W. BARRE.

STEAM TURBINE.

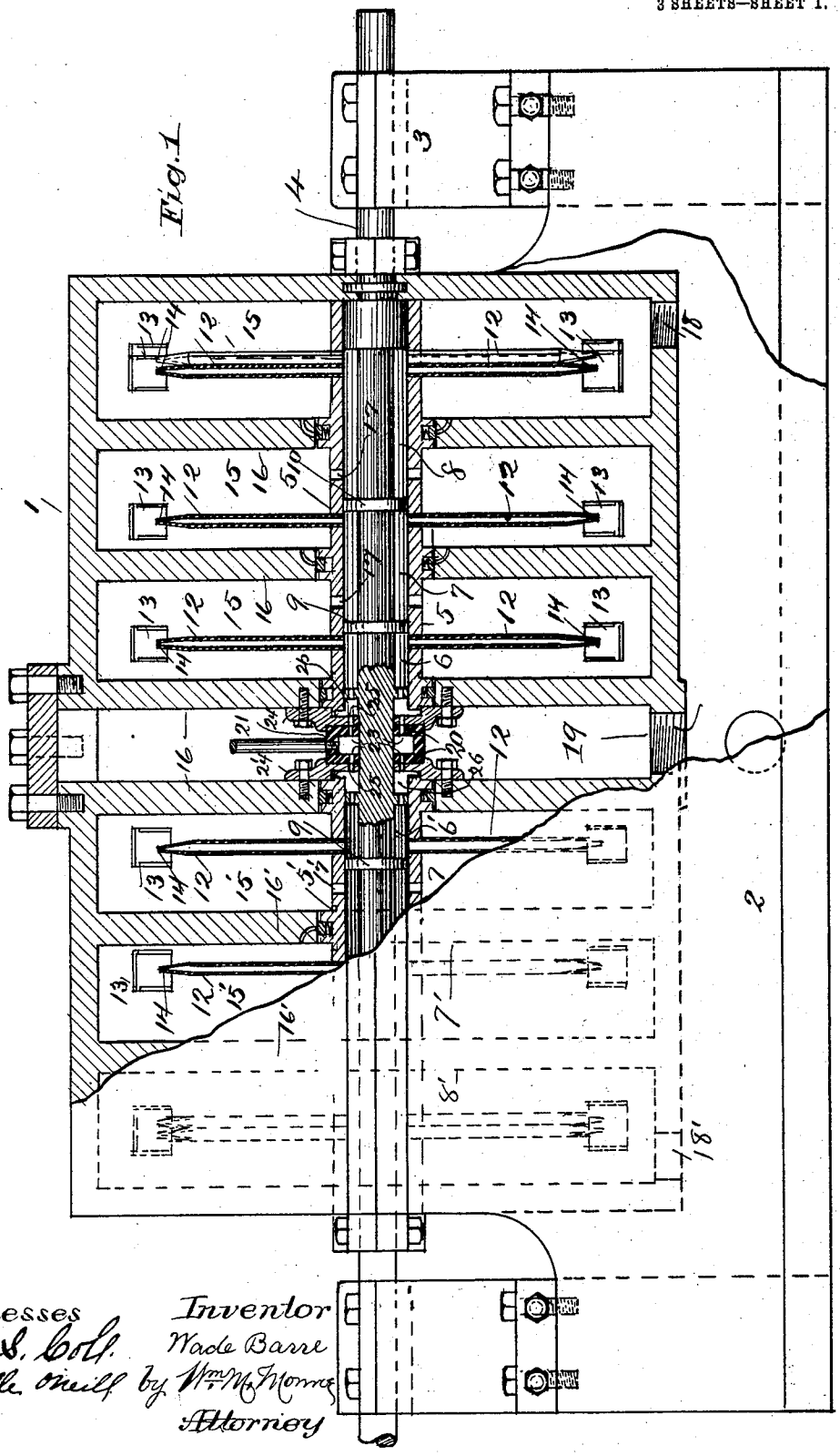
APPLICATION FILED FEB. 4, 1909.

934,497.

Patented Sept. 21, 1909.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses
Geo. S. Goff.
Lucille O'Neill

Inventor
Wade Barre
by Wm. McMorrow
Attorney

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3 SHEETS—SHEET 2.

Fig. 2

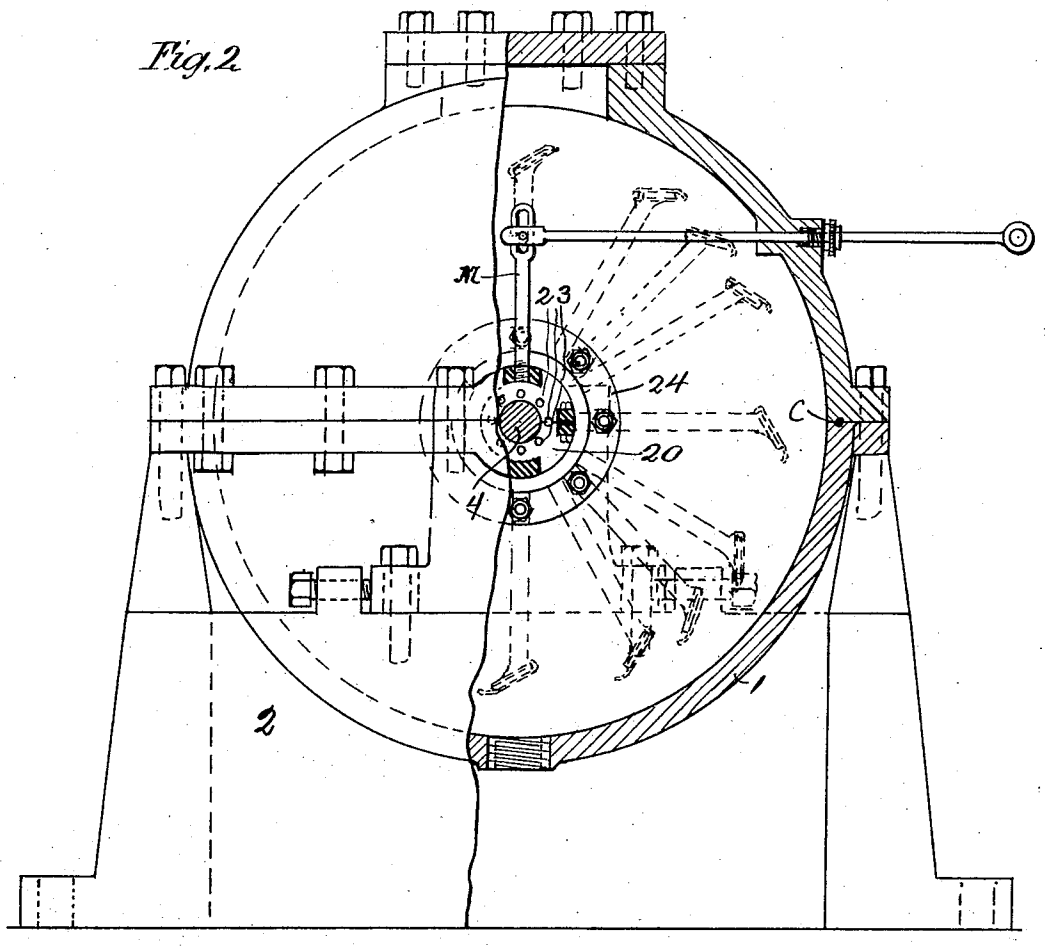
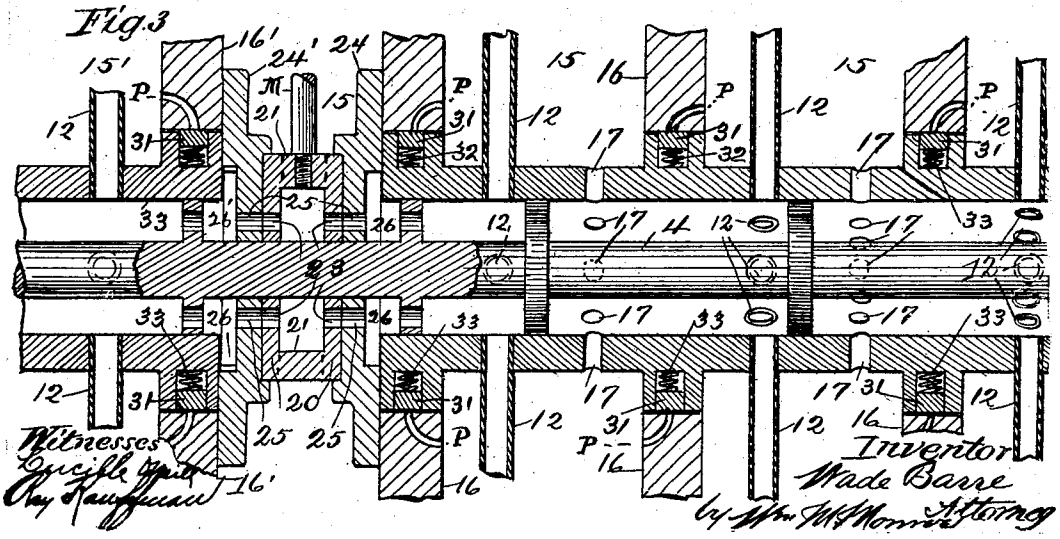


Fig. 3



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3 SHEETS—SHEET 3.

Fig. 4

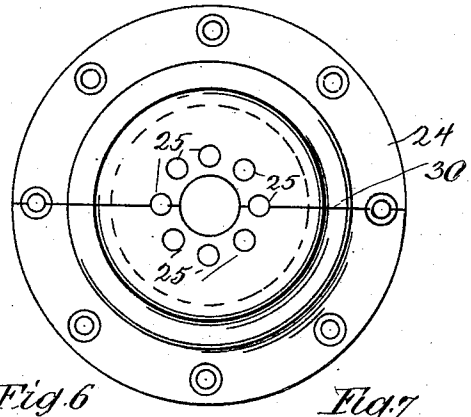


Fig. 5

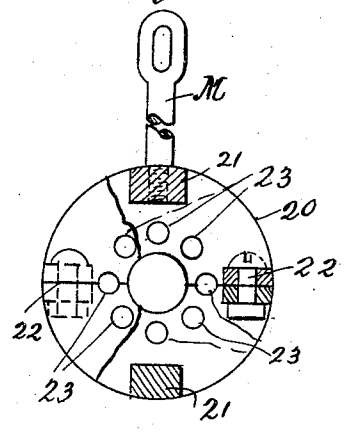


Fig. 6

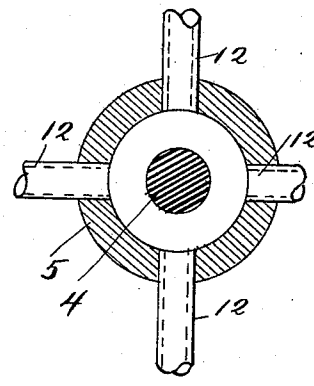


Fig. 7

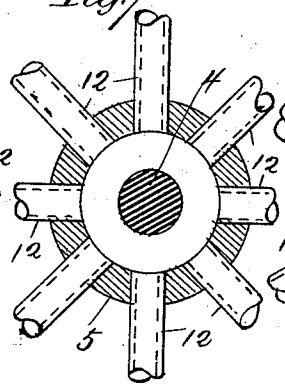


Fig. 8

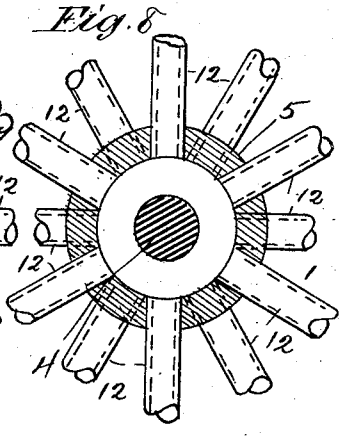


Fig. 9

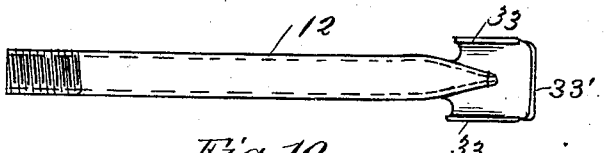
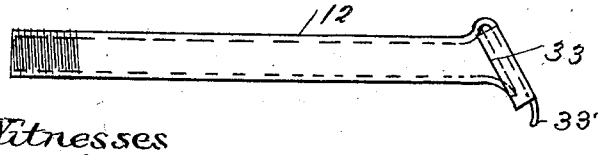


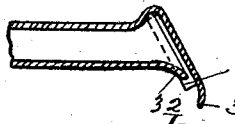
Fig. 10



Witnesses

Lucille O'Neill.

Fig. 11.



Inventor

Wade Barre

by Wm. M. Hoover

Attorney

UNITED STATES PATENT OFFICE.

WADE BARRE, OF CLEVELAND, OHIO.

STEAM-TURBINE.

934,497. Specification of Letters Patent. Patented Sept. 21, 1909.

Application filed February 4, 1909. Serial No. 476,009.

To all whom it may concern:

Be it known that I, WADE BARRE, a citizen of the United States, and resident of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Steam-Turbines, of which I hereby declare the following to be a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

The objects of the invention are to provide a steam turbine engine in which both the kinetic energy of the steam and the reaction from inclined blades are employed to rotate an axial shaft. The steam is also used expensively in consecutive stages. And the device is designed to possess features of peculiar efficiency and practicability in the art in the following particulars. The action of the steam upon the rotating blades is continuous, and the distance from each nozzle to its corresponding blade never varies, hence the kinetic energy of the steam is always a permanent quantity. The action of the steam is circumferential in direction, hence no end pressure upon the shaft is produced, and all pressure is utilized in the direction of rotation of the blades, whereas in ordinary types some pressure is directed longitudinally of the shaft and its influence upon the direction of movement is lost.

The arrangement of parts is such that no blowing through between the blades and the casing is possible and hence no leakage can occur, such as is due to wearing away of the adjacent parts, also no choking at one side due to settling of parts can occur.

The device is simplified by dispensing with stationary blades, and blade holders. The blades operated by expanded steam, revolve at the same circumferential speed as those for high pressure steam, and hence there is no retaring influence due to the difference in speed between the steam and blades. A less number of blades also can be employed since, the steam continually follows the blades, and the nozzles revolve with them, so that the distance from the mouth of the nozzle to its blade is not variable. Again no disks closely packed together are employed. And the nozzles are so arranged that the steam pressure is equalized therein, for this reason there is no danger of them giving way under pressure. The steam always has a free passage and no stationary baffling plates of any kind are employed. The blades can not be worn away by the steam pressure since the steam does not impinge on their edges. The nozzles and supporting tubes therefore revolve in steam under pressure, and all parts are balanced, radially and longitudinally, so that there is no longitudinal pressure on the blades. The shaft also is perfectly balanced in steam.

The invention further comprises the combination and arrangement of the various parts and construction of details as hereinafter described, shown in the accompanying drawings and specifically pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical longitudinal section of the device, showing the steam valve, steam chambers, and rotating blades mounted upon radial tubes; Fig. 2 is a transverse section thereof; Fig. 3 is a longitudinal central section taken through the valve and steam chambers or chest, showing the shaft and sleeve adapted to rotate therewith; Fig. 4 is a face view of one of the steam chests; Fig. 5 is a transverse section of the valve; Figs. 6, 7 and 8 are transverse sections of the shaft and sleeve showing the radial steam tubes attached thereto, as arranged for the first, second and third stages of expanding steam; Fig. 9 is a rear elevation of one of the radial steam tubes, showing the deflecting plate attached thereto; Fig. 10 is a side elevation thereof; and Fig. 11 is a longitudinal central section thereof.

In these views 1 is a closed cylindrical inclosing case for the operating parts mounted upon a pedestal 2, which is provided with longitudinal bearing 3, 3, for the axial shaft 4. This shaft passes centrally through the sleeve 5, which is concentric with the shaft and is spaced therefrom, to provide steam passages 6, 7, 8, and 6′, 7′, 8′, respectively, separated by partitions 9, 10, and 9′, 10′, respectively.

The shaft and sleeve rotate together within the casing 1, and radially extended steam conveying tubes 12, 12, extend into the inclosure of the casing. These tubes are provided at their extremities with deflector blades 13, 13, inclined preferably at an angle of 120°, against which the steam impinges as it is projected through reduced nozzles 14, 14, at the outer extremities of the tubes. The blades are integral with or are rigidly attached to the nozzles, so that the striking distance between the orifices of the nozzles

and the blades is always maintained the same, and the efficiency of the steam jets always remains constant.

The tubes 12, 12 are arranged circumferentially about the sleeve in sets or stages, and the casing is separated into expansion chambers, 15, 15 and 15′, 15′ respectively by means of transverse partitions, 16, 16 and 16′, 16′ respectively.

The steam enters each chamber through the steam tubes and after it has had its effect and exerted its force upon the blades reënters the annular chambers through the radial openings 17, 17 and 17′, 17′, respectively, and finally passes out at the exhaust openings 18 and 18 one at each end of the casing.

The steam enters centrally of the casing at 19, and first passes into a hollow valve formed of two disks 20, 20, secured together by means of spacers 21, 21, and preferably formed in halves bolted together at 22, 22 for convenience in placing. This valve is provided with openings 23, 23 for the passage of steam, and rotates in the steam chests, 24, 24 which are provided with corresponding steam ports 25, 25 which lead to one of the annular chambers about the shaft through the recessed chambers 26 and 26 in the inner walls of the steam chests.

Through the central valve the steam passes through the first annular chamber on each side of the valve into the first set or stage of radial steam tubes, thence through the radial passages 17 and 17 to the next annular chamber, and continuing in this manner passes through all the radial tubes and annular chambers on both sides of the valve to the exhaust openings in the ends of the casing.

The steam tubes are gradually increased in number in the several partitioned chambers to accommodate the expansion of the steam, but are not increased in length, since the rotating speed is the same. For instance in Fig. 6 four tubes are shown, in Fig. 7 eight tubes are shown, and in Fig. 8 twelve tubes are shown placed in staggered order to permit of their insertion in the sleeve. The full effect of the velocity of the expanded steam is therefore utilized. The valve is operated by means of a stem M. The upper portion of the casing is detachable for repairs or observation, and the steam chests are also separable on the center line at 30. Suitable steam tight joints are formed for the sleeve in the partition walls of the casing and may comprise friction rings 31, 31 formed in sections and held against the partitions by means of springs 32, 32. The friction upon these rings is reduced by steam pressure introduced through passages P, P. The valve can be automatically operated in connection with any desired form of governor as desired.

The form of nozzles shown employ a straight tube, flattened at the outer end which is inclined at the angle of the plate and separated therefrom by a predetermined distance preferably $\frac{1}{16}$ of an inch. The lateral and lower edges also turn slightly outward and downward. Thus giving the maximum of effective reaction from the steam pressure.

The lateral and terminal edges of the blades are somewhat downwardly curved at 33, and 33′, to give positive direction to the jet, so that the kinetic force and reaction of the steam are always exerted in a circumferential direction and no pressure longitudinally of the shaft can possibly take place. A copper wire C forms a horizontal joint between the sections of the casing.

Having described the invention what I claim as new and desire to secure by Letters Patent is;

1. In combination in a steam turbine, a casing, transverse partitions therein separating the same into a series of chambers, a central longitudinal shaft therein, a sleeve therefor separated therefrom by an annular space, annular partitions in said annular space on said shaft, forming corresponding chambers, a central steam inlet valve and a steam chest on each side thereof, registering steam ports in said valve and steam chests, communicating with the first annular chamber on each side thereof, a series of sets of radial steam tubes in said sleeve on each side of said valve, communicating respectively with said annular chambers, said steam tubes extending into the chambers in said casing, the said annular chambers communicating also with said chambers in said casing, and deflecting blades at the outer extremities of said steam tubes, the last chamber in said casing at each outer end provided with an exhaust passage.

2. In combination in a steam turbine, a cylindrical casing horizontally separable into two portions, partitions in said casing separating the same into a central chamber and expansion chambers on each side thereof, a central longitudinal shaft revoluble in said casing, an exterior sleeve therefor concentric therewith and spaced therefrom, partitions in said sleeve adapted to separate the same into a series of annular chambers concentric with the chambers in said casing, a valve and steam chests in said central chamber in said casing, said valve and steam chests provided with registering steam ports, adapted to admit steam to the inner chambers in said sleeve, a series of radial tubes extending from said sleeve into each expansion chamber in said casing, said series of tubes increasing in number from the next chamber outward on each side of said valve, and a deflecting plate for each tube, at its outer end, the said central chamber in said casing being provided with an inlet opening and the chambers farthest therefrom on each

side thereof with outlet openings, and the chambers in said sleeve provided with openings communicating with the respective chambers in said casing.

3. In a steam turbine, a cylindrical casing, a central inlet chamber therein intermediate of its ends, a series of exhaust chambers in said casing on each side of said central chambers, the outer chambers provided with outlet openings, a central longitudinal shaft in said casing, a sleeve supported thereon and spaced therefrom, partitions in said sleeve separating said space into annular chambers, radial tubes secured to said sleeve and extending into said chambers in said casing, said tubes increasing in number in stages from the inlet to the outlet sides of the turbine, deflectors upon the outer extremities of said tubes, oppositely placed steam chests upon the walls of the said central chamber in the casing, a rotary valve centrally secured between said steam chests, said valve and chests provided with registering steam ports and means for rotating said valve.

4. In a steam turbine, a casing, central inlet and expansion chambers therein, said expansion chambers arranged in series extending on both sides of said central chamber, the outer chambers provided with outlet openings, a shaft extending through all said chambers, a sleeve concentric with said shaft and spaced therefrom, partitions separating the annular space thus formed into a series of successive chambers along said shaft, said chambers in said sleeve communicating with the chambers in said casing respectively, a series of steam tubes extending radially from said sleeve, one set thereof for each chamber, deflecting plates at the extremities of said tubes, oppositely placed disk shaped steam chests secured around said shaft in said central chambers, a rotatable valve secured between said chests, said valve provided with a central inlet opening and said valve and chests provided with registering ports, communicating with the first annular chambers in said sleeve and means for rotating said valve.

5. The combination in a steam turbine, with a casing, and a central inlet chamber and expansion chambers extending on both sides from said central chambers, of a shaft and sleeve inclosing annular chambers concentric therewith and communicating with said expansion chambers, radial steam tubes in said sleeve, and deflector plates therefor, and a common valve and steam chests for said annular and expansion chambers, said chests secured to the opposite walls of said central chamber, and the said valve intermediate of said chests, said valve and chests provided with registering ports for steam inlet and the terminal chambers provided with outlet openings.

6. In a steam turbine, a casing, a central chamber therein, a shaft centrally placed therein, disk shaped steam chests secured to the opposite walls of said chambers around said shaft, said chests provided each with a steam recess, a rotary valve, intermediate between said chests, the engaging faces of said valve and chests provided with registering steam ports, said valve provided with a central opening, communicating with said ports, and a valve stem secured to said valve.

7. In a steam turbine, the combination with a series of expansion chambers and an intermediate inlet chamber, of a central shaft passing therethrough, a sleeve on each side of said central chamber, said sleeve inclosing annular chambers concentric with said shaft, said annular chambers communicating with said expansion chambers, a valve and steam chests in said central chambers, said valve and chests provided with registering ports communicating respectively with the inner annular chambers, and radial steam tubes extending from said sleeve into each expansion chamber, and a deflector blade at the extremity of each tube.

8. In a turbine, a steam motor tube, and a deflector blade therefor secured thereto, said steam tube reduced at its outer end and said deflector plate inclined at an angle to said tube, and spaced from the outer end thereof.

9. In a steam turbine, a steam motor tube therefor, said tube reduced at its outer end, an inclined blade secured to the outer end of said tube, the lateral and terminal edges of said blade being curved outwardly.

In testimony whereof, I hereunto set my hand this 30″ day of January 1909.

WADE BARRE.

In presence of—
WM. M. MONROE,
GEO. S. COLE.