pounds to the square inch. Now this pressure is too high for starting purposes, owing to the fact that if an explosion occurs in the engine while the latter is subject to the high pressure of the storage air tank an extremely high pressure is generated, which is very dangerous to the engine. I have also found that it is absolutely necessary to maintain a high pressure in my storage tanks owing to the fact that while the engine is at rest leakage is liable to occur, and if the pressure were only maintained in the storage tank at a point sufficiently high for starting, after a long period of rest an insufficient pressure would be left to properly start the engine. I overcome the difficulty by the construction I have just described.

When the engine is running both storage tanks are allowed to fill to the desired high pressure, the stop cock F being open and the stop cocks J and K closed. When the engine is stopped the stop cock F is preferably closed, making the storage tanks independent of one another. When it is desired to start the engine the stop cock J is opened. If there is an excess of pressure in the second storage tank it will vent itself through the safety valve, which will be set to blow off at the desired maximum pressure. When this pressure is reached the safety valve ceases to blow off, and the stop cock K may be opened ready for starting the engine It will be noted that although the pressure in the second storage tank has been reduced to that suitable for starting, the first tank retains the higher pressure which is necessary for use in spraying liquid fuel.

In the pipe G, at its junction with each of its branches N, is located a valve M. The pipe G communicates with the casing of each valve through the opening O (see Figs. 2 and 3). Above this opening is a valve seat communicating with the branch N above the valve. This valve seat is closed from above by the valve disk P, provided with a stem *a* secured to the small piston Q fitting closely in the lower part of the casing below the opening O. This piston is of approximately the area of the valve seat of the disk P, and hence the valve is balanced by the pressure within the casing. Each valve stem extends out through the casing and passes through the end of a rock arm R. Above the rock arm a nut *b* is screwed on the valve stem, and between this nut and the valve casing is located the coil spring *c*, tending normally to maintain the valve disk P on its seat. Below the rock arm a second nut *d* is screwed on the spindle, and between this and the rock arm is located a short coil spring *e*. The other end of the rock arm is journaled on an eccentric S, which is connected to the rock shaft T, suitably journaled on the frame of the engine. This rock shaft is provided with an arm U, by means of which it may be rocked. Spring fingers *f* are connected to the engine, with which the arm U may be frictionally engaged as shown in Figs. 1 and 3, to maintain the eccentrics in their raised position, thus causing the rock arms R to take the position shown in Fig. 3. These rock arms, it will be seen, are located above the cam shaft V, which is the main cam shaft of the engine, and will of course be operated in the ordinary manner by the engine itself. Below each rock arm is located one of the starting cams *g*. When the arm U is thrown down, as shown in Fig. 2, the rock arms R are brought into engagement with the starting cams *g*. For the purpose of reducing friction each rock arm is preferably provided with a friction roller *h*. The starting cams *g* are of course suitably timed to admit air into each cylinder at the proper time.

It will be noted that the valve disks P are raised by positive engagement of the rock arms R with the nuts *b*, and that the valves are returned to their seats by the pressure of the coil springs *c* after the operative parts of the cam have passed the friction rollers *h*. The ends of the rock arms R being held in engagement with the nuts *b* by means of the coil spring *e* a yielding connection is provided which enables the rock arms to tilt relative to the valve stems, as shown in Fig. 3.

The device I have above described will be found to be very simple, safe and effective in operation.

What I claim as my invention is:—

1. In an internal combustion motor the combination of a storage air tank; a second tank; a pipe connecting the two; a stop cock in said pipe; a pipe connecting the second tank with the cylinder of the engine; a pressure limiting valve in said pipe; and a stop cock between the pressure limiting valve and the second tank, substantially as described.

2. In an internal combustion motor the combination of a storage air tank; a second tank; a pipe connecting the two; a pipe connecting the second tank with the cylinder of the engine; a pressure limiting valve in said pipe; and a stop cock between the pressure limiting valve and engine, substantially as described.

3. In an internal combustion motor the combination of a storage air tank; a second tank; a pipe connecting the two; a stop cock in said pipe; a pipe connecting the second tank with the cylinder of the engine; a pressure limiting valve in said pipe; a stop cock between the pressure limiting valve and the second tank; and a stop cock between the pressure limiting valve and engine, substantially as described.

4. In an internal combustion motor the combination of a storage air tank; a second tank; a pipe connecting the two; a pipe connecting the second tank with the cylinder of the engine; a pressure limiting valve in said pipe; a stop cock between the pressure limiting valve and the second tank; and a supply and an outlet pipe for the first tank, substantially as described.

5. In an internal combustion motor the combination of a storage air tank; a second tank; a pipe connecting the two; a stop cock in said pipe; a pipe connecting the second tank with the cylinder of the engine; a pressure limiting valve in said pipe; a stop cock between the safety valve and the second tank; and a supply and an outlet pipe for the first tank, substantially as described.

6. In an internal combustion motor the combination of a storage air tank; a pipe connecting said tank with the engine cylinder; pressure limiting means between the tank and the cylinder; and a stop cock between the pressure limiting means and the tank; substantially as described.

7. In an internal combustion motor the combination of a cylinder; a pipe for conveying compressed air to said cylinder; a pressure limiting valve in said pipe; a second valve in said pipe; a stem projecting from said second valve; a cam shaft; a cam on said shaft; and means for forming or breaking an operative connection between the valve stem and cam, substantially as described.

Toronto, Ont., 7th January, 1907.

HOWARD A. JOHNSTON.

Signed in the presence of—

J. EDW. MAYBEE,

F. MCKENDRICK.