F. O. PETERSON.

ENGINE.

APPLICATION FILED SEPT. 6, 1911.

1,105,298.

Patented July 28, 1914.

3 SHEETS—SHEET 1.

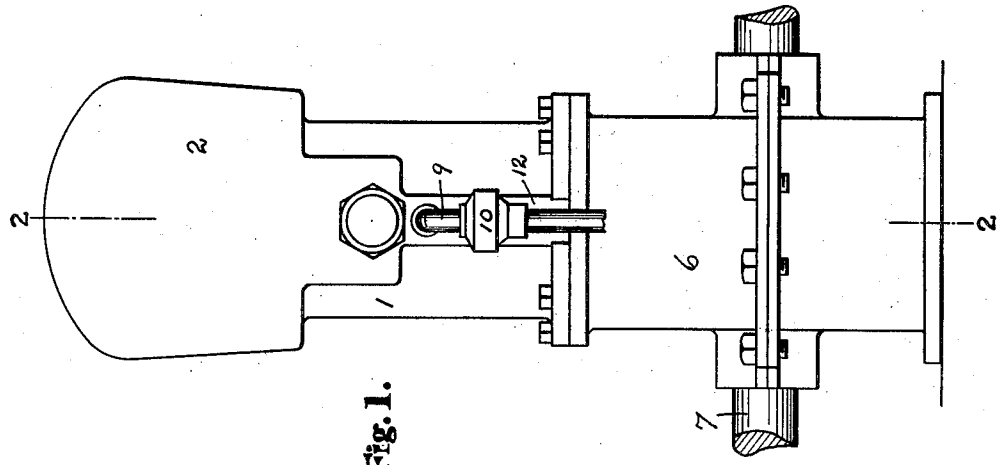


Fig. 1.

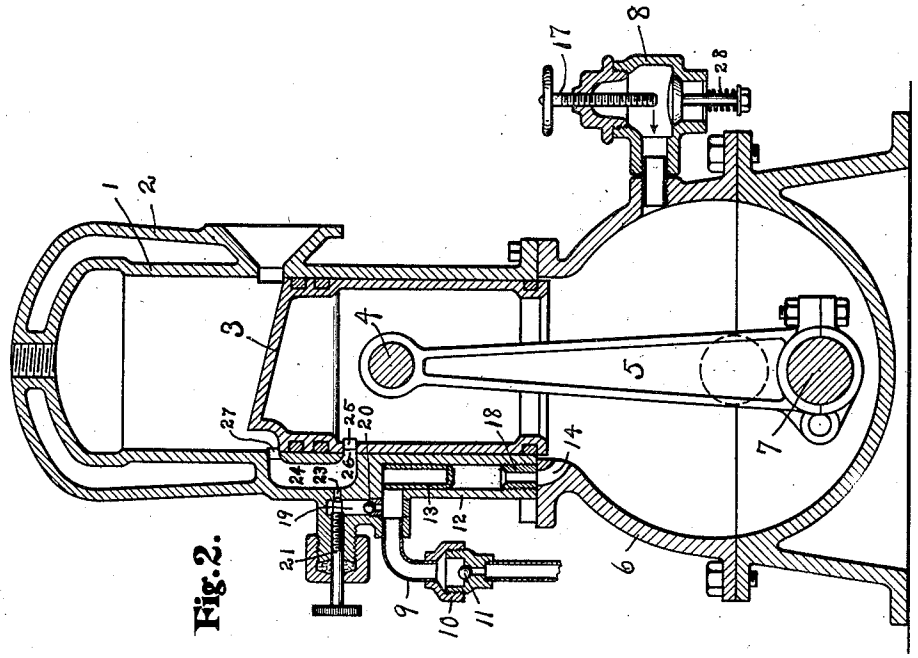


Fig. 2.

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3 SHEETS—SHEET 2.

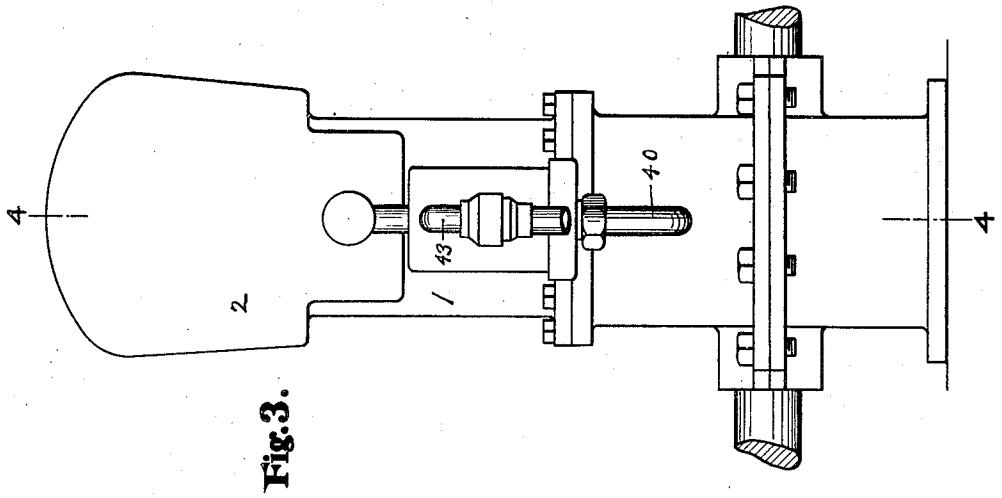


Fig. 3.

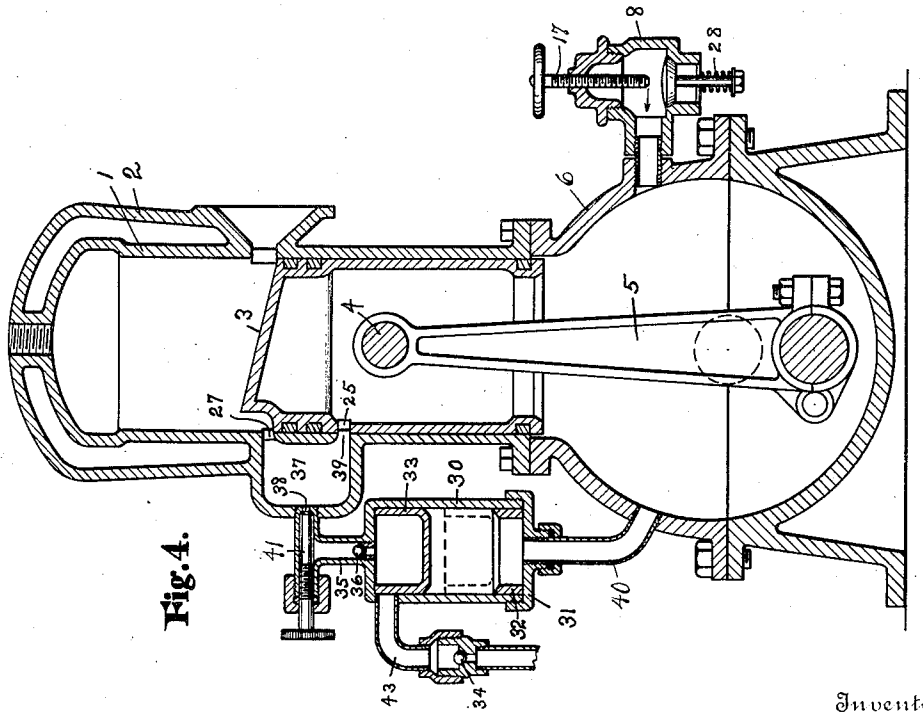


Fig. 4.

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3 SHEETS—SHEET 3.

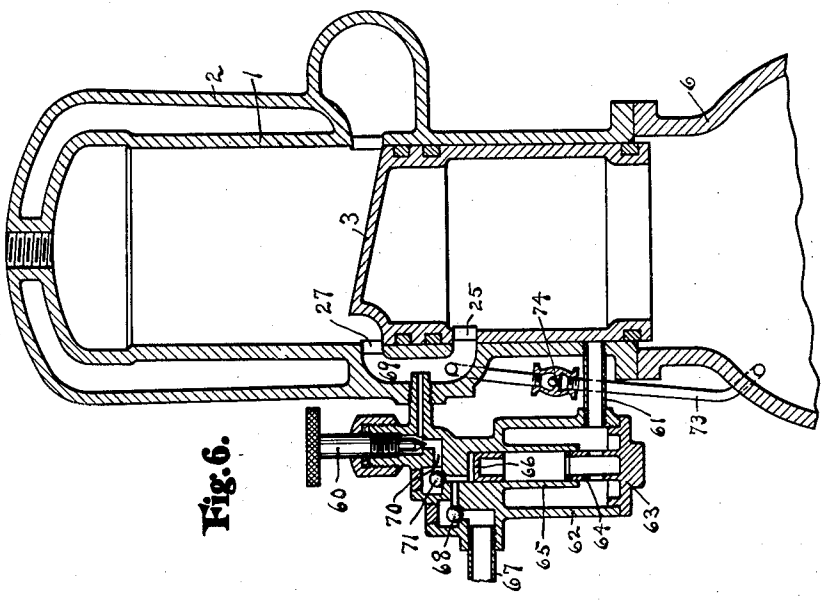
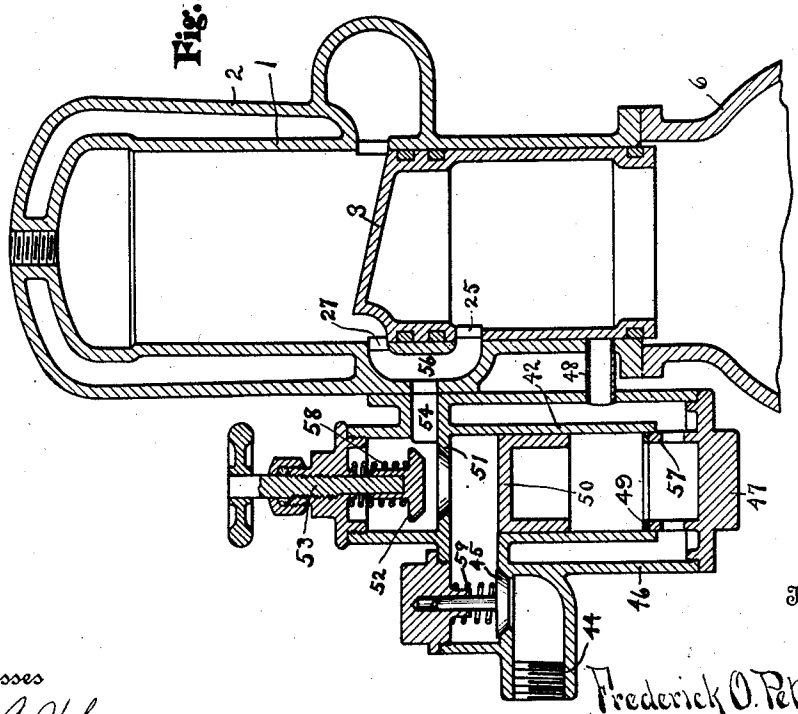


Fig.6.

Fig.5.



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UNITED STATES PATENT OFFICE.

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ENGINE.

1,105,298. Specification of Letters Patent. Patented July 28, 1914.

Application filed September 6, 1911. Serial No. 647,911.

To all whom it may concern:

Be it known that I, FREDERICK O. PETERSON, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented a new and useful Engine, of which the following is a specification.

This invention relates to internal combustion engines designed to be driven by the force of explosions of hydro-carbons mixed with air, and its object is to provide mechanism for supplying these hydro-carbons, either in the form of liquids or of gases in direct ratio to the different amounts of air entering the cylinders of two-cycle engines. Its object further is to provide such a mechanism which will be simple in construction and operation, and durable and which will obviate crank-case explosions.

In the accompanying drawings, Figure 1 is a side elevation of an engine equipped with this improved device. Fig. 2 is a section on the line 2—2 of Fig. 1. Fig. 3 is a side elevation of an engine equipped with a slightly modified form of this device which is adapted for gaseous fuel. Fig. 4 is a section on the line 4—4 of Fig. 3. Figs. 5 and 6 are vertical sections of other modifications of the invention.

Similar reference characters refer to like parts throughout the several views.

The constructions shown in Figs. 1, 2, and 6 are designed for liquid hydro-carbons, such as alcohol, gasolene and kerosene, while those of Figs. 3, 4 and 5 are adapted for gases, especially natural gas. In Figs. 1 and 2, the cylinder 1 with its water jacket 2, the piston 3, wrist-pin 4, connecting rod 5, crank-case 6, crank-shaft 7 and air-inlet valve 8, to control the air entering the crank-case, are of any well known design. The liquid-fuel is conveyed to the engine by the pipe 9, from any source of supply, into which pipe, near the engine, is connected a check-valve 10, having the valve-ball 11. In pumps running at high speed, the pistons travel proportionately large distances to move merely those portions of the liquid which lift and hold up the valves. At the end of a discharge and at the beginning of a suction stroke, the valves are supported by a quantity of liquid which passes back into the pump-cylinder or into the supply pipe at the change of movement of the piston. For this reason, the pump must be of larger size than computations would indicate, that is, it must be proportioned to take care of slippage. A small pump cylinder 12 has a light piston 13, and the pipe 9 connects into the upper end of this cylinder 12. The lower end of the cylinder is in constant communication with the crank-case by means of the passage 14. The piston is caused to move up by the pressure of the air in the crank-case, and down by the suction in the crank case, or rather by the pressure of the fuel in the pipe 9. The stroke of the piston may be controlled by the collar 18. The return flow of the fuel through the discharge passage 19 of the pump is prevented by the small valve 20. A needle valve 21 controls the maximum rate of flow of the fuel. The cylinder 12 is practically a fuel receptacle in constant communication with the crank-case.

The operation of the engine is as follows. When the piston 3 travels down under force of an explosion, the air in the crank-case is compressed, causing it to force up the piston 13, and thereby causing the liquid-fuel in the cylinder 12 to be forced up the passage 19, and through the opening 23 into the small chamber 24 which is also a by-pass of well-known use. When the piston 3 has reached the bottom of its stroke, the port 25 in the piston 3 registers with the port 26 of the chamber 24, and the compressed air will rush from the crank-case, through the chamber 24 and port 27 into the cylinder 1, carrying with it the liquid fuel. During the compression stroke of the piston 3, a partial vacuum occurs in the crank-case, depending upon the tension of the spring 28 of the admission valve 8, and the pump piston 13 will be drawn down by this partial vacuum. This will cause a fresh supply of fuel to flow through the pipe 9 into the cylinder 12. The valve 21 controls the rate of flow to the chamber 24, but may be omitted, if desired; in which case the small opening or passage 23 should be determined accurately. The engine will then be substantially "fool-proof" although it may be a trifle wasteful with varied fuels. The amount of air entering the crank case may be controlled by the screw 17 of the air-inlet valve 8.

Where the fuel is gas, a larger pump and a larger intermediate chamber are necessary than with liquid fuel. The cylinder, piston, crank-case, and air-valve, of Figs. 3 and 4, may be the same as before described, or of

any other desired construction. The pump cylinder 30 is shown separate from the engine although it may be integral therewith. A head 31 on its lower end holds the ring 32 in position, which ring is properly proportioned to limit the stroke of the piston 33. The gas passes through the pipe 43 to the cylinder 30, being prevented from flowing back by the ball-valve 34. From the cylinder 30 the gas passes up the passage 35, being prevented from returning by the check-valve 36. In this case, the cylinder 30 is also a fuel receptacle in constant communication with the crank-case by means of the pipe 40. A by-pass chamber 37 communicates with the passage 35 by means of the small passage 38. It communicates with the explosion chamber of the cylinder by the port 27 and with the compression chamber by the port 39 when the port 25 in the piston registers therewith. The gas is forced into the chamber 37 during the explosion stroke and remains there until the ports 39 and 25 register, when it will be carried into the explosion chamber by the rush of the air from the crank-case. A valve 41 may be employed to limit the maximum rate of flow of the fuel. In engines where the flow of air through the valve 8 is throttled by the screws 17 to reduce the power, the decrease of the pressure in the crank case will result in the pistons 13 and 33 moving at less than full stroke, and the fuel will thus be proportioned to the air.

In Fig. 5, a modified form of fuel-gas feeder is shown, one in which the air pipe, leading from the crank-case to the fuel receptacle is closed for short intervals of time by the piston. But because of the high speed of the piston, and the small portions of the cycles, during which the air-pipe is closed, the fuel receptacle is in substantially constant communication with the crank-case. The construction is merely a modification and avoids the long pipe 40 of Fig. 4.

The cylinder 1 has a water jacket 2, a piston 3, and a crank case 6, of which only a portion is shown. The fuel gas comes to the fuel-receptacle under light pressure through a pipe 44 and its return is prevented by the valve 45. A shell 46 surrounds a cylinder 42. The shell has a head 47 having an apertured cylindrical flange 57, and a pipe 48 connects this shell to the cylinder 1. A ring 49, of any desired height, controls the lower limit of the stroke of the piston 50. A head 51 of the shell furnishes a seat for the discharge valve 52, whose movement may be limited by a screw 53. A port 54 connects to the by-pass chamber 56 which connects to the explosion chamber by the port 27 and may connect to the crank-case by the port 25. The operation of this construction is as follows. With the parts in the position shown, the charge is just flowing into the explosion chamber from the chamber 56 where the gas from the port 54 and air from the port 25 mingle. During the up-stroke of the piston 3, this charge is compressed. As soon as the piston 3 has risen sufficiently to uncover the pipe 48, the pressure in the shell 46 is immediately reduced to that of the crank-case, which is slightly below atmospheric, and the piston 50 will fall, the valve 52 will seat itself, and the fuel will flow into the fuel-receptacle or cylinder 42. At the end of the compression stroke of the piston 3, the cylinder 42 above the piston 50 will be full of gas. During the explosion stroke, the air in the crank-case will be compressed, and so will also the air in the shell 46 and the gas in the cylinder 42 above the piston 50. When the passage 48 is closed, which may occur toward the end or at any portion of the explosion stroke, some pressure is stored in the shell 46. The amount of this pressure is immaterial, so long as it is sufficient to raise the valve 52 against its spring 58. The strength of the spring 59, must be sufficient to resist the pressure of the gas in the pipe 44, until that pressure is assisted by the partial vacuum in the shell 46. As soon as the ports 25 and 27 permit a flow of air from the crank-case to the cylinder 1, the stored pressure in the shell 46 will force the piston 50 upward, as shown in Fig. 5, the gas passing through the port 54 and mixing with the air from the crank-case. In this case therefore, the fuel receptacle is again under substantially the same pressure as the crank-case, excepting at those extremely short intervals when the piston 3 closes the pipe 48, which may be disregarded as they have little if any effect upon the operation of the engine.

The construction shown in Fig. 6 is of the same general type as that of Fig. 5, but the control valve 60 shown in this view is the same as the valve 21 of Fig. 1. The pipe 61 connects the crank-case and the shell 62. The head 63 has an apertured cylindrical ring 64, and the shell surrounds the cylinder 65. A piston 66 moves up or down accordingly as the air pressure in the crank case increases or diminishes. The liquid fuel under slight pressure is conducted to the engine by the pipe 67, and prevented from returning by the valve 68. It passes to the chamber by-pass 69 by the passage 70 and is prevented from returning by the valve 71. Connecting the chamber 69 and the crank-case is a pipe 73, in which is a check-valve 74 which prevents air from passing from the chamber 69 to the crank-case.

Fig. 6 shows the parts just as the piston 3 is about to begin its compression stroke. The piston 66 forces the liquid-fuel through the passage 70 into the chamber 69, where it is taken up by the air rushing from the crank-case through the port 25, and the air and fuel passed into the cylinder through

the port 27. Shortly afterward, the ports to the chamber 69 are closed and the pipe 61 opened. This will so reduce the pressure in the shell 62 that the piston 66 will descend, drawing a charge of fuel into the cylinder 65. The valve 74 prevents the pressure of air in the chamber 69 from falling. On the down-stroke of the cylinder, pressure is generated in the crank-case, shell 62 and chamber 69. This causes the piston 66 to remain at rest until the port 27 is opened as shown in Fig. 6. At this instant, the pressure in the crank-case and chamber 69 will fall below that in the shell 62 and the latter pressure will drive up the piston 66 and a charge of fuel will flow into the chamber 69 through the passage 70. Without this pipe 73, the action would be the same as in Fig. 1, where the charge of fuel is slowly forced into the chamber 24, while in the modification of Fig. 6, the charge is forced into the chamber 69 only at the time the port 27 is open.

The by-pass, or as generally known, the transport passage (24, 37, 56 or 69), is so constructed that in no case does the pressure therein fall below that of the atmosphere. The port 25 registers with the opening into this passage when the pressure in the crank-case is at or above that of the atmosphere. There is thus no suction from this passage to cause the flow of the fuel from the supply-pipe directly into this passage unless induced by the operation of the pressure in the crank-case acting on the pump-cylinder. No fuel will flow past the suction and discharge valves into or out of the fuel receptacle unless such flow is induced by the suction or pressure respectively, in the crank-case. The passage 40 connects the compression cylinder directly to the crank case, and the gas above the piston 33 and in the chamber 37 will be compressed during the down stroke of the piston 3, and rush through the passage 27 at the instant this passage is opened. This is desirable for high speed engines. When the construction used in Fig. 5 is employed, pressure will be stored below the piston 50 and around the chamber 42. When the port 27 is opened, this pressure will force up the piston 50 because the pressure in the chamber 56 and in the crank-case immediately falls to about that of the atmosphere. For slow running engines, this is often of advantage.

Many other changes in the details of construction may be made by those skilled in the art without departing from the spirit of the invention set forth in the claims.

Having now described several constructions, what I claim as my invention and desire to secure by Letters Patent is:—

1. In an internal combustion engine, the combination of a compression chamber, a cylinder having a transfer passage in its wall connecting to said compression chamber, a piston movable within said cylinder to open and close said passage, a fuel-pump adjacent the engine, an air-pipe connecting the lower end of the pump and the compression chamber, a piston slidable up and down in said pump, a discharge pipe connecting the upper end of the pump to the transfer passage, and a fuel-supply pipe for said pump, the pressure of air in the compression chamber forcing said piston upward and the fuel into said transfer passage.

2. In combination with a two-cycle internal combustion engine embodying a crank-case, a cylinder having an inlet port and a passage in its wall connecting to said port and said crank-case, and a piston movable within the cylinder to open and close said port; a hollow body adjacent the engine, an air-pipe connecting the body and the cylinder whose opening into the cylinder is opened and closed by the piston, a fuel-pump within the hollow body actuated by the pressure of the air within the crank-case when the pipe is opened by the piston, a pipe to supply fuel to said pump, and a discharge pipe leading from the pump to the passage in the cylinder wall.

3. In an internal combustion engine, the combination of a cylinder having a passage in its wall and ports at the ends of the same, a piston having a passage through its wall which registers with one port when the other port is opened into the explosion chamber, a fuel pipe connecting into the passage, a fuel supply pipe, a pump to draw the fuel from the supply pipe and to force it into the cylinder, a pressure storage chamber around the pump and connecting to the bore thereof and a pipe connecting to the pump and pressure storage chamber and the engine cylinder whereby the air in the cylinder at the end opposite the explosion chamber will actuate the pump.

4. In an internal combustion engine, the combination of a compression chamber, a cylinder having a passage in its wall and ports connecting the cylinder and passage, a piston slidable within the cylinder and having a passage through its wall which registers with one port when the other port is opened into the explosion-chamber portion of the cylinder, a pump-cylinder adjacent and connected to the engine cylinder, a pump-piston within the pump-cylinder, suction and discharge pipes connecting to one end of said pump-cylinder, said suction pipe connecting to a source of fuel supply and said discharge pipe connecting to the engine cylinder, and a pipe connecting the opposite end of the pump-cylinder and the engine so that the pressure in the compression chamber of the engine may actuate the piston of the pump to force fuel into said passage.

5. In an internal combustion engine, the combination of a compression chamber, a cylinder having a transfer passage in its wall connecting to said compression chamber, a piston movable within said cylinder to open and close said passage, a fuel pump adjacent the engine, a piston slidable in said pump, an air-pipe connecting one end of the pump and the compression chamber, a discharge pipe connecting the other end of the pump to the transfer passage, and a fuel supply pipe for said pump, the pressure of the air in the compression chamber operating said piston to force the fuel into said transfer passage.

In testimony whereof I have signed this application in the presence of two subscribing witnesses.

FREDERICK O. PETERSON.

Witnesses:

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EDWARD N. PAGELSEN.