No. 785,108. PATENTED MAR. 21, 1905.

J. KERNS.

VALVE MECHANISM FOR EXPLOSIVE ENGINES.

APPLICATION FILED FEB. 29, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

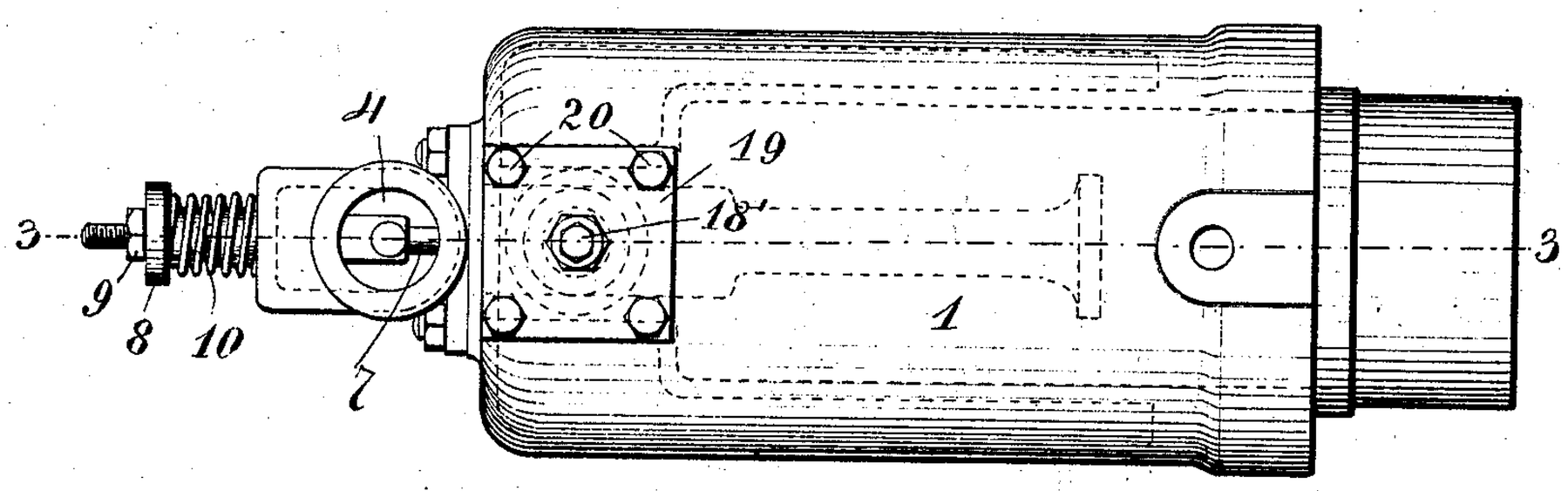
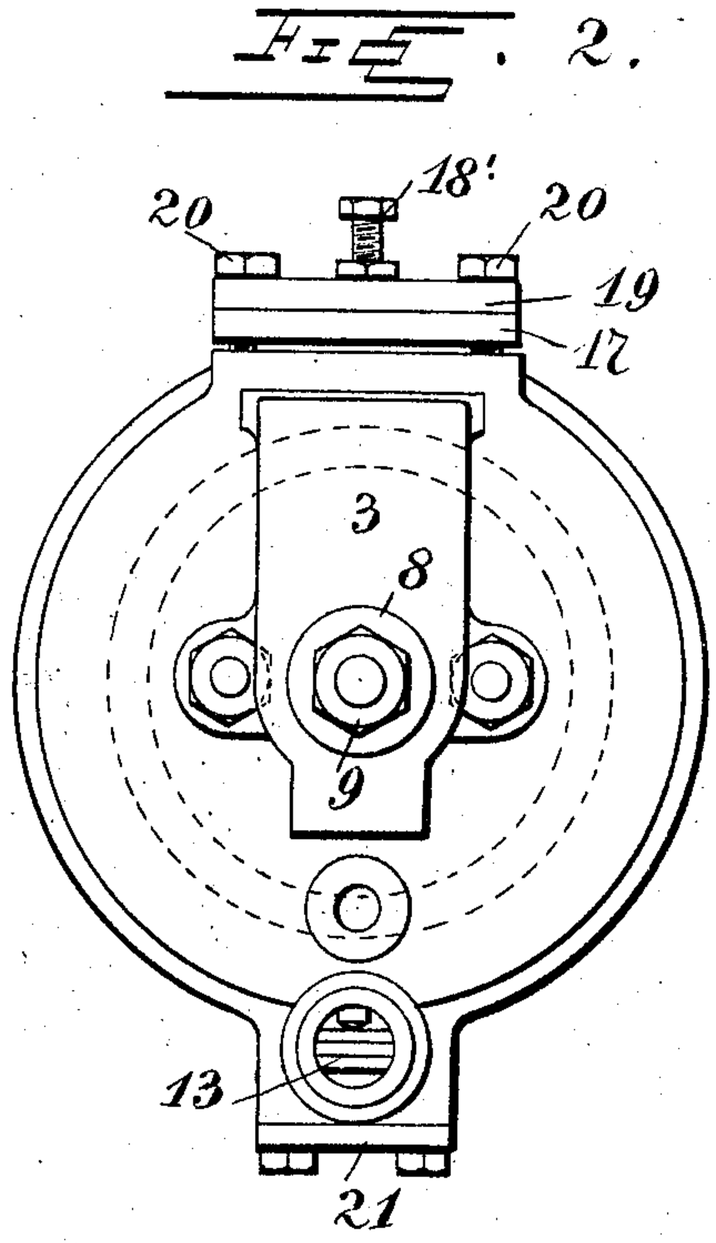


Fig. 2.



Witnesses

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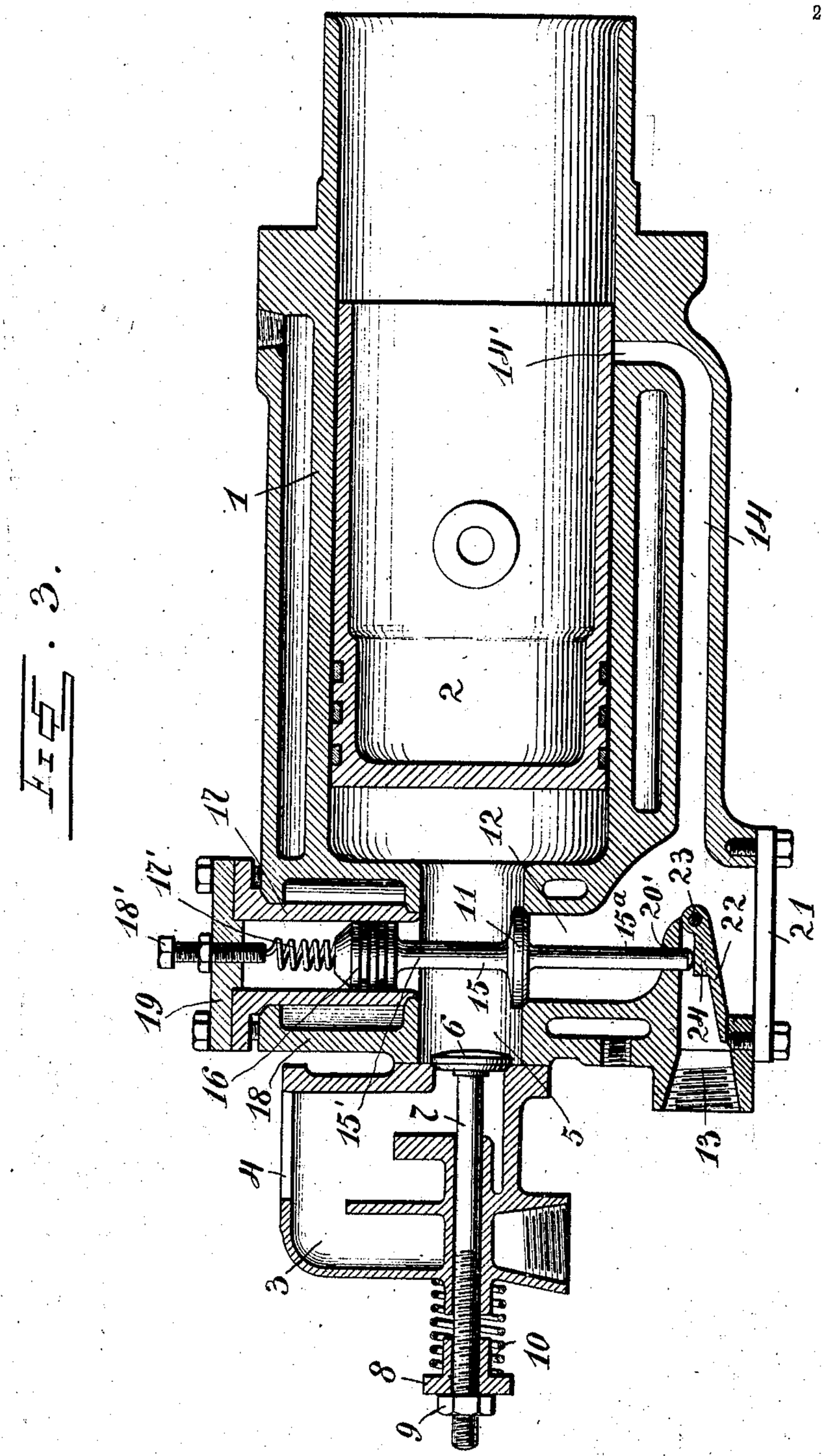
Fig. 3.



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UNITED STATES PATENT OFFICE.

JAMES KERNS, OF DEFIANCE, OHIO, ASSIGNOR TO MODEL GAS ENGINE COMPANY, OF AUBURN, INDIANA, A CORPORATION.

VALVE MECHANISM FOR EXPLOSIVE-ENGINES.

SPECIFICATION forming part of Letters Patent No. 785,108, dated March 21, 1905.

Application filed February 29, 1904. Serial No. 195,876.

To all whom it may concern:

Be it known that I, JAMES KERNS, a citizen of the United States, residing at Defiance, in the county of Defiance and State of Ohio, have invented certain new and useful Improvements in Valve Mechanism for Explosive-Engines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to valve mechanism for explosive-engines of the four-cycle compression type, and particularly to exhaust-valve mechanism for controlling the exhaust of the spent gases.

The object of the invention is to provide an exhaust-valve which will be automatically operated to open the exhaust-port by the pressure of the exhaust-gases and which will be accurately balanced through the action of the piston of the engine to make the operation thereof at all times sensitive and reliable during the running of the engine.

In the accompanying drawings, showing one embodiment of my invention, Figure 1 is a top plan view of the cylinder and associated parts of a gas-engine equipped with the invention. Fig. 2 is an elevation looking toward the working end thereof, and Fig. 3 is a vertical longitudinal section on the line 3 3 of Fig. 1.

Referring now more particularly to the drawings, 1 represents the cylinder of the engine, in which reciprocates the piston 2, and 3 is the suction-valve casing, which is designed to communicate with a suitable source of gas-supply (not shown) through a port 4 and which communicates with the working end of the cylinder through a combined admission and exhaust port or passage 5. The suction-valve 6 opens inwardly into the said passage 5 to admit a charge of an explosive mixture into the cylinder when the piston is on its suction-stroke and is provided with a stem 7, suitably guided in the casing 3 and threaded at its outer end to receive an adjusting nut or sleeve 8 and a check-nut 9, the said nut or sleeve 8 serving to regulate the tension of the spring 10, which normally forces the stem outwardly to hold the valve in its closed position. The exhaust-valve 11 also opens into the passage 5 and governs an exhaust-passage 12, which has an outlet at 13 to the atmosphere or a suitable escape-pipe and which is in communication with the exhaust end of the cylinder through a channel or passage 14, whose function will be hereinafter described. The valve 11 is carried by a stem 15, one (the upper) end 15′ of which crosses the passage 5 and is provided with a piston 16, operating in a cage or cylinder 17, mounted in a chamber 18, formed upon the cylinder, the inner end of said cage or cylinder being in open communication with said passage 5. Preferably the piston 16 is made hollow or chambered to lighten it and to form a socket to receive the inner end of a coiled valve-closing spring 17′, the outer end of which is acted upon by a set-screw 18′, whereby the tension of the spring may be regulated to oppose more or less resistance to the opening of the valve. The said set-screw is mounted upon a plate or head 19, secured by screws 20 to and closing the outer end of the cage 17. These screws are also employed to secure the cage to the wall of the chamber 18, so that the plate 19 may be removed to secure access to said piston 16 and spring 17′ and so that the cage itself may also be removed when occasion requires. The piston 16 is made of somewhat smaller area than the exhaust-valve, so as to allow just enough more pressure on the valve to hold it on its seat. Owing to this preponderance of size of the valve, the valve could not be removed through the piston cage or cylinder 17 if the latter were a fixed part of the engine; but by removably mounting said cage or cylinder 17 the exhaust-valve and associated parts may upon the detachment of the cylinder be withdrawn through the chamber 18. The cage or cylinder may be entirely water-jacketed, as shown, to keep it cool.

The opposite or lower end 15^a of the stem 15 extends down through the passage 12 and into the outlet 13 and works in a suitable guide or partition 20′, below which is an open-

ing to admit access to said passage and outlet, said opening being closed by a removable plate 21. A flap-valve or damper 22 is disposed in the outlet 13 above said plate and is adapted to be inserted and removed through the said opening covered thereby. This valve or damper is pivoted at its inner end, as shown at 23, below the lower end of the guide or partition 20′ and rests at its free end upon the bottom wall of the outlet 13 beyond the outer end of the opening, whereby said valve normally has an inclined position and closes the outlet 13. Adjacent to its pivot 23 the valve is provided with a boss 24, which engages the extremity of the lower portion 15ª of the stem 15, so that said stem will raise and lower with the valve.

The operation is as follows: Assuming that the parts are in the position shown in Fig. 3, in which the piston 2 is represented as beginning its working stroke, it will be understood that when the piston reaches the end of said stroke it will uncover the port 14′, leading to the exhaust-passage 14, so that a portion of the exhaust-gases will flow from the cylinder to the discharge-passage 12 and outlet 13, and thus equalize the pressure on both sides of the valve 11, thus placing the same in condition to be opened by a comparatively small amount of pressure on the side contiguous the stem portion 15ª. That portion of the exhaust-gases entering the passage 12 and outlet 13 from the passage 14 will expend its forces in two directions—namely, on the under side of the valve 11 and under side of the damper or valve 22, such forces producing a pressure on said valve greater than that of the pressure of the spring 17′, whereby the valve 22 will be elevated with the valve 11 and will supplement the lifting action of the gases directly acting thereon to raise said valve 11, so that the gases in the cylinder 1 may exhaust through the passage 5, passage 12, and outlet 13, the valve 22 being held in upraised or open position during the entire backward stroke of the piston, thus allowing all the spent or exhaust gases to discharge. As soon as all the gases have been forced out of the cylinder 1 the pressure on the upper side of the piston 11 again predominates, and the spring 17 exerts its expansive forces on the piston 16 to move the valve-stem 15 downward, and thus close the valves 11 and 22 against their seats, thereby reëstablishing closure of the exhaust and allowing the piston 2 on its next working stroke to open the valve 6 to draw in a fresh charge of the explosive mixture for the ensuing explosion to again drive it out on its next working stroke.

It will thus be seen that in the operation of the engine the pressure of the exhaust-gases will be utilized to open the exhaust-valve and maintain it in open position until all of said gases have escaped and that by the construction and arrangement of the parts set forth the exhaust-valve is sensitively balanced, so that it will operate with a minimum expenditure of force and will not partially close or chatter on its seat during the exhaust of the spent gases.

From the foregoing description, taken in connection with the accompanying drawings, the construction and operation of the invention will be readily understood without requiring a more extended explanation.

Changes in the form, proportion, and minor details of the construction may be made without departing from the spirit or sacrificing any of the advantages of the invention. For instance, any other suitable form of adjusting device may be employed in lieu of the set-screw 18′ to regulate the tension of the spring 17. Said spring may be arranged below instead of above the exhaust-valve, and any other suitable equivalent means may be employed to open the valve under the pressure of the exhaust in a substantially similar manner.

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

1. In a gas-engine, the combination of a cylinder provided with an opening in its working end, an admission-port, a passage communicating between said admission-port and the opening in the working end of the piston, a valve governing said inlet portion, a discharge-port communicating with said passage between the inlet-port and the opening in the working end of the piston, an exhaust-passage leading from the opposite end of the cylinder and having an outlet end communicating with said discharge-port, a valve governing said discharge-port, an auxiliary cylinder, a piston operating in said auxiliary cylinder and in communication with the passage, said piston and valve controlling the outlet-port being so proportioned that a preponderating pressure normally exists on the adjoining side of the valve to hold it closed, a valve governing the outlet of the exhaust-passage and adapted to actuate said piston and discharge-valve, and a piston operating in the cylinder and adapted to control the exhaust-passage and admit preponderating pressure to the under side of the valve.

2. In a gas-engine, a cylinder provided with an opening in its working end, an admission-valve casing, a passage connecting said admission-valve casing with the opening in the working end of the cylinder, a piston operating in said cylinder, a second cylinder communicating with said passage, a piston operating in said second cylinder, an exhaust-conduit also communicating with said passage, a supply connection between the opposite end of the first-named or main cylinder and the exhaust-passage, said sup-

ply connection being controlled by the main piston, an exhaust-valve governing communication between the aforesaid opening and exhaust-passage and exposed to pressure in the said passage connecting the admission-port with the opening in the working side of the cylinder, a valve-stem connecting said valve with the secondary piston to move in unison therewith, means acting on said piston to oppose the opening of the valve, and means operated by the exhaust-gases from the supply connection to operate said stem against said resistance.

3. In an engine, a main cylinder provided in its working end with an opening, a secondary cylinder in communication with said opening, an exhaust-passage also communicating with the opening, an exhaust-valve governing the exhaust of the spent gases from the cylinder to the exhaust-passage, a piston connected to said valve and moving in said secondary cylinder, said piston and valve being so proportioned that a preponderating pressure normally exists on the adjoining side of the valve to hold it closed, a stem connecting the valve and secondary piston to move in unison, and a flap-valve having a boss upon its upper surface, said valve normally closing the exhaust-passage and adapted to be actuated by the pressure of the discharging spent gases to open said passage and to impart movement to said stem, the latter normally resting upon the boss of the flap-valve, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JAMES KERNS.

Witnesses:
J. A. MOORE,
GEO. T. FARRELL.