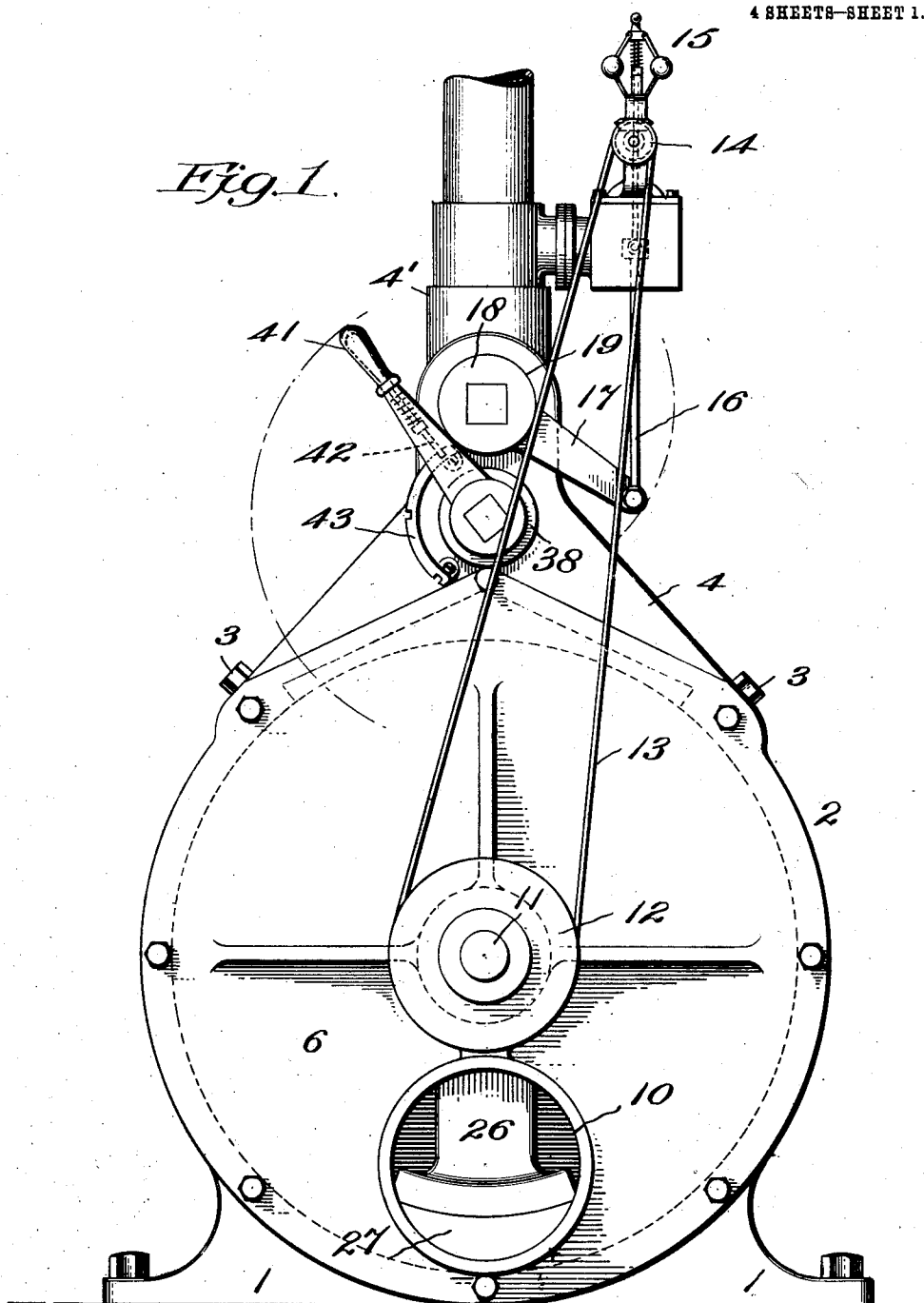


H. A. McCULLOCK.
 REVERSIBLE TURBINE.
 APPLICATION FILED MAY 10, 1912.

1,061,858.

Patented May 13, 1913.

4 SHEETS—SHEET 1.



Witnesses:
 C. James Cronin
 J. A. Byrne.

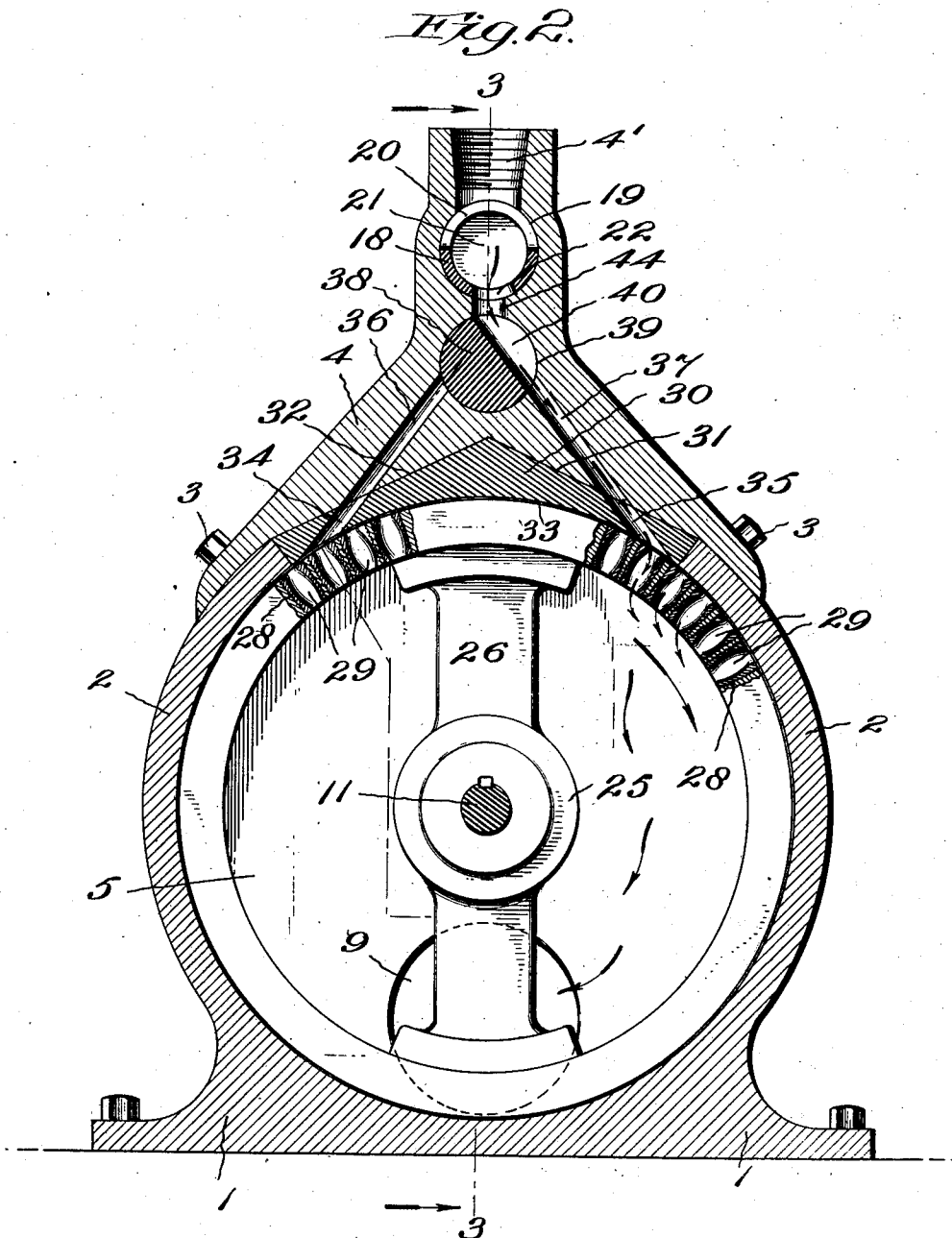
Inventor
 Henry A. McCulloch
 By Attorney
 Victor J. Evans

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4 SHEETS—SHEET 2.



Witnesses:
C. James Cronin
Geo. A. Dupul.

Inventor
Henry A. McCulloch
 By *Attorney*
Victor J. Evans

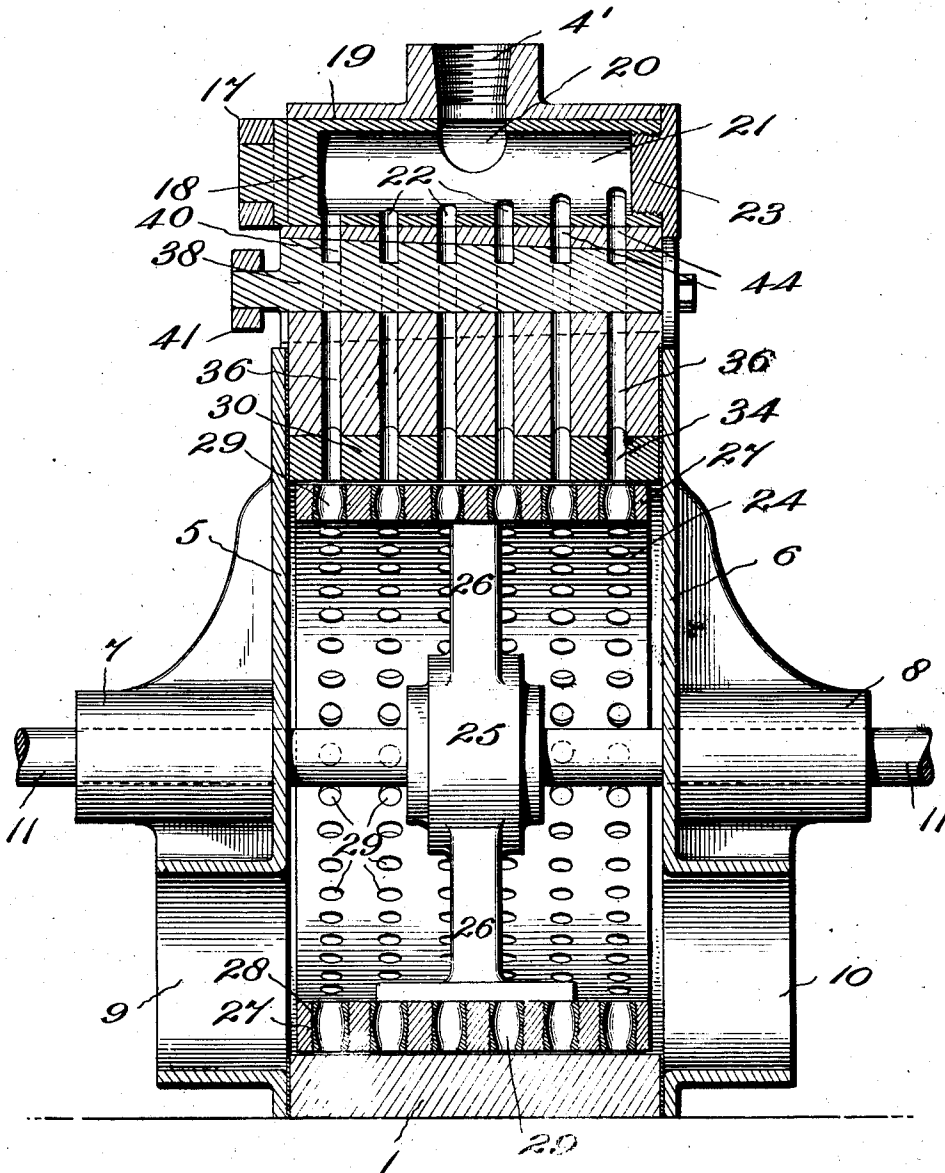
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4 SHEETS—SHEET 3.

Fig. 3.



Witnesses:
 C. James Cronin
 Geo. A. B. Bue

Inventor
 Henry A. McCulloch
 By Attorney
 Victor J. Evans

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4 SHEETS—SHEET 4.

Fig. 4.

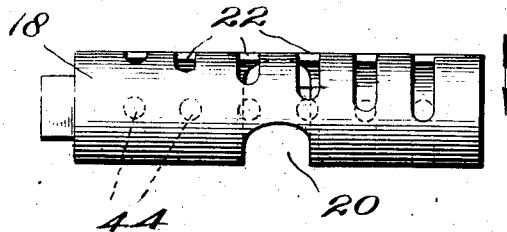


Fig. 5.

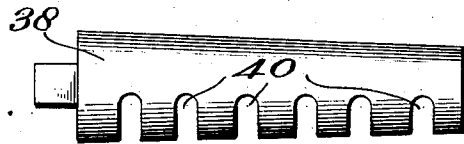


Fig. 6.

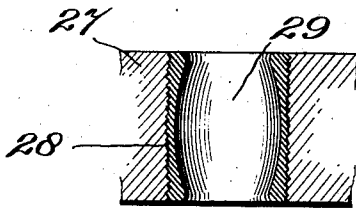
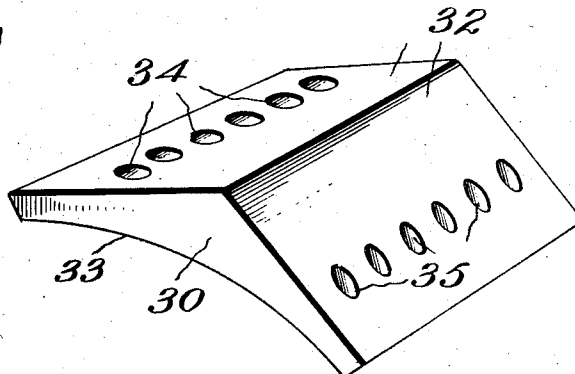


Fig. 7.



Witnesses:
 C. James Cronin
 Geo. A. Byrne.

Inventor
 Henry A. McCulloch
 By Attorney
 Victor J. Evans

UNITED STATES PATENT OFFICE.

HENRY A. McCULLOCH, OF NEW YORK, N. Y.

REVERSIBLE TURBINE.

1,061,858.

Specification of Letters Patent.

Patented May 13, 1913.

Application filed May 10, 1912. Serial No. 696,437.

To all whom it may concern:

Be it known that I, HENRY A. McCULLOCH, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented new and useful Improvements in Reversible Turbine-Engines, of which the following is a specification.

This invention relates to certain new and useful improvements in reversible turbines; and has for its object to provide an engine of the improved type whereby the motive fluid shall be economically utilized.

A further object of the invention is to provide a turbine in which the pockets of the rotor are so arranged around its periphery that they may receive the fullest impact and pressure of the motive fluid.

A still further object of the invention is to provide a turbine of this type with a throttle valve having a plurality of different openings which may be automatically operated for regulating the speed of the turbine.

To these ends the invention consists in the novel details of construction and combination of parts more fully hereinafter described and particularly pointed out in the claims.

Referring to the accompanying drawings forming a part of this specification in which like numerals designate like parts in all the views:—Figure 1 is a side elevational view of a reversible steam turbine constructed in accordance with my invention. Fig. 2 is a transverse sectional view of the same. Fig. 3 is a cross sectional view taken on the line 3—3 of Fig. 2 and looking in the direction of the arrow. Fig. 4 is a detail plan view of the throttle valve. Fig. 5 is a detail plan view of the reversing valve. Fig. 6 is an enlarged detail cross sectional view of one of the bowl shaped pockets and Fig. 7 is a detail perspective view of the removable nozzle plate.

The frame of the turbine comprises the bed plate 1 which has formed thereon the cylinder-casing 2 to the top of which is connected by the bolts 3, the valve casing 4 which valve casing is provided in its upper portion with the usual steam inlet 4'. The cylinder heads 5 and 6, each of which are provided with the bearings 7 and 8 and exhaust outlets 9 and 10, are bolted to the cylinder-casing 2 and are adapted to support within the bearings 7 and 8 the main

shaft 11, which shaft has mounted thereon the belt wheel 12 over which passes a belt 13 to a governor pulley 14, the latter actuating an ordinary form of centrifugal governor 15 that controls, through the connecting rod 16 and arm 17, the throttle or governor valve 18. The throttle valve is held within the opening 19 in the upper portion of the valve casing 4 and is provided with a steam inlet 20, a central hollow portion 21 and a series of steam outlets 22, which outlets are gradually increased in length, the purpose of which will be hereinafter described. A head 23 closes one end of the throttle valve and also retains it within the opening 19 as shown in Fig. 3.

Keyed to the main shaft 11 within the cylinder-casing 2 is the rotor 24 which consists of a hub portion 25 and radial arms 26 to which are held the cylinder 27 which cylinder is provided with a series of openings 28 into which are screwed the bowl shaped steam pockets 29. To prevent considerable wear as is usual in engines of this type, a small space is provided between the periphery of the rotor and the casing. A removable nozzle plate 30 is seated within the cut away portion 31 of the valve casing and comprises the sloping top walls 32 and circular bottom wall 33. This nozzle plate is of the width of the rotor and is provided with two series of nozzles 34 and 35 which nozzles are arranged approximately tangentially so that the steam shall strike the bowl shaped pockets of the rotor, as it rotates, practically at right angles, and the whole power of the impact may be thus obtained.

Located within the valve casing 4 are two series of approximately tangentially arranged steam passages 36 and 37 which communicate with the nozzles 34 and 35 for delivering the steam thereto.

In order to govern the direction of the flow of the steam, and consequently the direction of the travel of the rotor, a reversing valve 38 is placed within the seat 39 of the valve casing, at a point between the governor valve 18 and nozzle plate 30. The reversing valve is provided with a series of slots 40 which communicate with the passages 36 or 37 for directing the steam to either side of the nozzle plate. The valve is also provided with an operating lever 41 which may be held in any one of three positions, forward, stop or reverse by the spring pressed pawl 42 engaging the

notched segment 43. A series of steam passages 44 are located within the valve casing between the throttle valve 18 and reversing valve 38 and are in direct communication with the outlets 22 of the throttle valve and the slots 40 of the reversing valve.

During the operation of the turbine, steam will pass through the inlet 20 of the throttle valve into the central hollow portion 21 where it is distributed to the outlets 22 from which it passes through the passages 44, slots 40 and passages 37 to the nozzles 35 which direct it against the bowl shaped pockets of the rotor, which, on account of lying approximately at right angles thereto receives the full impact of the steam and drives the rotor at a high rate of speed. The steam after having performed its work, passes into the interior of the rotor and on out through the exhaust ports located within each of the cylinder heads. Should the turbine reach an excessive speed, it will be automatically throttled by the action of the centrifugal governor, which, through the connecting rod 16 and arm 17 cause the throttle valve 18 to be turned so that the shorter ports therein are successively brought from alinement with the communicating passages 44. This effects a gradual reduction of the supply of steam to the nozzles until such time as the speed of the turbine becomes normal, after which the throttle valve will again be operated so that steam may again be supplied uniformly to all of the nozzles.

It is obvious that those skilled in the art may vary the details of construction and arrangements of parts without departing from the spirit of my invention and therefore I do not wish to be limited to such features except as may be required by the claims.

What I claim as new is,—

1. In a turbine, the combination with a casing provided with a plurality of steam passages, of a nozzle plate mounted within the casing, provided with steam outlets in alinement with the passages and a cylindrical rotor within the casing provided with a plurality of pockets passing through its wall, the interior of the rotor forming an exhaust chamber.

2. In a turbine, the combination with a casing provided with a plurality of steam passages, of a nozzle plate mounted within the casing provided with steam outlets in alinement with the steam passages, of a cylindrical rotor within the casing provided with a plurality of pockets passing through its wall, the interior of the rotor forming an exhaust chamber, and a means for controlling the passage of steam to the pockets successively.

3. In a turbine, the combination with a casing provided with a plurality of longitudinally disposed steam passages, of a nozzle

plate mounted within the casing provided with steam outlets in alinement with the steam passages, of a cylindrical rotor provided with a plurality of longitudinally disposed pockets passing through its wall and a means mounted within the casing adapted to control the passage of steam to the pockets successively.

4. In a turbine, the combination with a cylinder provided with a plurality of longitudinally disposed steam passages, of a reversing valve provided with slots in alinement with said steam passages, of heads provided with exhaust outlets mounted on said cylinder, and a cylindrical rotor provided with a plurality of pockets passing through its wall, the interior of the rotor forming an exhaust chamber.

5. In a turbine, the combination with a cylinder provided with a plurality of longitudinally disposed steam passages, means arranged to control the passage of steam to the steam passages, of a reversing valve provided with steam passages, of heads provided with the exhaust outlets mounted on said cylinder and a cylindrical rotor provided with a plurality of pockets passing through its wall, the interior of the rotor forming an exhaust chamber.

6. In a turbine, the combination with a casing provided with a cut-away portion and a plurality of angularly disposed steam passages, a nozzle plate mounted within the cut-away portion and provided with a plurality of angularly disposed outlets in alinement with the steam passages, a cylindrical rotor within the casing provided with a plurality of pockets, and a means for controlling the passage of steam to the pockets successively.

7. In a turbine, the combination of a casing provided with a plurality of steam passages, a rotor provided with a plurality of openings passing through its wall and removable steam pockets mounted within the openings.

8. In a turbine, the combination of a casing provided with a plurality of horizontally arranged and angularly disposed steam passages, a rotor provided with a plurality of horizontally arranged openings passing through its wall, and removable bowl-shaped steam pockets mounted within the openings.

9. In a turbine, the combination of a casing provided with a plurality of horizontally arranged and angularly disposed steam passages, a removable nozzle plate mounted within the casing provided with a plurality of horizontally arranged and angularly disposed steam outlets in alinement with the steam passages, and a rotor provided with a plurality of bowl-shaped pockets and a means for controlling the passage of steam to the pockets successively.

10. In a turbine, the combination of a casing provided with a cut-away portion, a nozzle plate mounted within the cut-away portion and provided with two series of oppositely disposed nozzles arranged approximately tangentially and a rotor provided with a plurality of steam pockets passing through its wall, said pockets adapted to receive the impact of the steam when at right angles to the nozzles.

11. In a turbine, a casing, a rotor mounted in the casing and provided with parallel arranged series of impact surfaces, the casing having fluid admitting portways leading to the respective impact surfaces, and means for controlling the admission of a working fluid to the portways in successive or collective order.

12. In a turbine, a casing, a rotor therein, said rotor having passageways therein arranged in parallel series and disposed parallel

with the axis of the rotor, the casing having portways leading to the respective series of passages, a valve adjustably supported by the casing and provided with portways adapted to control the admission of fluid to the first portways and arranged in different fluid admitting positions, and means for controlling the valve to bring the portways therein in successive registration with the portways on one position of the valve and for causing the collective registration of the portways of the valve with the said first portways on another position of the valve.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY A. McCULLOCH.

Witnesses:

JAMES F. DUHAMEL,
GEO. A. BYRNE.