No. 798,485. PATENTED AUG. 29, 1905.

B. F. AUGUSTINE

ROTARY ENGINE.

APPLICATION FILED JAN. 11, 1905.

2 SHEETS—SHEET 1.

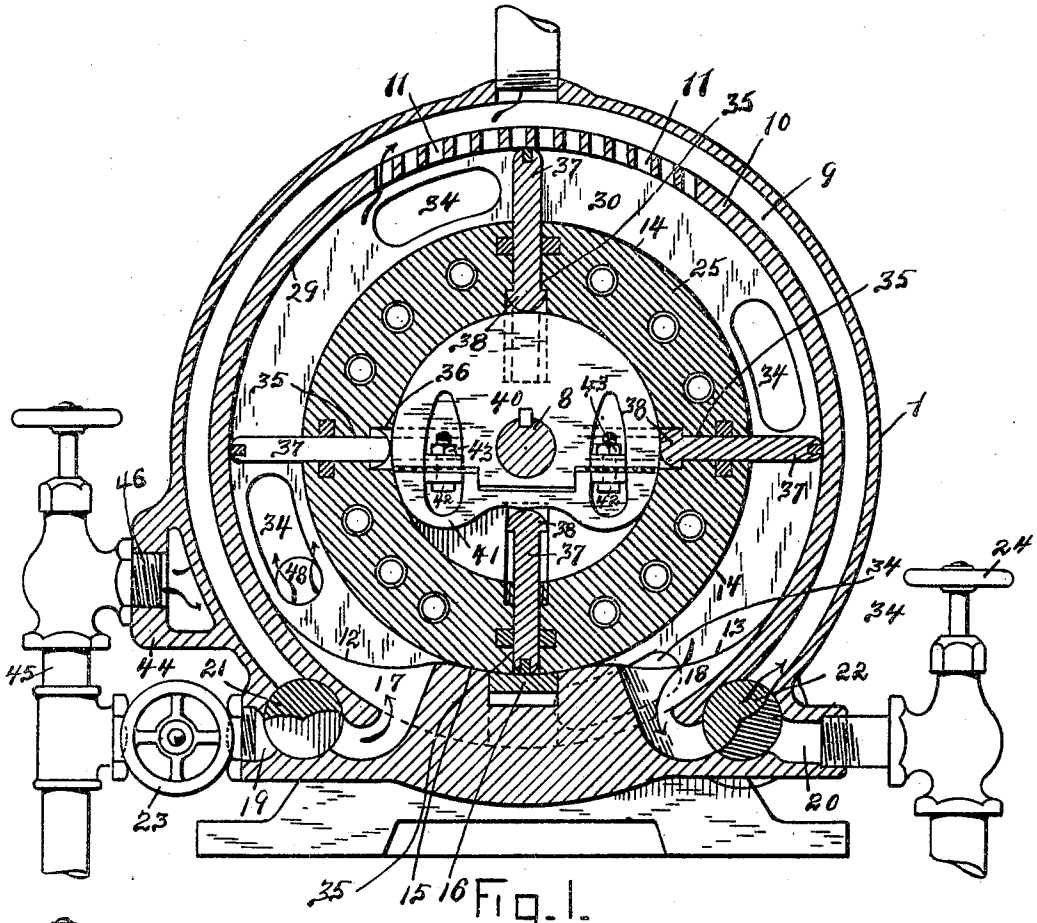

Fig. 1.

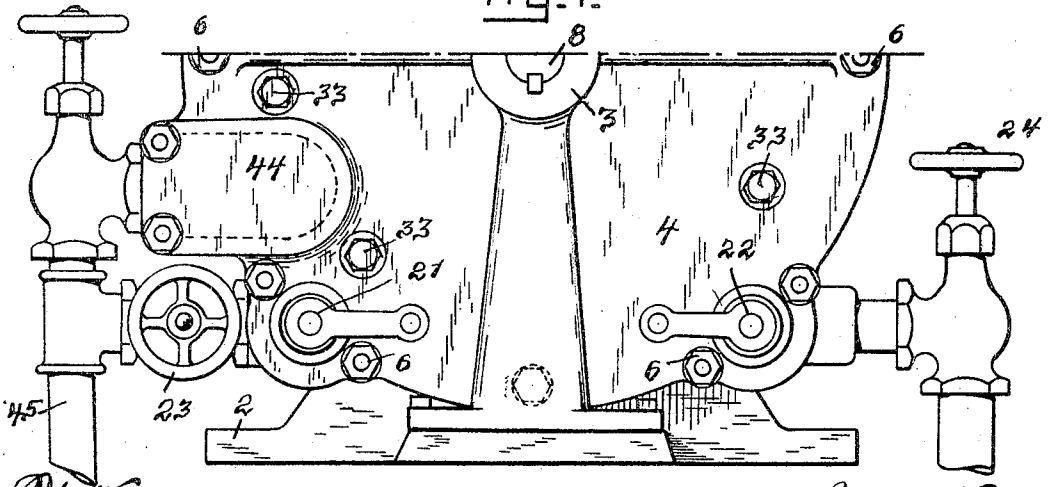

Fig. 2.

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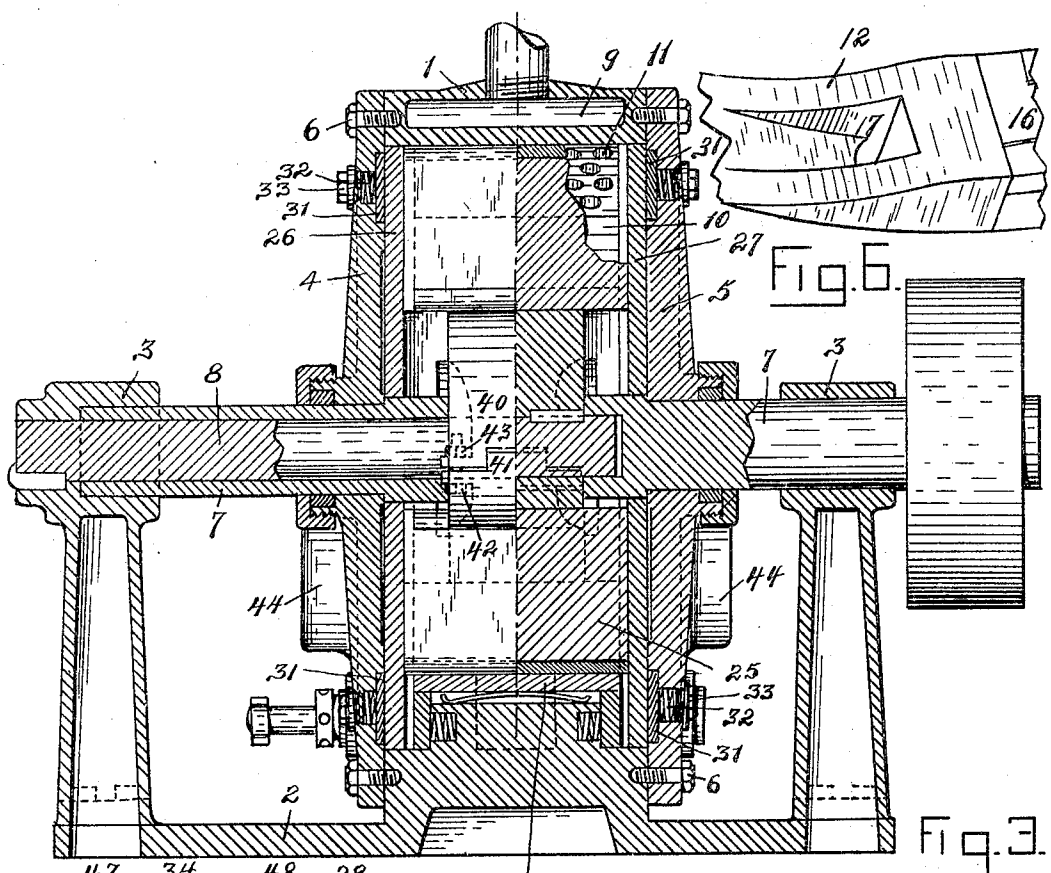

Fig. 6.

Fig. 3.

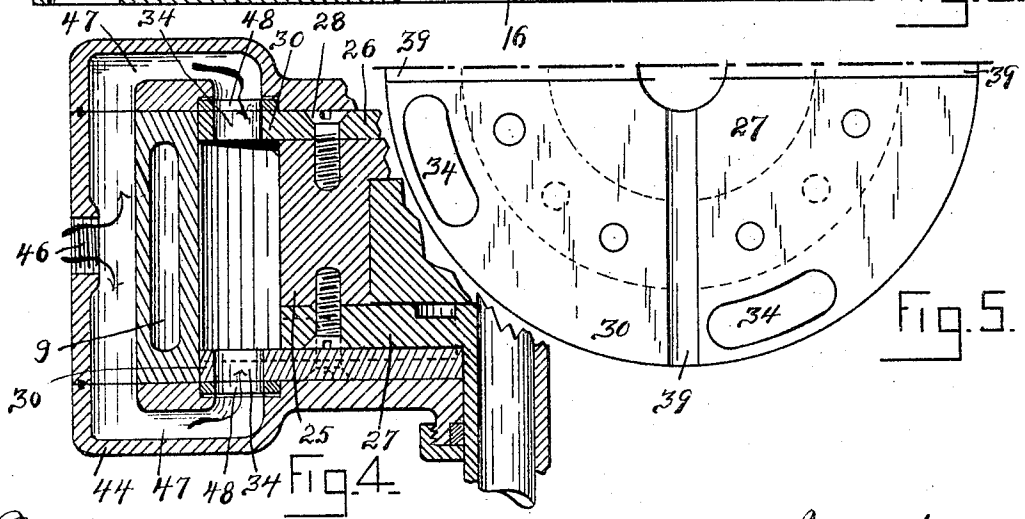

Fig. 4.

Fig. 5.

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UNITED STATES PATENT OFFICE.

BENJAMIN F. AUGUSTINE, OF BUFFALO, NEW YORK.

ROTARY ENGINE.

No. 798,485. Specification of Letters Patent. Patented Aug. 29, 1905.

Application filed January 11, 1905. Serial No. 240,566.

To all whom it may concern:

Be it known that I, BENJAMIN F. AUGUSTINE, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in Rotary Engines; and I do hereby 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, reference being had to the accompanying drawings, and to figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in rotary engines, and more particularly to that class of engine for which Letters Patent No. 776,882 were granted to me on the 6th day of December, 1904. The general construction covered by such Letters Patent is the combination of the following instrumentalities, viz: a power-shaft, a compound rotary cylinder rigid on the power-shaft and composed of a series of radial cylinders, a series of radial pistons reciprocating in the radial cylinders, a casing surrounding the compound rotary cylinder, the inner wall of which curves inwardly to meet the compound rotary cylinder to form an abutment, an abrupt outward incline adjacent to the abutment, side annular flanges on the compound rotary cylinder, spring-pressed annular rings seated in the inner faces of the side plates of the casing and adapted for tight contact with the annular flanges on the compound rotary cylinder, and means for introducing and exhausting the steam employed against the pistons and for forcing the pistons into their operative positions.

The objects of my present invention are to combine certain novel features with the above-outlined construction, to make my engine reversible, and to manipulate the radial pistons in a positive manner by means of a novel arrangement and combination of a cam with such pistons.

To these ends my invention consists of certain details of construction, all of which will be fully hereinafter described and claimed.

In the drawings, Figure 1 is a central vertical longitudinal section of my improved engine. Fig. 2 is a side elevation of the lower half of my improved engine. Fig. 3 is a central vertical transverse section of my improved engine. Fig. 4 is an enlarged detached detail, in horizontal section, of the steam-chest. Fig. 5 is a detached detail of one-half of one of the side disks attached to the compound rotary cylinder, and Fig. 6 is a perspective view of one of the abrupt inclines, showing the by-pass.

Referring to the drawings, 1 is the cylindrical casing, having the integral base 2 and the two removable shaft-bearings 3 3.

4 and 5 are the inclosing side plates, which, with the casing 1, form the chamber in which the operative parts are assembled. These plates 4 and 5 are removably secured in position by the bolts 6.

7 is the sectional power-shaft, journaled in the bearings 3 3. The left-hand end of this power-shaft is hollow, adapting it for the reception of the stationary shaft 8, keyed in the left-hand bearing 3 and extending across the steam-chamber.

Around the cylindrical casing 1 and within its outer wall is the concentric exhaust-chamber 9, its upper division-wall 10 being provided with a series of perforations 11, forming outlet-ports. The lower portion of the inner wall of the cylindrical casing 1 curves inwardly in opposite directions in abrupt inclines 12 and 13 to meet the compound rotary cylinder 14 to form the intermediate abutment 15, provided with the central spring-pressed packing-block 16. In each of the abrupt inclines 12 and 13 are the by-passes 17 and 18, (see Figs. 1 and 6,) which communicate with the high-pressure ports 19 and 20, controlled by the valves 21 and 22. The stop-cocks 23 and 24 control the reversal of steam through the ports 19 and 20.

25 is the compound rotary cylinder, concentric with the cylindrical casing 1 and rigid with the sectional power-shaft 7. 26 and 27 are disks which are secured to the sides of the compound rotary cylinder 25 and extend to the inner wall of the cylindrical casing 1. They are secured by the countersunk screws 28. (See Fig. 4.) These disks 26 and 27 fit snugly against the inner wall 29 of the cylindrical casing, being practically of the same diameter, such disks forming where they extend beyond the compound rotary cylinder annular flanges 30 30 of such compound rotary cylinder. These disks 26 and 27 may, if found desirable, be cast integral with the compound rotary cylinder. 31 31 are annular rings set loosely into the inner faces of the side plates 4 and 5 of the inclosing casing. In sockets in the side plates are placed the springs 32, which bear against the outer faces of the annular rings 31 31. The tension of

these springs against the annular rings is regulated by the bolts 33. With the above construction I effect a steam-tight joint between the compound rotary cylinder and the inner faces of the side plates 4 and 5, besides making provision for taking up the frictional wear between these parts. Both of these disks 26 and 27 are provided in their outer portions 30 with the elongated concentric steam-inlet ports 34, preferably four in number.

The compound rotary cylinder 25 is composed of the four radial cylinders 35, (see Fig. 1,) having shouldered inner ends 36. In each cylinder 35 is arranged a radial piston 37, having a shouldered inner end 38 adapted for holding contact with the shouldered inner end of the cylinder 35 for neutralizing the centrifugal force of the piston. Each piston 37 has a radial reciprocating movement in the radial grooves 39 on the inner faces of the disks 26 and 27. (See Fig. 5.)

Centrally arranged within the compound rotary cylinder and rigid upon the stationary shaft 8 is the cam composed of the upper and lower sections 40 and 41, adjustably secured by bolts and nuts 42 and 43 to provide for accurate play upon the pistons 37 and to take up lost motion when necessary. This sectional cam 40 41 by contact with the pistons 37 forces them successively into operative position to enable them to receive the expansive force of the steam.

44 is the steam-chest, into which steam is admitted from the supply-pipe 45 through the port 46. The steam is conducted along the twin passages 47 47 (see Fig. 4) to the outlet-ports 48 48, adjacent to the outer faces of the flanges 30 of the disks 26 and 27 and in the path of the steam-inlet ports 34 in the flanges 30. This provision for admitting the steam from opposite sides effects a perfect balance of the action of the steam against the compound rotary cylinder.

In operation, referring to Fig. 1, the valve 21 in the position shown is closing the exhaust and is open to admit steam through by-pass 17 into the steam-chamber to start the engine in positive rotation. The opposite valve 22 is closed against admission of steam and open to the concentric chamber 9 to exhaust the steam which has been carried by the exhaust-ports 11 by the rotating pistons. When the engine is thus started, steam is admitted through port 46 into the steam-chest 44, and valve 23 is closed to shut off steam from by-pass 17, thus operating the engine with the cut-offs. When the inlet-ports 34 34 in the disks 26 and 27 successively reach the outlet-ports 48 48 in the steam-chest 44, the steam is intermittently admitted against the pistons 37 to revolve the same. The right-hand piston 37, just in advance of the meeting ports 34 and 48, is thus forced forward by the steam-pressure until the port 48 is cut off, at which point the expansion of the steam comes into play and continues until the following piston 37 reaches the bottom of the left-hand abrupt incline 12. Until this point is reached the left-hand piston 37 is receiving the full expansive force of the steam, which is made possible by the open by-pass 17. (See Fig. 6.) When the left-hand piston 37 reaches the forward outlet-port 11, the steam behind such piston exhausts expansively through the perforated division-wall 10 11 into the concentric chamber 9 and out through exhaust-pipe. In reversing the engine high-pressure steam only is employed in the construction shown, in which case no steam passes through the steam-chest, and valve 22 is thrown open to the steam-chamber and closed to the exhaust-chamber and the opposite valve 21 is closed to the steam-chamber and open to the exhaust-chamber. It is perfectly feasible, however, to reverse the motion of the engine by means of cut-off ports in practically the same manner as herein shown; but for the sake of simplicity of construction I prefer to employ the high-pressure steam, as described.

I claim—

1. In a rotary engine, in combination, a revolving power-shaft, a stationary shaft within the revolving power-shaft, a compound rotary cylinder rigid on the revolving power-shaft and composed of a series of radial cylinders, a series of radial pistons reciprocating in the radial cylinders, a casing surrounding the compound rotary cylinder, the inner wall of which curves inwardly in opposite directions, in abrupt inclines, to meet the compound rotary cylinder to form an intermediate abutment, means for introducing and exhausting, in opposite directions, the steam employed against the pistons and a sectional cam on the stationary shaft for forcing the pistons into their operative positions, the two sections of such cam being adjustable to and from each other, for the purpose stated.

2. In a rotary engine, in combination, a power-shaft, a compound rotary cylinder rigid on the power-shaft and composed of a series of radial cylinders, a series of radial pistons reciprocating in the radial cylinders, a casing surrounding the compound rotary cylinder, the inner wall of which curves inwardly in opposite directions in abrupt inclines, to meet the compound rotary cylinder to form an intermediate abutment, an exhaust-chamber concentric with the cylindrical casing, the upper portion of its division-wall being perforated and means for introducing and exhausting, in opposite directions, the steam employed against the pistons and for forcing the pistons into their operative positions.

3. In a rotary engine, in combination, a revolving power-shaft, a stationary shaft within the revolving power-shaft, a compound rotary cylinder rigid on the revolving power-shaft and composed of a series of radial cylinders, a

series of radial pistons reciprocating in the radial cylinders, a casing surrounding the compound rotary cylinder, the inner wall of which curves inwardly in opposite directions, in abrupt inclines, to meet the compound rotary cylinder to form an intermediate abutment, an exhaust-chamber concentric with the cylindrical casing, the upper portion of its division-wall being perforated, means for introducing and exhausting, in opposite directions, the steam employed against the pistons and a cam rigid on the stationary shaft for forcing the pistons into their operative positions.

4. In a rotary engine, in combination, a power-shaft, a compound rotary cylinder rigid on the power-shaft and composed of a series of radial cylinders having shouldered inner ends, a series of radial pistons reciprocating in the radial cylinders and provided with shouldered inner ends adapted for holding contact with the shouldered inner ends of the radial cylinders for neutralizing the centrifugal force of the pistons, a casing surrounding the compound rotary cylinder, the inner wall of which curves inwardly in opposite directions, in abrupt inclines, to meet the compound rotary cylinder to form an intermediate abutment and means for introducing and exhausting, in opposite directions, the steam employed against the pistons and for forcing the pistons into their operative positions.

5. In a rotary engine, in combination, a revolving power-shaft, a stationary shaft within the revolving power-shaft, a compound rotary cylinder rigid in the revolving power-shaft and composed of a series of radial cylinders having shouldered inner ends, a series of radial pistons reciprocating in the radial cylinders and provided with shouldered inner ends adapted for holding contact with the shouldered inner ends of the radial cylinders for neutralizing the centrifugal force of the pistons, a casing surrounding the compound rotary cylinder, the inner wall of which curves inwardly in opposite directions, in abrupt inclines, to meet the compound rotary cylinder to form an intermediate abutment, means for introducing and exhausting, in opposite directions, the steam employed against the pistons and a cam rigid on the stationary shaft for forcing the pistons into their operative positions.

6. In a rotary engine, in combination, a power-shaft, a compound rotary cylinder rigid on the power-shaft and composed of a series of radial cylinders, a series of radial pistons reciprocating in the radial cylinders, a casing surrounding the compound rotary cylinder, the inner wall of which curves inwardly in opposite directions, in abrupt inclines, to meet the compound rotary cylinder to form an intermediate abutment, a by-pass in each of the abrupt inclines communicating with the steam and exhaust chambers and means for introducing and exhausting, in opposite directions, the steam employed against the pistons and for forcing the pistons into their operative positions.

7. In a rotary engine, in combination, a revolving power-shaft, a stationary shaft within the revolving power-shaft, a compound rotary cylinder rigid on the revolving power-shaft and composed of a series of radial cylinders, a series of radial pistons reciprocating in the radial cylinders, a casing surrounding the compound rotary cylinder, the inner wall of which curves inwardly in opposite directions, in abrupt inclines, to meet the compound rotary cylinder to form an intermediate abutment, a by-pass in each of the abrupt inclines communicating with the steam and exhaust chambers, means for introducing and exhausting, in opposite directions, the steam employed against the pistons and a cam rigid on the stationary shaft for forcing the pistons into their operative positions.

8. In a rotary engine, in combination, a power-shaft, a compound rotary cylinder rigid on the power-shaft and composed of a series of radial cylinders, a series of radial pistons reciprocating in the radial cylinders, a casing surrounding the compound rotary cylinder, the inner wall of which curves inwardly in opposite directions in abrupt inclines, to meet the compound rotary cylinder to form an intermediate abutment, an exhaust-chamber concentric with the cylindrical casing, the upper portion of its division-wall being perforated, side annular flanges on the compound rotary cylinder, spring-pressed annular rings seated in the inner faces of the side plates of the casing and adapted for tight contact with the annular flanges on the compound rotary cylinder and means for introducing and exhausting, in opposite directions, the steam employed against the pistons and for forcing the pistons into their operative positions.

9. In a rotary engine, in combination, a revolving power-shaft, a stationary shaft within the revolving power-shaft, a compound rotary cylinder rigid on the revolving power-shaft and composed of a series of radial cylinders, a series of radial pistons reciprocating in the radial cylinders, a casing surrounding the compound rotary cylinder, the inner wall of which curves inwardly in opposite directions, in abrupt inclines, to meet the compound rotary cylinder to form an intermediate abutment, an exhaust-chamber concentric with the cylindrical casing, the upper portion of its division-wall being perforated, side annular flanges on the compound rotary cylinder, spring-pressed annular rings seated in the inner faces of the side plates of the casing and adapted for tight contact with the annular flanges on the compound rotary cylinder, means for introducing and exhausting, in opposite directions, the steam employed against the pistons and a cam rigid on the stationary

shaft for forcing the pistons into their operative positions.

10. In a rotary engine, in combination, a power-shaft, a compound rotary cylinder rigid on the power-shaft and composed of a series of radial cylinders, a series of radial pistons reciprocating in the radial cylinders, a casing surrounding the compound rotary cylinder, the inner wall of which curves inwardly in opposite directions, in abrupt inclines, to meet the compound rotary cylinder to form an intermediate abutment, an exhaust-chamber concentric with the cylindrical casing, the upper portion of its division-wall being perforated, side disks rigid with the compound rotary cylinder provided with radial grooves adapted for the sliding reception of the radial pistons and means for introducing and exhausting, in opposite directions, the steam employed against the pistons and for forcing the pistons into their operative positions.

11. In a rotary engine, in combination, a revolving power-shaft, a stationary shaft within the revolving power-shaft, a compound rotary cylinder rigid on the revolving power-shaft and composed of a series of radial cylinders, a series of radial pistons reciprocating in the radial cylinders, a casing surrounding the compound rotary cylinder, the inner wall of which curves inwardly in opposite directions, in abrupt inclines, to meet the compound rotary cylinder to form an intermediate abutment, an exhaust-chamber concentric with the cylindrical casing, the upper portion of its division-wall being perforated, side disks rigid with the compound rotary cylinder provided with radial grooves adapted for the sliding reception of the radial pistons, means for introducing and exhausting in opposite directions, the steam employed against the pistons and a cam rigid on the stationary shaft for forcing the pistons into their operative positions.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

BENJAMIN F. AUGUSTINE.

Witnesses:
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