W. BALL.

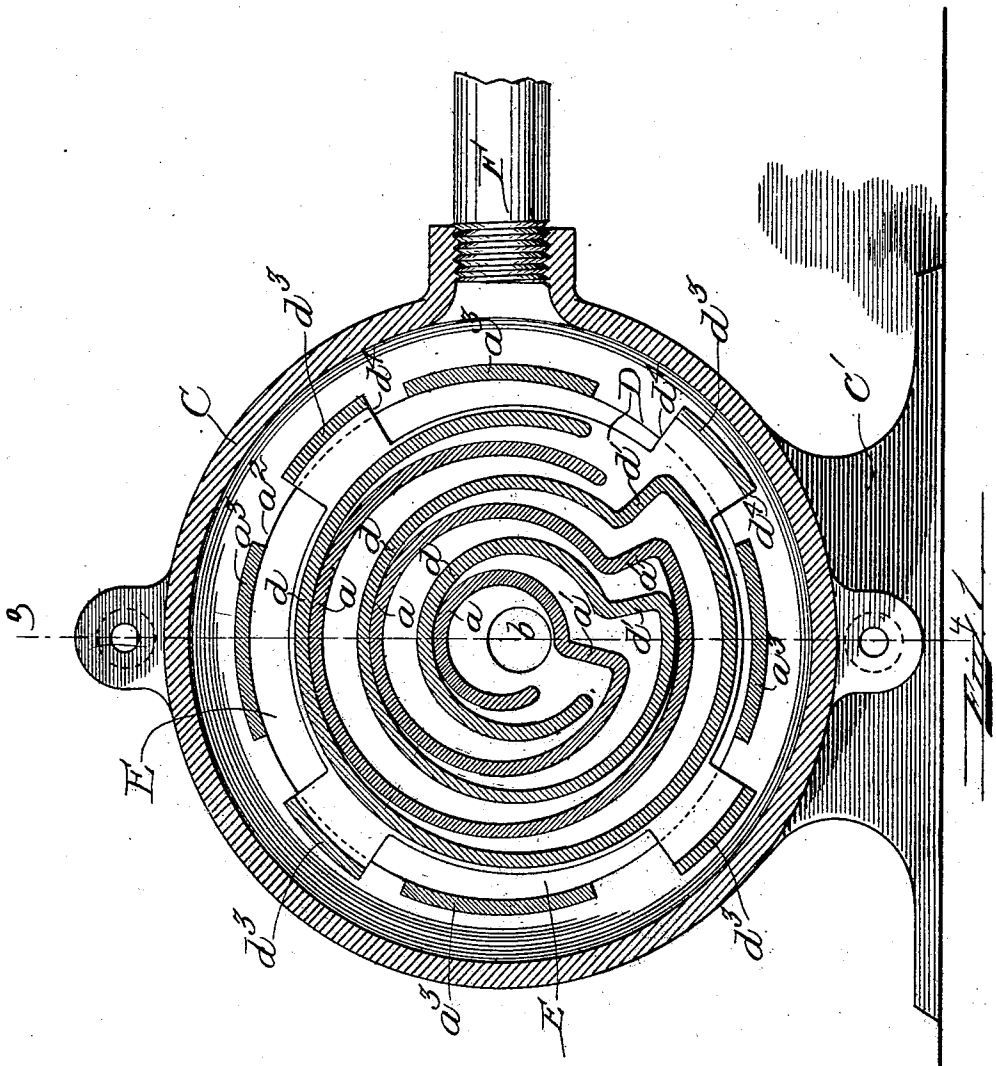
ROTARY ENGINE.

APPLICATION FILED MAY 14, 1908.

969,026.

Patented Aug. 30, 1910.

3 SHEETS—SHEET 1.



Witnesses:
Josephine H. Ryan
Charles D. Woodbury.

Inventor:
Walter Ball,
By Roberts, Roberts & Dellinger,
Attorneys.

THE NORRIS PETERS CO., WASHINGTON, D. C.

W. BALL.

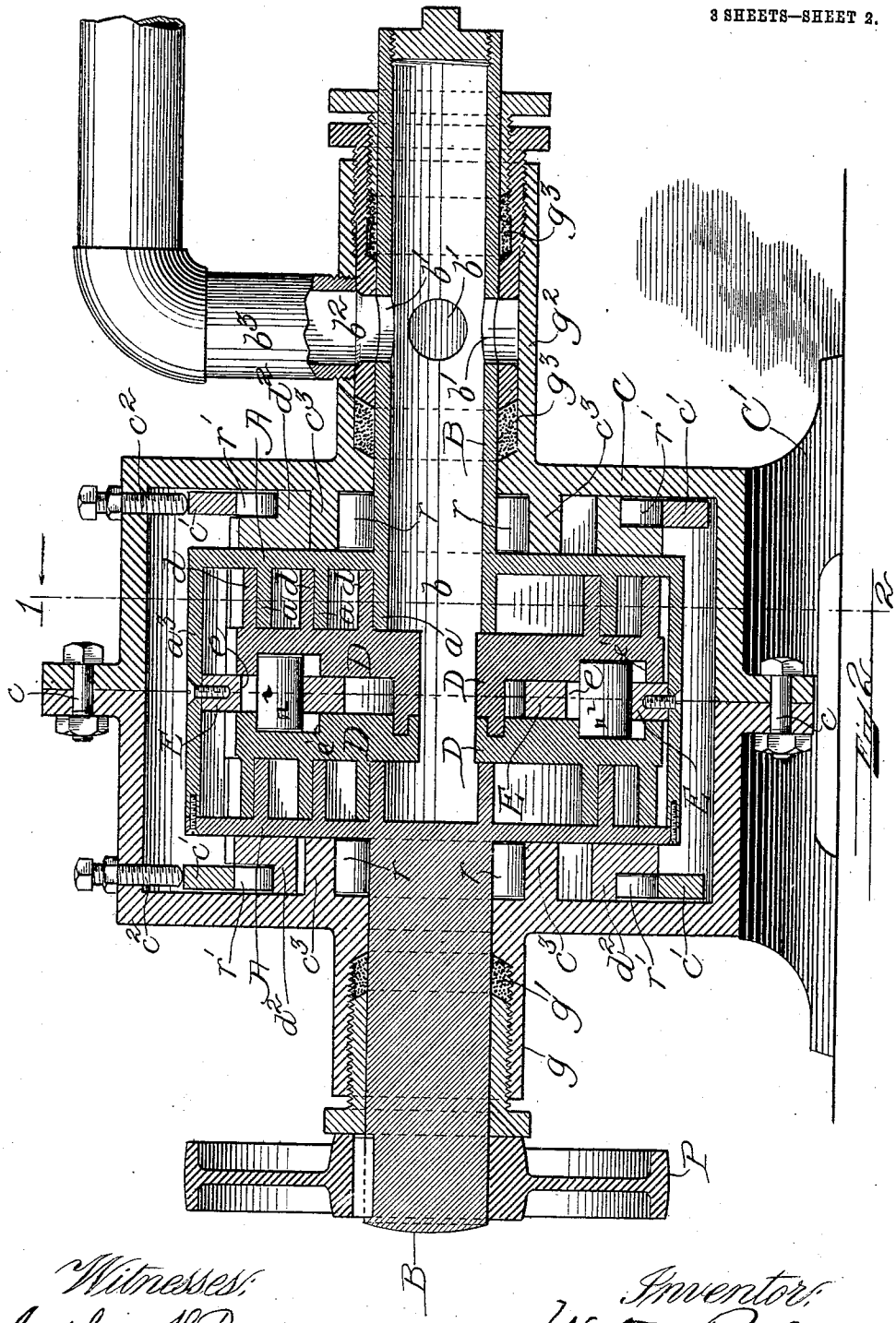
ROTARY ENGINE.

APPLICATION FILED MAY 14, 1908.

969,026.

Patented Aug. 30, 1910.

3 SHEETS—SHEET 2.



Witnesses:
Josephine H. Ryan
Charles S. Wadsley

Inventor:
Walter Ball,
By Roberts, Roberts & Cushman,
attorneys.

THE NORRIS PETERS CO., WASHINGTON, D. C.

W. BALL.

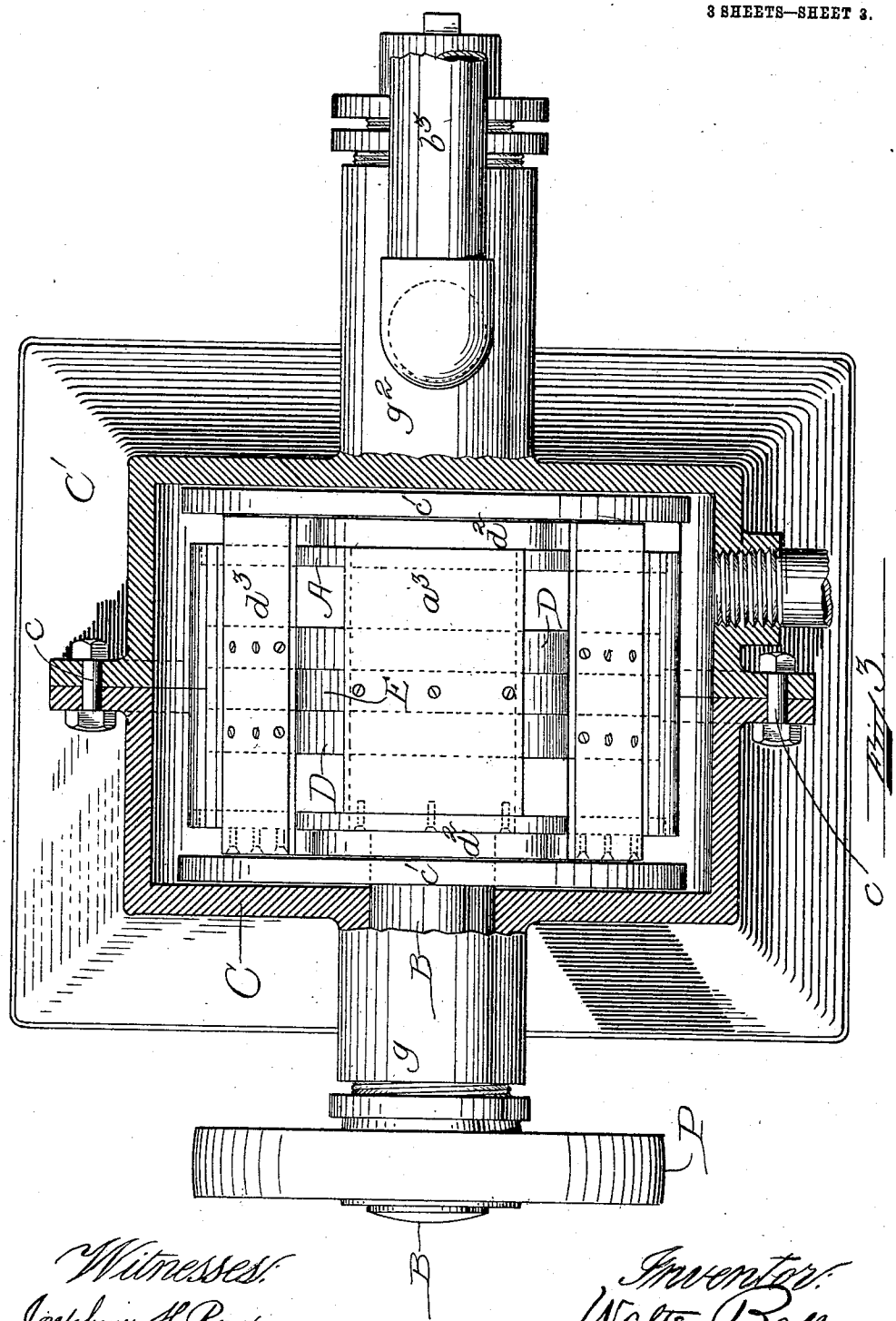
ROTARY ENGINE.

APPLICATION FILED MAY 14, 1908.

969,026.

Patented Aug. 30, 1910.

3 SHEETS—SHEET 3.



Witnesses:
Josephine H. Pope
Charles S. Wolfkeil

Inventor:
Walter Ball,
By Roberts, Roberts & Cushman,
Attorneys

THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WALTER BALL, OF BOSTON, MASSACHUSETTS.

ROTARY ENGINE.

969,026. Specification of Letters Patent. **Patented Aug. 30, 1910.**

Application filed May 14, 1908. Serial No. 432,796.

To all whom it may concern:

Be it known that I, WALTER BALL, a citizen of the United States, and resident of Boston, in the county of Suffolk and State of Massachusetts, have invented new and useful Improvements in Rotary Engines, of which the following is a specification.

This invention relates to rotary engines, the word engines being used in its broad sense signifying pumps, motors and meters, and air compressors and consists in certain modifications of the engine set forth in my application for patent filed March 27, 1908, Serial No. 423,705, and in certain improvements hereinafter pointed out.

In the accompanying drawings which illustrate one embodiment of my invention, Figure 1 is a vertical cross-section of an engine embodying my invention, on line 1—2 of Fig. 2; Fig. 2 is a longitudinal central section of the engine shown in Fig. 1 on line 3—4 of Fig. 1; and Fig. 3 is a plan view of said engine, the casing being removed to show the rotary elements.

Referring to the drawings, A represents one of the two principal rotary elements secured to an axially extending shaft B. The shaft B is mounted for rotation in suitable bearings in a frame or casing C supported by a base or standard C'. The casing C is preferably made in two parts, as shown, connected together by bolts *c*.

The element A is provided with laterally projecting walls *a* in the form of concentric, interrupted circles (see Fig. 1). The end of each such circular wall on element A, is connected by a wall *a'* with the beginning of the next outer circular wall, considering the structure illustrated in the drawing clockwise. Thus a continuous wall is provided made of the circular parts *a* and the offset parts *a'*, and forming between its convolutions a continuous depression or channel having circular parts and offset parts. The other principal rotary element is made up of the disk-like members D having the laterally projecting walls *d*, in the form of concentric interrupted circles, the end of each of which is connected with the beginning of the next outer circle by the offset wall *d'*, thus forming between the convolutions of the wall a continuous depression or channel having circular parts and offset parts. The walls of said rotary elements A and D are opposed to each other and project each within the channel between the walls of the opposite element.

The axes of the two elements are relatively fixed, and are offset from each other and parallel. The axis of element A is the center of shaft B, and of element C is the center of the bearing ring *c'* which is mounted within the casing C surrounding but eccentric to shaft B, and is adjustable therein by means of adjusting screws c^2. The bearings for shaft B consist of the annular projections c^3 upon the end walls of casing C, and the rollers *r* contained between the projections c^3 and the shaft. The bearing surfaces for the rotary element made up of the disk like members D, D, consist of the rings d^2 located outside of the element A and secured to disks D, D, by means of the bridge plates d^3 screwed to disks D, D, and extending through slots a^2 in the peripheral walls or plates a^3 of element A. The disks D are provided with notches or slots d^4 between the bridge plates d^3 through which the plates a^3 of the element extend. Between the bearing rings *c'* and d^2 are roller bearings *r'*.

The means for causing the two eccentric elements to rotate together at equal angular velocities consists, as herein shown, of the partition flange or disk E, secured by screws within the peripheral walls a^3 of element A, interposed between the disks D, D, and coupled with disks D, D, by cylindrical rollers r^2 engaging circular bearing surfaces *e* and *e'* in the disks E and D respectively. Said bearing surfaces are located in like angular and radial positions in both elements and the rollers r^2 are of a diameter less than the diameters of their respective bearing surfaces by an amount equal to the offset between the axes of the elements.

The shaft B is made hollow as shown at *b*, and is provided with a series of ports *b'*, which successively register with the opening b^2 as the shaft rotates. The hollow *b* of the shaft communicates with the inner ends of the channels between the walls *a* and *d* of the two rotary elements. The other end of said channel opens into the casing C which is provided with a port F. The casing C is also provided with the projection or sleeve *g* surrounding the shaft B, to accommodate the packing *g'*, held in place in the usual

way by a gland and the projection or sleeve g^2 holding similar packing g^3 held as usual by glands and having the opening b^2 with which a pipe b^3 communicates.

For the purpose of illustration I will describe the operation of the device when used as a pump. Rotary motion is imparted in any manner as through pulley P, from an external source of power to rotary element A through shaft B. The other principal element will also thereby be caused to rotate on its own fixed axis by means of the coupling rollers r^2, at the same angular velocity as element A. The walls a will roll, also slipping slightly, upon the walls d, said walls at all times remaining tangent to each other, the difference in radial distance between the elements at their lines of contact being equal to the offset between the axes of the elements. The line of tangency between the walls a and d will progress relatively to the elements as the latter rotate, but will remain fixed in relation to a plane passing through the relatively fixed offset axes of the elements. The offset portions a' and d' of the walls are so located and formed as to make contact with each other as the line of contact progresses in the course of the revolution of the elements. As the line of contact progresses, the spaces between the walls will progress correspondingly with relation to the elements and will draw in liquid through pipe b^3, which is connected with a source of supply. The liquid will pass from the hollow b of the shaft through the progressively increasing chambers or channels between the walls a and d and be discharged from the outer end of said channels into the space surrounding the elements and inclosed by casing C and thence through outlet port F. In the above described operation the elements have been assumed to have been rotated counter clockwise.

Should it be desired to use the device as an air compressor or the like, the engine will be rotated in reverse direction to that above described and the outlet port just described will become the inlet port and vice versa. As the spaces between the outer and larger walls a and d will be of greater volume than the spaces between the inner and smaller walls, the air or other electric fluid drawn in from the periphery of the elements will be compressed in its progress to the hollow b of the shaft from whence the compressed air or gas is delivered.

When used as a motor, steam is admitted through pipe b^3, and hollow b of the shaft, whence it passes between walls a and d, and expanding, tends to enlarge the space therebetween causing the elements to rotate counter clockwise in the view shown in the drawings. As the rotation progresses the steam continues to expand in the progressively enlarging chamber containing it, thus exerting its force to cause rotation until it is discharged into the space within the casing C surrounding the elements.

As already stated the word "engine," as used in the specification and claims, is used comprehensively and intended to include pumps, motors, meters, air compressors, etc.

I claim:

1. In a rotary engine, two rotary elements mounted on parallel relatively fixed axes offset from each other, connection between said elements to cause them to rotate in the same direction at equal angular velocities, said elements being provided with opposed complementary walls, and depression therebetween, said walls and depressions being in the form of interrupted circles, the walls of one member projecting into the depressions of the other member, and being of less width than said depressions by an amount equal to twice the offset between the axes of the elements, and adapted as said elements rotate to remain tangent to the walls of the depressions, the lines of tangency being progressive with relation to the elements as the latter rotate and remaining in a plane fixed in relation to the plane of the offset axes of the elements, said depressions provided with an inlet and outlet ports.

2. In a rotary engine, two rotary elements mounted on parallel relatively fixed axes offset from each other, connection between said elements to cause them to rotate in the same direction at equal angular velocities, each of said elements being provided with walls in the form of interrupted concentric circles, the end of each such circular wall being connected with the beginning of the next outer circular wall, whereby a continuous wall is provided formed of circular and offset parts having between its convolutions a continuous channel formed of circular and offset parts, the wall of one member projecting within the channel of the other member, and adapted as the elements rotate to maintain a line of contact progressive with relation to the elements but in a plane fixed in relation to the offset axes of the elements, said channels provided with inlet and outlet ports.

3. In a rotary engine, two rotary elements mounted on parallel relatively fixed axes offset from each other, connection between said elements to cause them to rotate in the same direction at equal velocities, each of said elements being provided with walls in the form of interrupted concentric circles, the end of each of such circular walls being connected with the beginning of the next outer circular wall, whereby a continuous wall is provided formed of circular and offset parts having between its convolutions a continuous channel formed of circular and offset parts, the walls of one member projecting within the channel of the other member, and adapted

as the elements rotate to maintain a line of contact progressive with relation to the elements but in a plane fixed in relation to the offset axes of the elements, said channels provided with inlet and outlet ports one of said elements being mounted on an axially extending shaft supported in suitable bearings and the other of said elements being supported by circular bearings surrounding said shaft but eccentric thereto.

4. In a rotary engine, two rotary elements mounted on parallel relatively fixed axes offset from each other, connection between said elements to cause them to rotate in the same direction at equal angular velocities, one of said elements comprising a pair of discoid members spaced apart and rigidly fastened together to form a unitary element, each of said members having inwardly projecting spaced concentric walls in the form of interrupted circles connected in pairs by substantially radial walls forming a continuous channel therebetween, and the other of said elements being located between said members of the first element and having outwardly projecting walls of like formation with the walls of the first named element and arranged to coöperate therewith.

5. In a rotary engine, two rotary elements mounted on parallel relatively fixed axes offset from each other, one of said elements comprising a pair of discoid members spaced apart and rigidly fastened together to form a unitary element, each member having inwardly projecting walls in the form of concentric circles connected by offset parts, forming channels therebetween, and the other element being located between said members of the first element and comprising a pair of discoid members each having outwardly projecting curved walls forming channels therebetween and coöperating with the walls of the first element, a partition secured within the first named element and interposed between the discoid members of the second named element, and connection between said partition and the discoid members of the second named element to cause the two elements to rotate in the same direction at equal angular velocities.

6. In a rotary engine, two rotary elements mounted on parallel relatively fixed axes offset from each other, connection between said elements to cause them to rotate in the same direction at equal angular velocities, one of said elements comprising a pair of discoid members spaced apart, each member having inwardly projecting curved walls forming channels therebetween, and the other of said elements being located between said members of the first element and having outwardly projecting curved walls forming channels therebetween at each side of the second named element, coöperating with the wall of the first element, a pair of bearing rings, one at each side of the first named element, peripheral bridge pieces connecting said bearing rings with the second named element, peripheral bridge pieces connecting the discoid members of the first named element, the first named element being provided with suitable slots or openings through which pass the parts connecting said bearing rings and the second named element.

7. In a rotary engine, two rotary elements mounted on parallel relatively fixed axes offset from each other, one of said elements comprising a pair of discoid members spaced apart, each member having inwardly projecting curved walls forming channels therebetween, and the other element being located between said members of the first element and comprising a pair of discoid members each having outwardly projecting curved walls forming channels therebetween and cooperating with the walls of the first element, a partition within the first named element interposed between the discoid members of the second named element, peripheral bridge pieces spaced apart and connecting the discoid members and partition of the first named element, a pair of bearing rings for the second named element, one at each side of the first named element, radial projections upon the discoid members of the second named element projecting through the spaces formed between said bridge pieces, peripheral bridge pieces connecting said radial projections and said bearing rings, and connection between said partition and the discoid members of the second element to cause the two elements to rotate in the same direction at equal angular velocities.

8. In a rotary engine, two rotary elements mounted on parallel relatively fixed offset axes, each of said elements being provided with walls in the form of interrupted concentric circles, the end of each such circular wall being connected with the beginning of the next outer circular wall, whereby a continuous wall is provided formed of circular and offset parts, the walls of each member projecting within the channel between the walls of the other member, and means to cause said offset elements to rotate together at equal angular velocities, comprising circular bearing surfaces located in like angular and radial position in each element, and roller couplings engaging said bearing surfaces, substantially as described.

Signed by me at Boston, Mass. this ninth day of May 1908.

WALTER BALL.

Witnesses:
ROBERT CUSHMAN,
CHARLES D. WOODBERRY.