No. 869,120. PATENTED OCT. 22, 1907.

T. J. WESTERMAN.

TURBINE.

APPLICATION FILED MAR. 8, 1907.

4 SHEETS—SHEET 1.

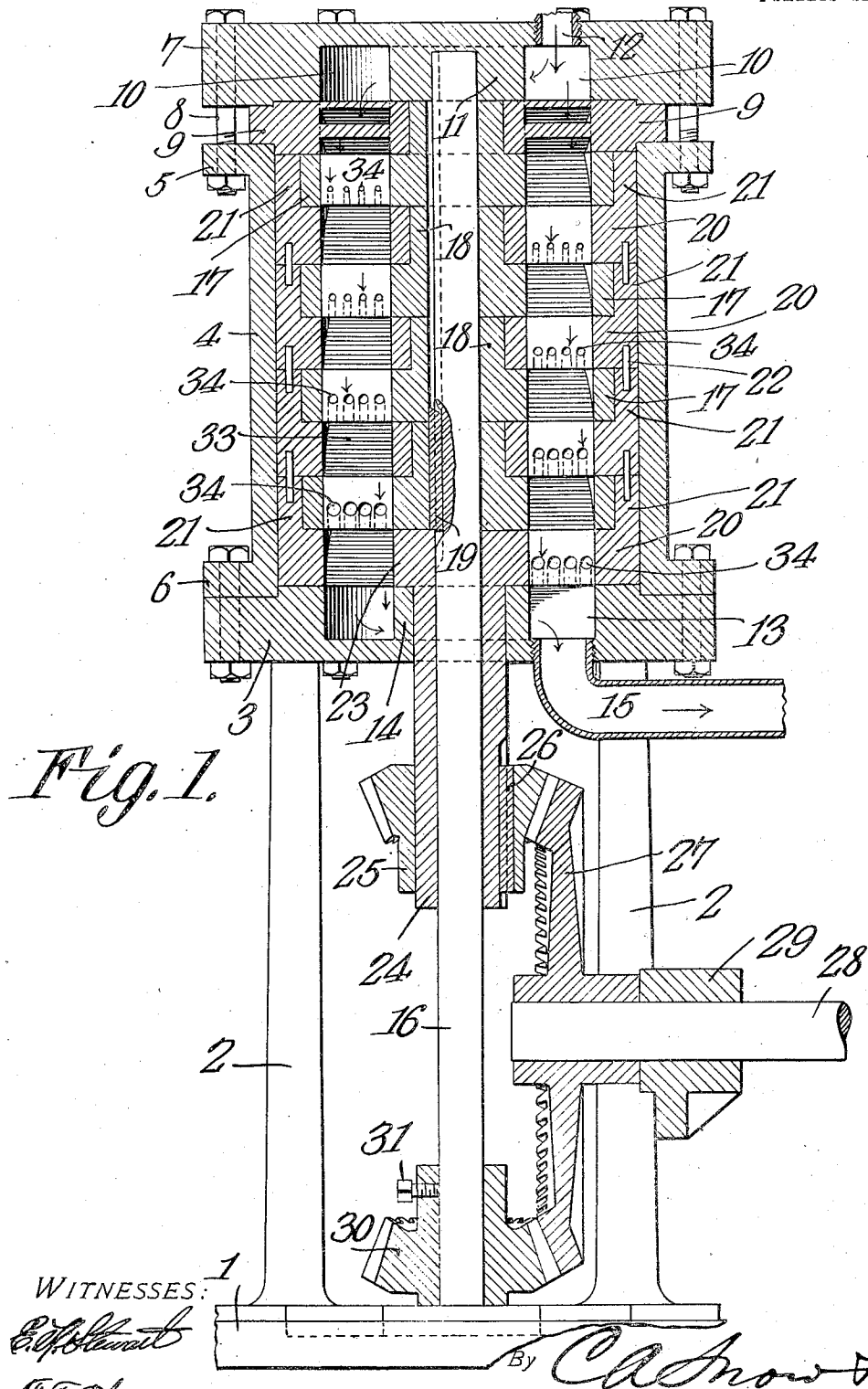

Fig. 1.

Thomas J. Westerman
INVENTOR.

WITNESSES:

E. F. Bleistadt

F. J. Chapman

By C. A. Snow & Co.

ATTORNEYS

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4 SHEETS—SHEET 2.

Fig. 2.

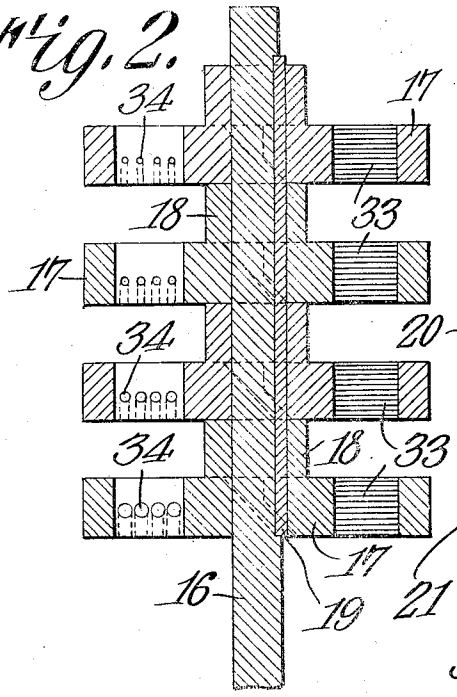


Fig. 3.

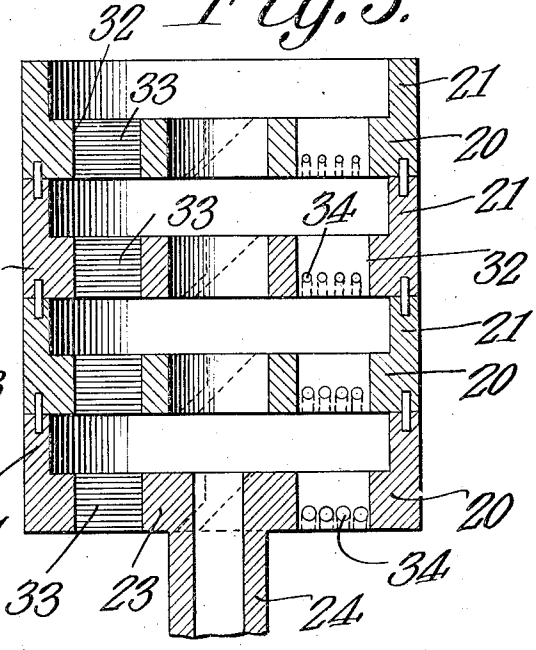


Fig. 4.

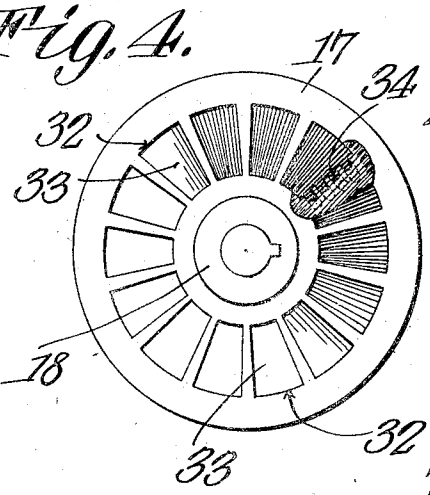
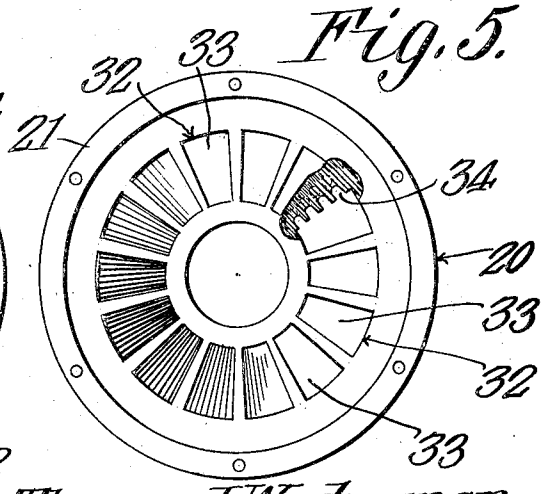


Fig. 5.



Thomas J. Westerman,

INVENTOR

WITNESSES:

E. H. Stewart

F. T. Chapman

By C. A. Snow & Co.

ATTORNEYS

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4 SHEETS—SHEET 3.

Fig. 6.

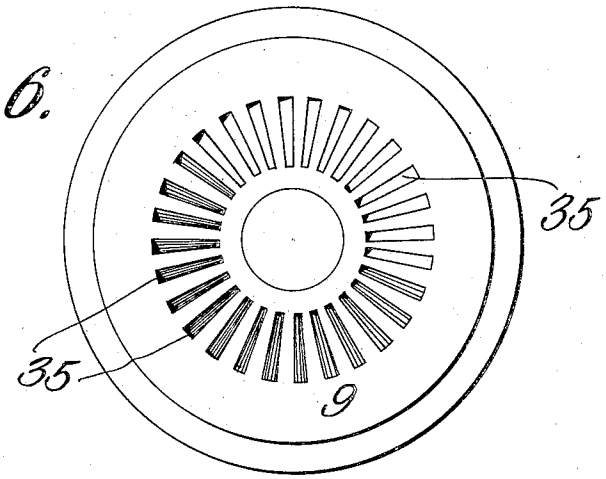


Fig. 7.

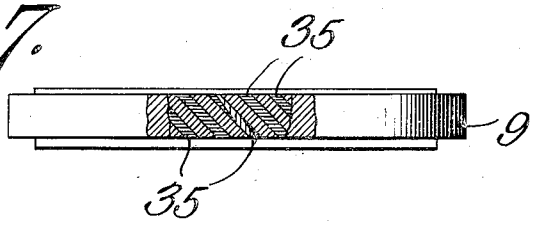
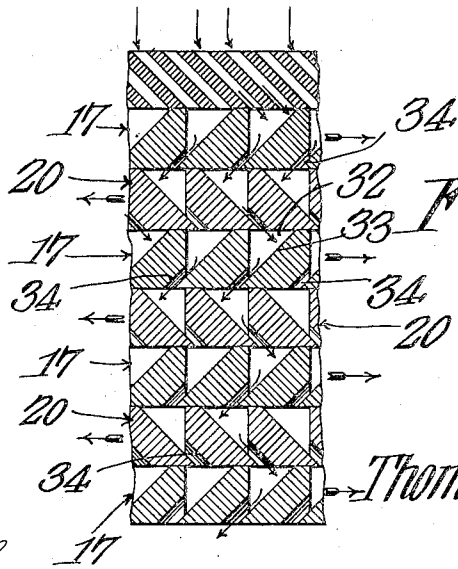


Fig. 8.



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4 SHEETS—SHEET 4.

Fig. 9.

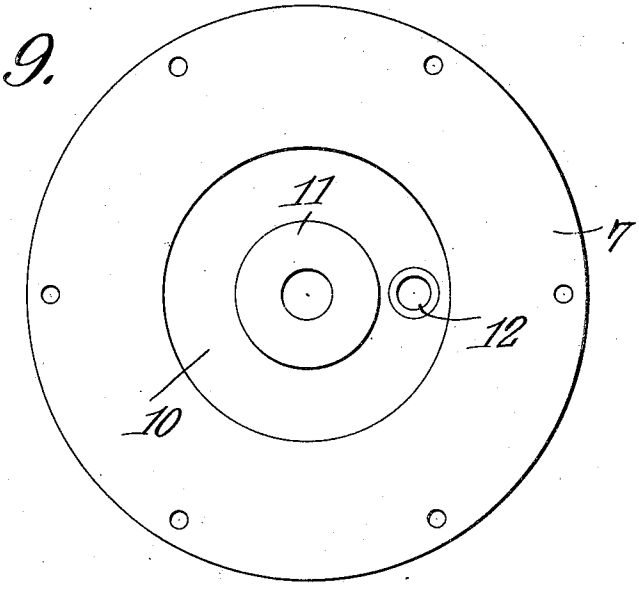
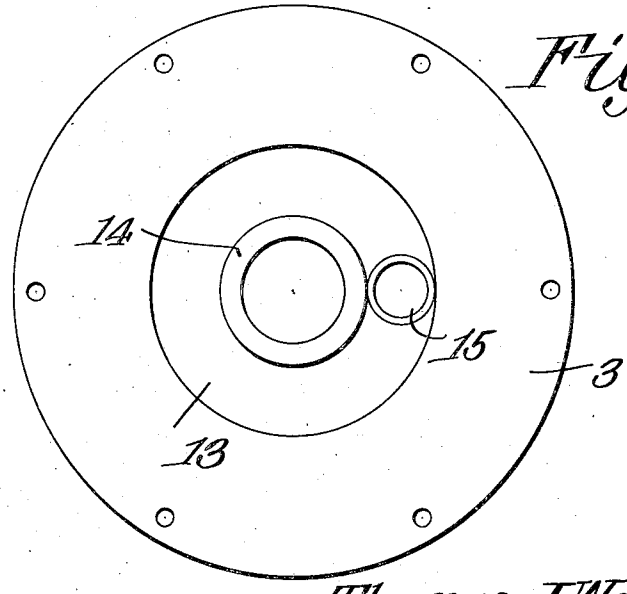


Fig. 10.



WITNESSES:

E. C. Stewart

F. T. Chapman

Thomas J. Westerman,
INVENTOR

By C. A. Snow & Co.
ATTORNEYS

UNITED STATES PATENT OFFICE.

THOMAS JAMES WESTERMAN, OF OLALLA, WASHINGTON.

TURBINE.

No. 869,120. Specification of Letters Patent. Patented Oct. 22, 1907.

Application filed March 8, 1907. Serial No. 361,363.

To all whom it may concern:

Be it known that I, THOMAS JAMES WESTERMAN, a citizen of the United States, residing at Olalla, in the county of Kitsap and State of Washington, have invented a new and useful Turbine-Engine, of which the following is a specification.

This invention has reference to improvements in steam turbines, and its object is to produce a rotary steam engine of the reaction type carrying steam under initial high pressure which is caused to impinge upon a series of rotary members in succession, the said members being capable of rotating in opposite directions, all those members rotating in one direction being coupled for simultaneous rotation and all those members rotating in the other direction being also coupled for simultaneous rotation.

The invention comprises means whereby steam under initial high pressure is directed in jets against a surface at right angles thereto and from thence is directed against the next adjacent surface rotating in the opposite direction at right angles thereto, and so on through the system whereby the greatest resultant rotary force is obtained from the steam jets throughout the whole system, provision being made for the constantly decreasing force of the steam so that its impelling effect remains practically constant as it is gradually expanded and therefore has less pressure.

The invention will be fully understood from the following detailed description wherein reference is made to the accompanying drawings forming part of this specification, in which,—

Figure 1 is a central vertical section through the improved steam turbine; Fig. 2 is a similar section through one of the assembled series of reaction disks constituting one of the rotary members of the steam turbine; Fig. 3 is a similar section through the other member; Fig. 4 is a top plan view, with parts in section, of the structure shown in Fig. 2; Fig. 5 is a top plan view, with parts broken away, of the structure shown in Fig. 3; Fig. 6 is a plan view of the steam inlet ports; Fig. 7 is a side view, partly broken away, of the same; Fig. 8 is a displayed sectional view through a portion of the assembled rotary parts of the turbine and the steam inlet ports to show the course of the steam through the turbine; Fig. 9 is a bottom plan view of the cap plate of the machine; and Fig. 10 is a top plan view of the bottom plate of the machine.

Referring to the drawings, there is shown a base or bed-plate 1 upon which is mounted a number of columns 2 forming the support for a circular bottom plate or head 3 to be hereinafter described. This bottom plate has securely bolted thereto a cylindrical casing 4 having top and bottom annular flanges 5—6, and to the said casing 4 there is secured a top plate or head 7 by bolts 8 or otherwise but the top plate or head 7 is separated from the cylinder 4 by an interposed annular plate or disk 9, to be hereinafter described. The head 7 has formed on its under side an annular channel 10 around the hub 11 and into this channel extends the end 12 of a steam inlet pipe coming from some suitable source of steam under pressure. The lower head 3 has a similar annular channel 13 formed in its upper face and surrounding the hub 14, and this channel 13 is in communication with a steam exhaust pipe 15 leading to some point of discharge.

Extending centrally through the casing 4 is an upright shaft 16 having a bearing in its upper end in the hub 11 and having a step bearing in the base 1. Mounted upon this shaft is a series of disks 17 each provided on one side with a hub 18 which abuts against the next adjacent disk and serves to separate the disks one from the other. All the disks 17 are caused to rotate together and with the shaft by means of a spline 19.

Mounted upon the hubs 18 of the disks 17 are other disks 20 intermediate of the disks 17 and extending radially beyond the peripheries of the said disks 17 where they are provided with annular flanges 21 overlapping the disks 17 and abutting against the next adjacent disks 20 except in the case of the topmost disk 20 where the flange 21 abuts against the under face of the annular plate 9 clamped between the casing 4 and the head 7. The contiguous or meeting edges of the flanges 21 and next adjacent disks 20 are provided with matching perforations in which are fitted dowel pins serving to connect the entire series of disks 20 for simultaneous rotation.

The lowermost disk 20 does not bear upon a hub 18 but is provided with its own hub 23 embracing the shaft 16 and freely rotatable thereon. Extending from the hub 23 is a sleeve 24 passing through the hub 14 of the lower head 3 and below the same receiving a bevel pinion 25 made fast to the said sleeve by means of a spline 26 to rotate therewith.

The pinion 25 meshes with a large bevel pinion 27 mounted upon a shaft 28 by means of which power is transmitted from the turbine to the machinery to be driven, and this shaft has a journal bearing 29 which may be fast to the contiguous columns 2 or otherwise supported upon the base plate 1. Upon the lower end of the shaft 16 there is fast a bevel pinion 30 meshing with the gear wheel 27 and secured to the shaft by a set-screw 31 or otherwise. The construction of this trans-

mission gear is such that rotary motion is imparted to the shaft 28 by the combined action of the gears 25 and 30 rotated in opposite directions by the oppositely-rotating members of the turbine.

The steam ports or buckets in the several disks 17 and 20 are in general structure the same, and each consists of a sectoral chamber 32 having a wall 33 inclined at an angle of forty-five degrees to the plane of rotation of the disk, the chamber thus being segmental at its widest point and triangular in cross section with the apex of the triangle located on a radius of the disk and close to the other face of the disk, which, in the structure shown in the drawings, is the lower face of the disk. Upon the radial lower edge of the triangular port are circular passages 34 in line with the inclined face 33 and these passages lead into the port 32 of the next adjacent disk in order at such an angle that steam leaving the passages 34 will impinge upon the inclined walls 33 of those next adjacent ports at an angle of ninety degrees.

The disk or plate 9 is provided with a circular series of inclined passages 35 radially disposed with relation to the axis of the plate and inclined at an angle of forty-five degrees to the plane of rotation of the disks next adjacent thereto, so that steam passing through the passages 35 will impinge upon the walls 33 of the ports 32 at an angle of ninety degrees. Steam under pressure entering through the pipe 12 will circulate around through the passage 10 and passing through the inclined passages 35 will strike the walls 33 of the first disk 17 next adjacent to the plate 9 and the steam will then escape through the passages 34 and entering the ports in the next adjacent disk 20 will strike the walls 33 thereof at an angle of ninety degrees to the said walls but in a direction displaced ninety degrees from the angle of impact of the steam with the walls 33 of the first-mentioned disk 17. The course of the steam through the remaining disks will be alternately to the right and left, as indicated most clearly in Fig. 8, and, as will be clearly apparent, the two sets of disks 17 and 20 will be set in rotation in opposite directions and their motion will be transmitted to the gear wheel 27 and shaft 28. The steam, however, in its course through the turbine has expanded and therefore the passages 34 are made progressively larger from the inlet end of the turbine toward the outlet end in order that there may be no choking effect and in order that the action of the steam on the several disks may be practically constant. The number of disks and the pressure of the steam will be suitably adjusted in operation. By arranging the disks horizontally and the shaft vertically all condensed steam will find its way readily to the exhaust pipe 15 and so be expelled from the turbine.

The manner in which we have constructed the turbine enables us to replace damaged parts without the necessity of entirely dismantling the turbine or removing any fastening devices since the disks are interlocking and therefore a part may be readily removed and another put in its place without disturbing any parts below it.

It will be understood, of course, that all meeting surfaces contiguous to the steam ports are made steam-tight. It will also be understood that while we have in the foregoing description spoken of steam under pressure as the motive fluid, any other compressed fluid or fluid under a head may be used.

It will be observed that the ported disks constituting the rotors of the turbine are solid structures moving in close contact, so that there is no loss by leakage between the surfaces and for this reason, by the addition of a suitable means for exploding charges, the engine may be used as an explosive engine, since the parts are solidly enough constructed to withstand the shocks of the explosions.

Should wear between the surfaces occur, there would still be no leakage since the parts will gravitate together and still form steam-tight joints, although this would be true only of the vertical type of engine, for it will be understood that our turbine may be placed horizontally if so desired.

We claim:—

1. In a turbine, a series of rotatable ported disks each having a peripheral flange extended to and connected with the next adjacent disk of the series, and another series of ported disks housed in the spaces between the first-mentioned series of disks and provided with spacing hubs constituting bearings for the said first-mentioned series of disks.

2. In a turbine, a series of spaced rotatable ported disks having peripheral flanges constituting spacing means, pin connections between the meeting faces of the flanges and the next adjacent disks, and another series of ported disks housed in the spaces between the disks of the first-mentioned series and having spacing hubs constituting journal bearings for the first-mentioned series of disks.

3. A turbine comprising a series of ported disks having spacing hubs and mounted upon and connected to a common shaft, another series of ported disks mounted upon the hubs of the first-mentioned disks and having peripheral flanges encircling the peripheries of the first-mentioned disks, pin connections between the meeting faces of the flanges and the next adjacent members of the same series of disks, a final member of the second series of disks carried by and free to rotate with the shaft and provided with an extended sleeve, gearing connections between the sleeve, shaft and a driven shaft, a ported distributing fixed disk adjacent to one end of the first-mentioned series of disks, a casing for both series of disks, a distributing head carried by the casing and opening into the ports of the distributing disk, and another head having a channel communicating with the ports in the exhaust end of the system.

4. In a turbine, adjacent disks rotating in opposite directions and each provided with ports or buckets having inclined walls, the walls of the buckets in each disk inclining at an angle of forty-five degrees to the plane of rotation of the disk but at an angle of ninety degrees to the inclination of the walls of the buckets of the next adjacent disk, and passages from said buckets to the buckets of the next adjacent disk arranged in line with the inclined walls of the disk wherein they are formed.

5. In a turbine, a rotatable disk having a circular series of ports or buckets extending therethrough, each of said ports having a wide mouth and a series of narrow passages or throats leading therefrom and having an impinging surface for the incoming fluid under pressure, arranged at an angle of ninety degrees to the direction of impact of the fluid and at an angle of forty-five degrees to the plane of rotation of the disk.

6. A turbine comprising a suitable casing, a distributing head, a stationary ported disk with ports inclined at an angle of forty-five degrees to the plane of rotation of the rotary ports of the turbine, two series of oppositely rotating disks having ports or buckets with wide mouths and narrow directing throats, the buckets of each disk having impinging walls at right angles to the impinging walls of the next adjacent disk, an exhaust receiving head, a shaft moving with and carrying one series of disks, jour-

nal bearings for the other series of disks upon the first series of disks, and interconnected means for converting the motions of the two oppositely rotating series of disks into a resultant motion in one direction.

7. In a turbine, a series of rotatable disks each having parallel faces and an annular series of ports, and another series of disks each having parallel faces and an annular series of ports matching the ports of the first-mentioned disks, the said second series of disks housing the first series of disks and having journal supports on said first series of disks.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

THOMAS JAMES WESTERMAN.

Witnesses:
HENRY PFUNDT,
MRS. J. E. GREEN.