No. 762,934. PATENTED JUNE 21, 1904.

R. A. NORLING.

ENGINE VALVE.

APPLICATION FILED DEC. 7, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

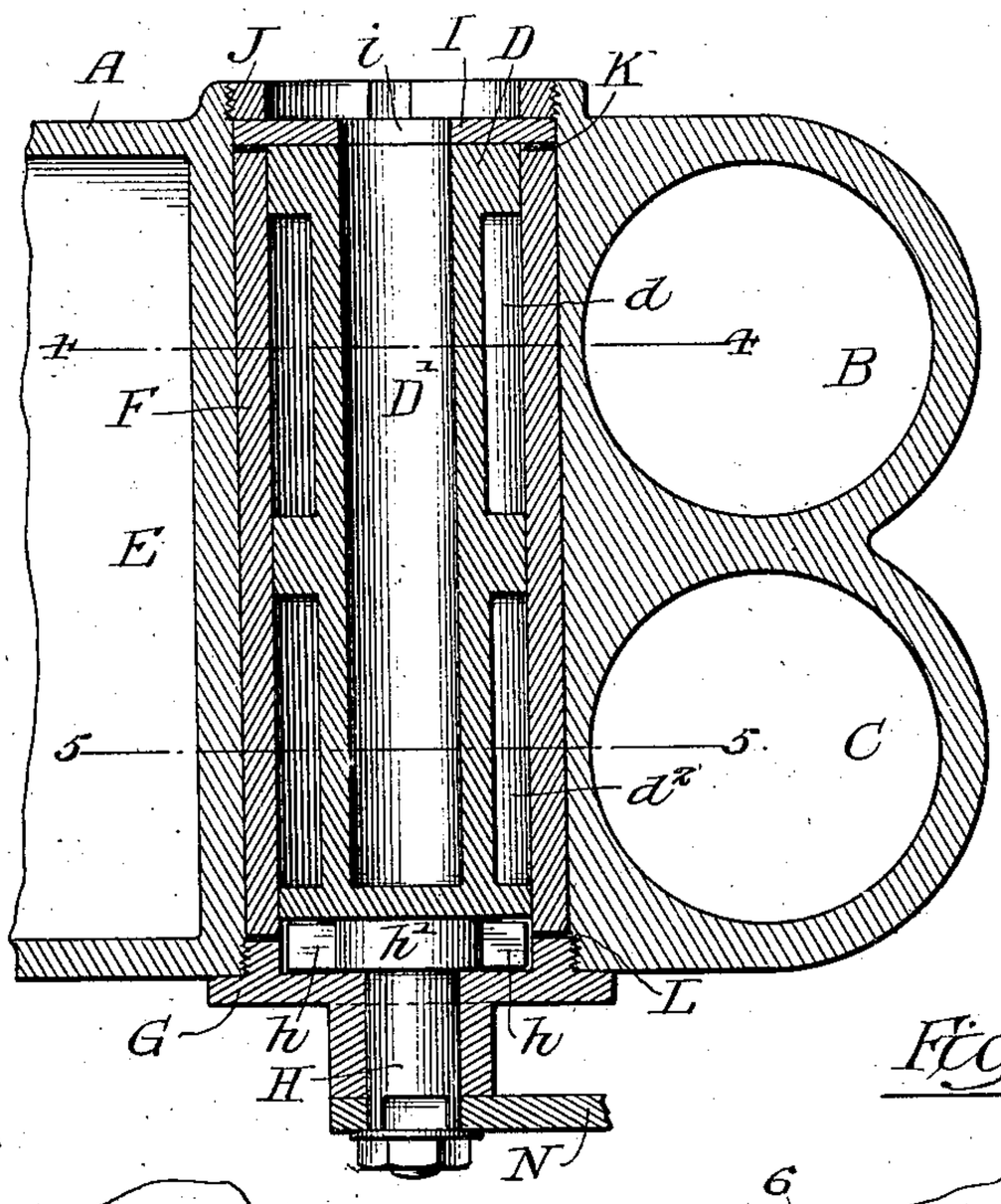
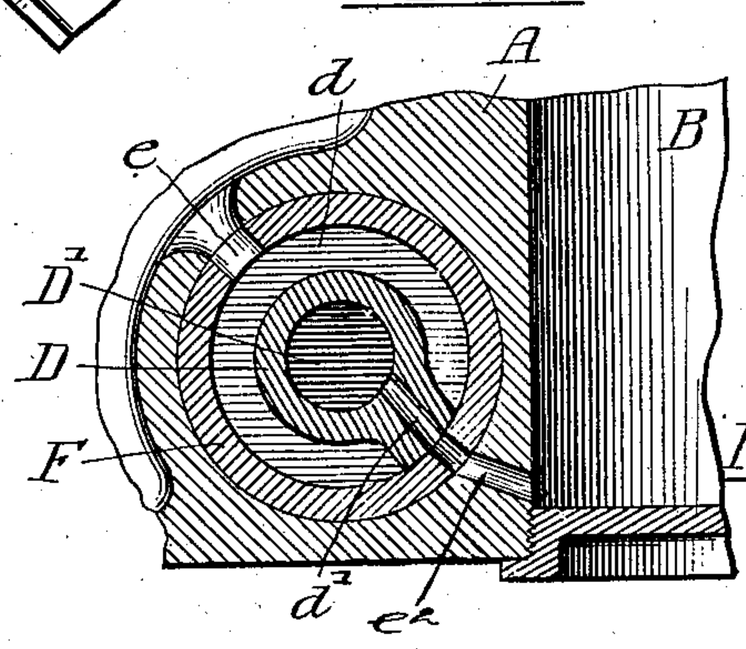


Fig. 3.

Fig. 2.

Fig. 4.



Witnesses:-
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H. G. Barrett.

Inventor:-
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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 6.

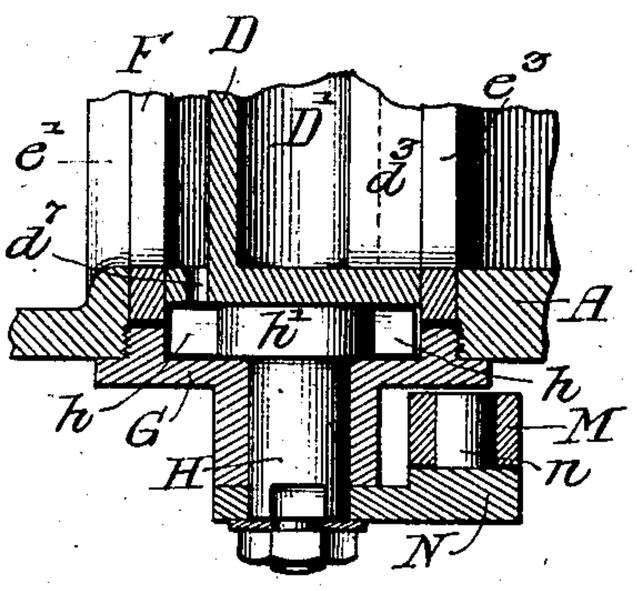


Fig. 5.

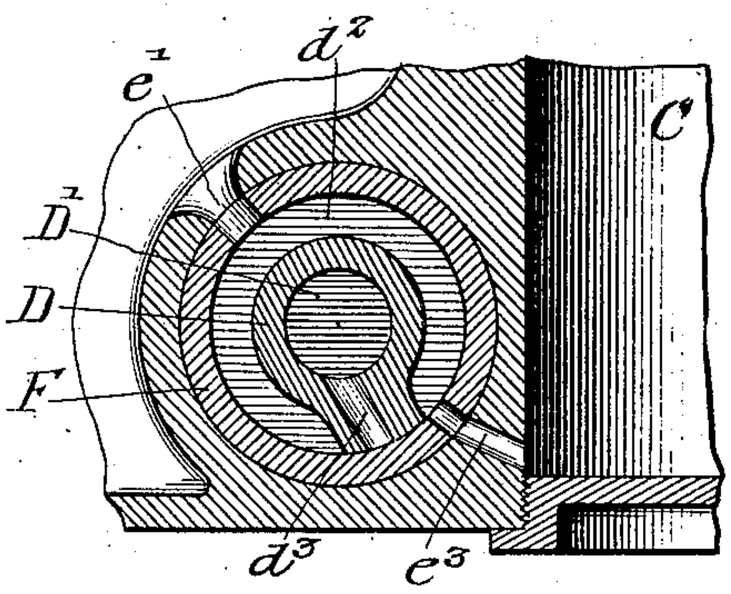


Fig. 9.

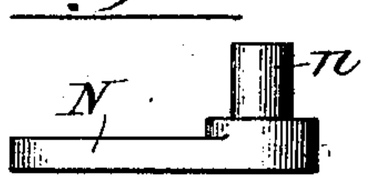


Fig. 8.

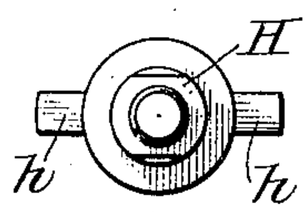


Fig. 11.

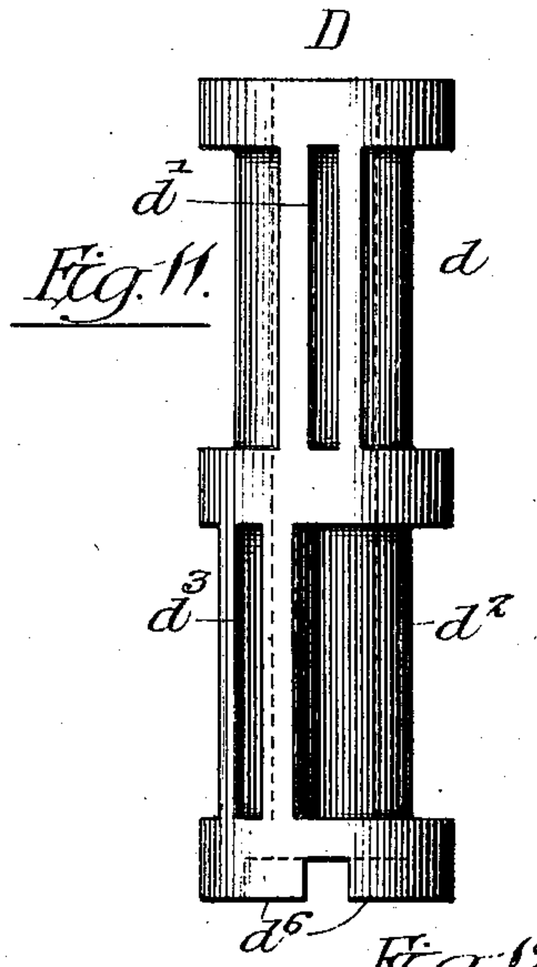


Fig. 7.

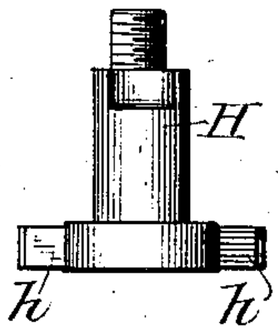


Fig. 10.

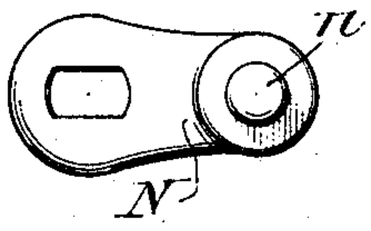
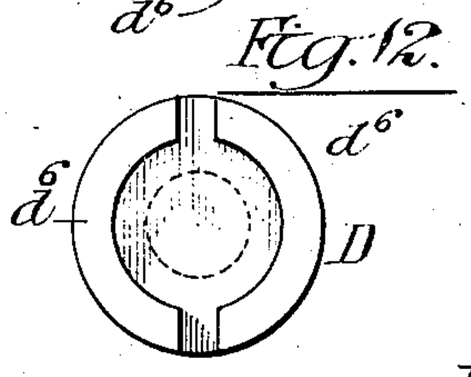


Fig. 12.



Witnesses:-
Louis M. T. Whitehead
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No. 762,934. Patented June 21, 1904.

UNITED STATES PATENT OFFICE.

REINHOLD A. NORLING, OF AURORA, ILLINOIS, ASSIGNOR TO AURORA AUTOMATIC MACHINERY COMPANY, OF AURORA, ILLINOIS, A CORPORATION OF ILLINOIS.

ENGINE-VALVE.

SPECIFICATION forming part of Letters Patent No. 762,934, dated June 21, 1904.

Application filed December 7, 1903. Serial No. 184,080. (No model.)

To all whom it may concern:

Be it known that I, REINHOLD A. NORLING, a citizen of the United States, and a resident of Aurora, in the county of Kane and State of Illinois, have invented certain new and useful Improvements in Engine-Valves, and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in valves for controlling the admission and exhaust of pressure fluid to the power-cylinders of engines or motors of the kind known as "oscillatory" plug-valves.

The valve embodying my invention is more especially designed for use upon pneumatic drills or mechanisms of that kind embracing a fluid-pressure engine of portable form applied to operate a drill or like tool; but the features of construction herein described and claimed may be applied to engines or motors of other kinds.

My invention includes improvements in valves of the kind referred to in several particulars, as will hereinafter appear.

In the accompanying drawings, illustrating my invention, Figure 1 is a sectional view of a valve embodying my invention, taken through the central axis of the valve-plug and chamber. Fig. 2 is a top or plan view of the valve-casing. Fig. 3 is a bottom view of the same. Fig. 4 is a detail section taken on line 4 4 of Fig. 1. Fig. 5 is a detail section taken on line 5 5 of Fig. 1. Fig. 6 is a detail section of the cap of the valve-seat, taken on line 6 6 of Fig. 3. Fig. 7 is a side view of the operating-stud through which one of the valves is actuated. Fig. 8 is an end view of the same. Fig. 9 is a side view of one of the valve-actuating arms. Fig. 10 is a face view of the same. Fig. 11 is a side view of the valve-plug. Fig. 12 is an end view thereof.

In the said drawings, A indicates a part of the casing of a pneumatic motor or other engine, and B C two power-cylinders formed in said casing. The valve shown in the drawings as embodying my invention is adapted for controlling the admission of the pressure fluid to and its escape from the said power-cylinders B and C. Said valve embraces an oscillating plug or cylinder D, which is adapted to turn in a cylindric seat or chamber formed therefor in the main casing A and arranged with its central axis or axis of rotation transverse to the cylinders B and C, the valve-plug being arranged to operate in connection with both of the cylinders. The valve-plug and the cylindric seat therefor have two sets of coacting valve ports or passages located one set near each end of the plug and seat and opposite the cylinders with which the ports or passages constituting the sets are associated. The said valve-seat is formed in the casing A at one side of the cylinders B and C and extends across the outer ends of said cylinders, the valves being interposed between the outer ends of said cylinders and a pressure-fluid-supply chamber E, which occupies a space in the casing A at one side of the valve-chamber and from which the pressure fluid passes through the ports or passages of the said valves to the outer ends of said cylinders.

The valve seat or chamber is shown as provided with a bushing or cylindric tubular lining F, which forms the bearing-surface for the valve-plug and which is provided with slots or openings which constitute the inlet and outlet ports and coöperate with the ports or passages in the valve-plug D. The ports or passages in said plug associated with the cylinder B are lettered $d\,d'$, while those associated with the cylinder C are lettered $d^2\,d^3$. The sets of ports or passages formed in the casing A and the bushing F embrace ports e and e', which open from the chamber E to the valve-seats and into the same through slots in the bushing F and ports e^2 and e^3, which extend from the outer ends of the cylinders B and C to the valve-seats and likewise terminate in slots in the bushings. The valve-plug is provided with a longitudinal centrally-arranged exhaust-passage D′ and is provided with external recesses $d\,d^2$, which extend partially around the plug and form passages adapted to connect the outer

ends of the cylinders with the air-chamber E when the plug is turned into position to bring one end of one of said passages d or d^2 opposite one of the cylinder-ports e^2 or e^3, the said recesses d and d^2 being always in communication with the supply-ports e e'. The exhaust-ports in the valve-plug are formed by means of the transverse passages d' d^3, which extend from the central exhaust-passage D' of said plug to the side face of the plug at points between the ends of the recesses d d^2 and are adapted for communication with the cylinder-ports e^2 or e^3 when the valve-plug is turned to bring said exhaust-ports into register with the said cylinder-ports. The sets of passages and ports for the two cylinders are arranged at an angle to each other, so that when the plug is turned to bring one exhaust-port into register at its end with a port in the casing, thereby bringing the exhaust-passage D' into communication with the outer end of one of the cylinder-ports e^2 or e^3, the other exhaust-port in the plug will be out of register with its associate cylinder-port, and the latter will be in communication with the recess d or d^2.

The cylinder valve seat or chamber for the valve-plug D opens at its ends directly through the opposite side faces of the main casing A; but at the end of said casing at which are located the devices for actuating the valve-plug the said valve-seat is closed by means of a cap-plate G, which has screw-threaded engagement with the wall of the casing and in which is mounted a short rotative valve-operating spindle H, through which motion is transmitted to the valve-plug. At the opposite side of the main casing the cylindric opening constituting the valve-seat is preferably closed by means of a disk I, which is inserted in the end of said opening over the valve-plug and held in said opening by means of a screw-threaded ring J, said disk I being provided with a central aperture i, arranged opposite the longitudinal exhaust-passage D', for the escape of exhaust pressure fluid from the engine. Said disk I is employed for the purpose of excluding dust from the bearing of the valve-plug and to afford an end bearing for said valve-plug. Said cap-plate G and disk I are arranged to bear against the ends of the bushing F, which is held in place by said cap and disk. Packing rings or gaskets K and L are shown as interposed between the end of the bushing F and the cap-plate G and disk I, said packing-rings serving to insure tight joints between the parts at these points.

Actuating devices for the valve-plug D embrace an endwise-moving actuating-rod M, which is connected with and operates the valve-plug D through the medium of the actuating-spindle H, which is provided with a crank-arm N, to which the rod M is connected by means of a pivot-stud n, Fig. 6. A loose or flexible connection is provided between the actuating-spindle H and the valve-plug, as follows: The end of said valve-plug adjacent to its operating-spindle is provided with two partial or segmental endwise-projecting flanges d^6 d^6, Figs. 11 and 12, between the ends of which are formed radial notches or openings adapted for engagement with radial holding-arms h h, extending outwardly from a disk or hub h' on the inner end of the spindle, as clearly seen in Figs. 7 and 8. Said spindle is held from endwise movement in its bearing in the cap-plate by contact of the disk h' with the inner end of said cap-plate and by the contact of the arm N with the outer face of said cap-plate. The disk h' is free from contact with the end of the valve-plug; but the arms h h have close bearing contact with the ends of said flanges d^6 d^6, so that while the oscillatory movement transmitted to the driving-spindles is transmitted directly to the valve-plug there is no such rigid connection between said valve-plug and said spindle as to prevent the valve-plug from maintaining its position in the surrounding seat uninfluenced by the adjustment of or any equalities in the movement of said driving-spindle. Moreover, the pressure fluid in the supply-chamber E tends by its pressure on the adjacent side face of the valve-plug D to press the same laterally toward the cylinder-ports, and thus maintain a tight joint between the valve-plug and its seat, and it is manifest that the loose connection between the driving-spindle and the valve-plug, provided as above described, enables the plug to be thus pressed against its surrounding seat by the pressure coming thereon without restriction by reason of its engagement with the said driving-spindle. Special provision is made to insure pressure of the valve-plug laterally against the side of its seat in which the cylinder-ports are located by extending both of the recesses d and d^2 around the plug D past or beyond the inlet-ports e and e', so that the said recesses will in general terms be located at the side of the plug nearest the inlet-ports and will have their ends at approximately equal distances from the cylinder-ports. The actual length given to the said recesses may be greater or less, depending upon the extent of rotative movement given to the plug, which will control the width of the bearing-faces of the plug between the exhaust-ports and the adjacent ends of the recesses which register with the cylinder-ports, or other considerations; but to produce the result stated the recesses must extend around the plug in both directions from a point on the plug diametrically opposite the exhaust-ports. In other words, the bearing-faces at either side of the exhaust-ports may be wider or narrower than shown, and the lengths of the recesses or distances which they extend around the plug may vary correspondingly; but for the purpose stated the said recesses will be arranged symmetrically with respect to the cylinder-ports in the casing or the ex-

haust-ports in the plug, so that pressure of the air or other fluid admitted to the said recesses from the supply-ports will tend to press the plug as a whole toward the part of the circumference of the valve-casing at which the cylinder-ports are located.

In the end of the valve-plug adjacent to the operating-stud is a small air-hole d^7, Fig. 6, which connects the air-supply port d^2 with the space between the end of the valve-plug and the plate G. Air under pressure is admitted through said hole d^7 to the said space between the end of the valve-plug and said cap-plate G and serves to press the valve-plug endwise toward the exhaust end of the valve-seat, and thus hold said valve-plug in contact with the disk I and prevent leakage at that end of the valve-plug. The air-pressure thus supplied to the space at the inner face of the cap-plate G also serves to press the operating-spindle H outwardly and hold the disk h' against the cap-plate G, thereby preventing leakage between the cap-plate and spindle.

I claim as my invention—

1. The combination with a casing provided with a valve-chamber having admission and cylinder ports, of an oscillatory valve-plug provided with a longitudinal exhaust-passage, a radial exhaust-port extending from said longitudinal passage to the surface of the plug, and a recess extending partially around the plug at the side of the same remote from the exhaust-port in the plug and adapted to bring the admission-port into communication with the said cylinder-port, and means for actuating the plug embracing a rotative operating-stud mounted in the casing in alinement with the axis of the valve-plug and which is loosely connected with the valve-plug by means adapted to transmit rotative movement of the stud to the plug while permitting lateral movement of the plug relatively to the stud.

2. The combination with a casing provided with a valve-chamber, of a valve-plug in said chamber, a cap applied to the casing over the end of the valve-plug, an operating-stud mounted in said cap and provided on its inner end with an enlargement or disk which bears against the inner face of the cap, said plug having a notched flange which surrounds the said disk and the said stud being provided with peripheral arms which engage the notches of said flange, and means affording a supply of pressure fluid to the space between the end of the plug and said cap to hold the said disk against the cap.

3. The combination with a casing provided with a valve-chamber and with a pressure-fluid-supply passage, of a valve-plug in said chamber, a cap applied to the casing to close the end of the chamber, an operating-stud which is mounted to turn in said cap and is loosely connected at its inner end with the valve-plug; said stud having a disk or enlargement at its inner end which bears against the inner face of the cap, one of the parts having a passage which connects said pressure-fluid-supply passage with the space between the plug and cap, and which affords pressure in said space by which the disk on the operating-stud is held in contact with said cap.

4. The combination with a casing provided with a cylindric valve-chamber having lateral inlet and cylinder ports and with a pressure-fluid-supply passage, of a cylindric valve-plug in said chamber provided with a longitudinal exhaust-passage opening through one end of the plug, said chamber having at one end an exhaust-passage and an annular bearing-surface against which the exhaust end of the valve-plug has bearing, a cap closing the opposite end of the chamber, and an operating-stud mounted in said cap which is loosely connected with the valve-plug, said stem having a disk or enlargement which bears against the face of the cap, one of said parts having a passage which connects said pressure-fluid-supply passage with the space between the plug and cap and which affords pressure on the plug to hold the exhaust end of the latter in contact with said annular bearing-surface.

5. The combination with a casing provided with a cylindric valve-chamber having lateral inlet and cylinder ports and with a pressure-fluid-supply passage communicating with the inlet-port, of a cylindric valve-plug in said chamber provided with a longitudinal exhaust-passage opening through one end of the plug, said chamber having at one end an exhaust-passage and an annular bearing-surface against which the exhaust end of the plug has bearing, a cap closing the opposite end of the chamber, and an operating-stud mounted in said cap, which is loosely connected with the valve-plug, said stud having on its inner end a disk or enlargement which bears against the inner face of the cap, one of the said parts having a passage which connects said fluid-supply passage with the space between the plug and cap and which affords pressure to press the plug endwise against said annular bearing-surface and to also press the disk against the said cap.

In testimony that I claim the foregoing as my invention I affix my signature, in presence of two witnesses, this 24th day of November, A. D. 1903.

REINHOLD A. NORLING.

Witnesses:
C. E. ERIKSON,
F. A. BURGESS.