(No Model.) 3 Sheets—Sheet 1.

F. W. REEVES.

RECIPROCATING ROTARY STEAM ENGINE.

No. 523,053. Patented July 17, 1894.

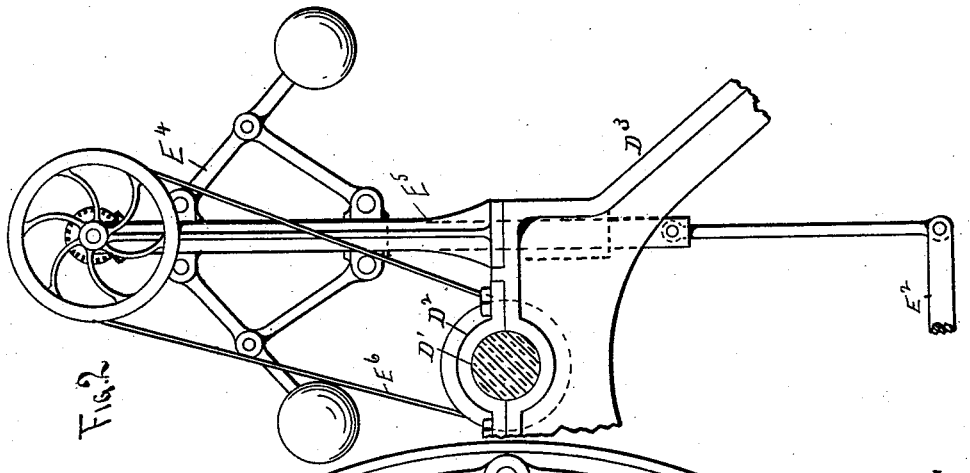

Fig. 2.

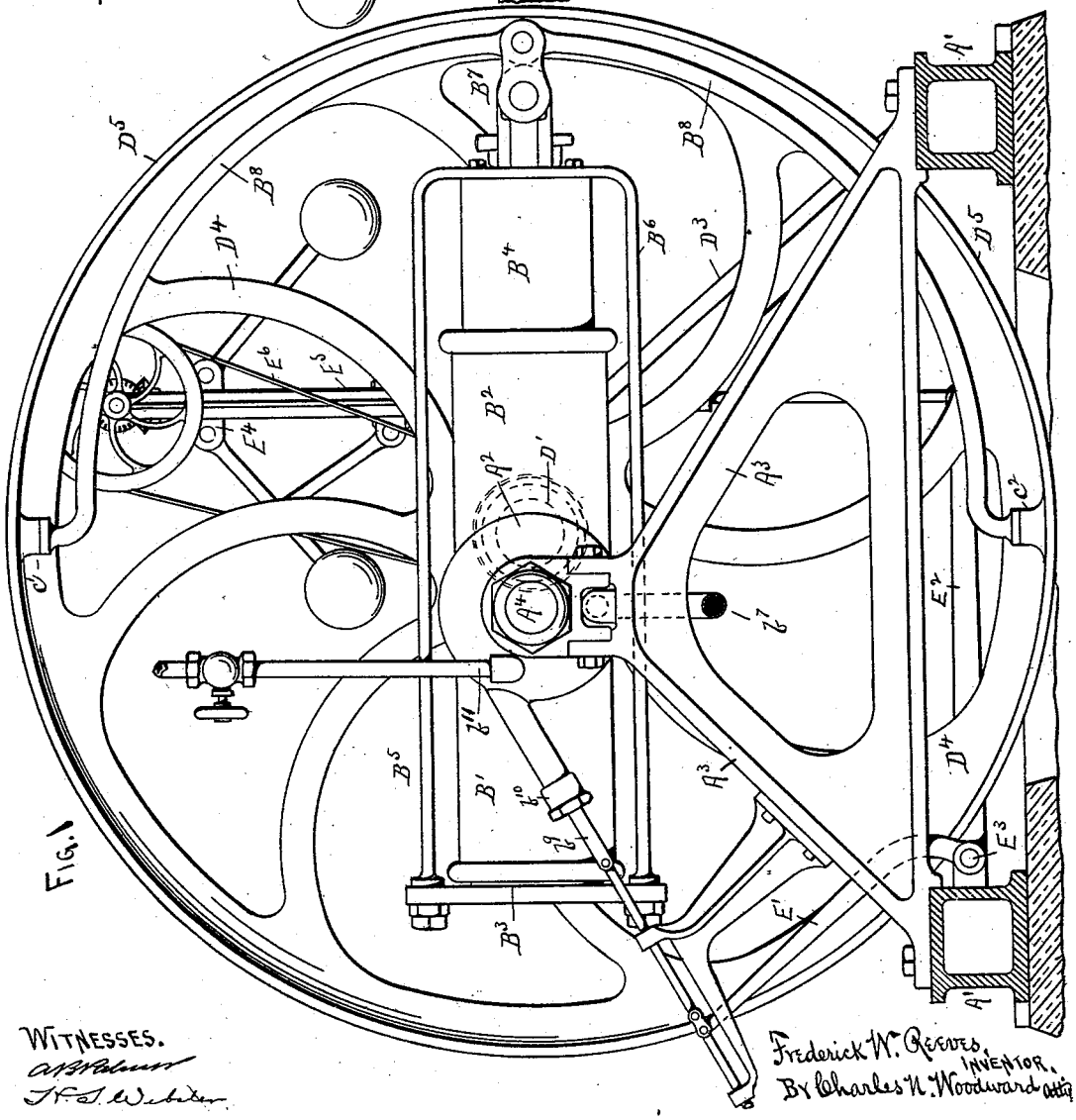

Fig. 1.

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By Charles N. Woodward Atty

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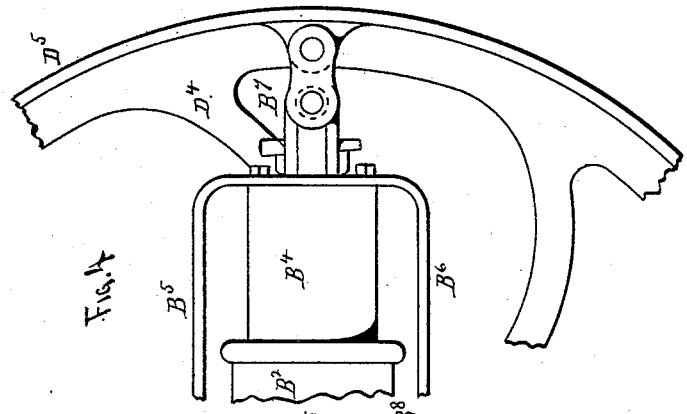

Fig. 4.

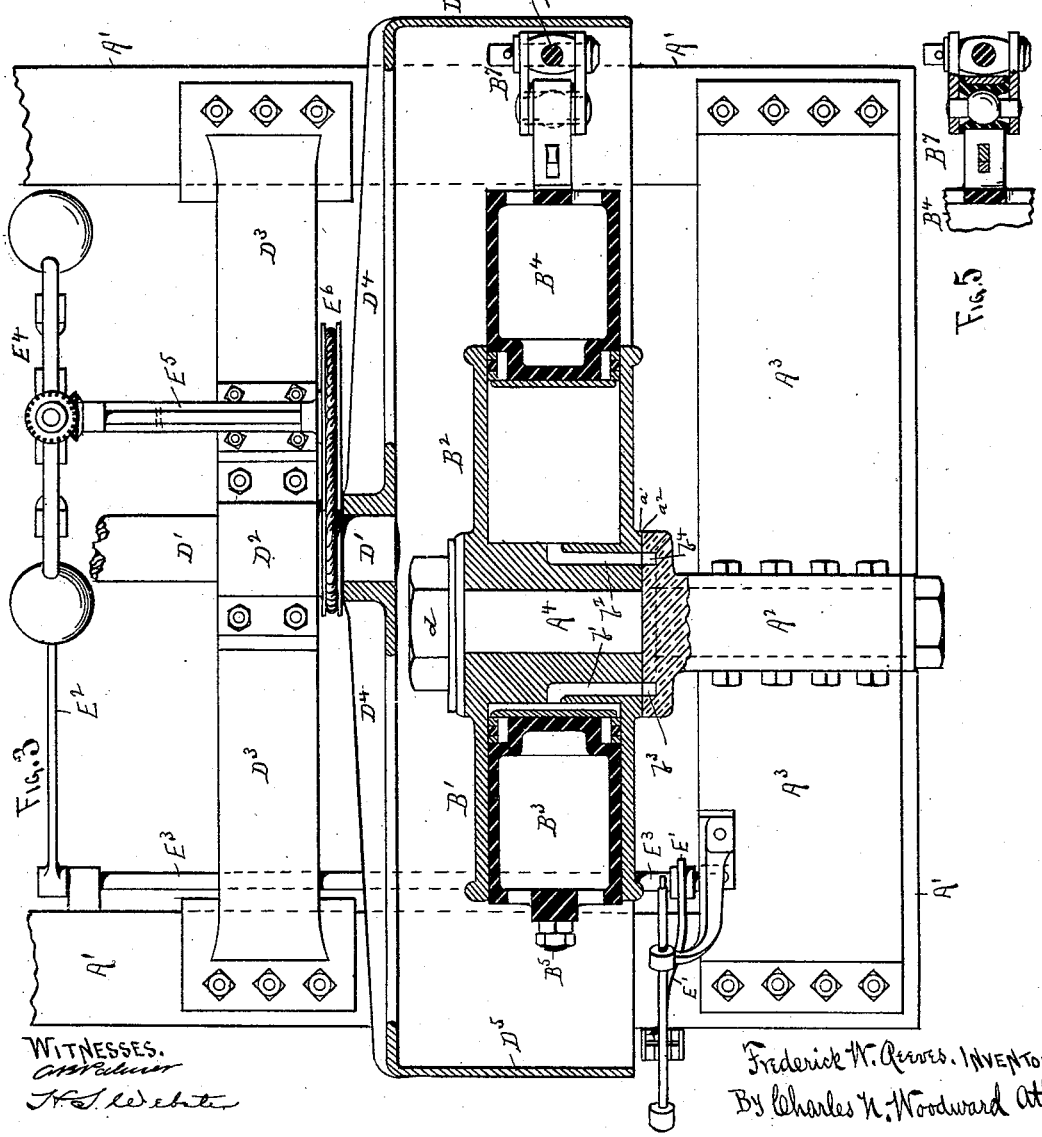

Fig. 5.

Fig. 3.

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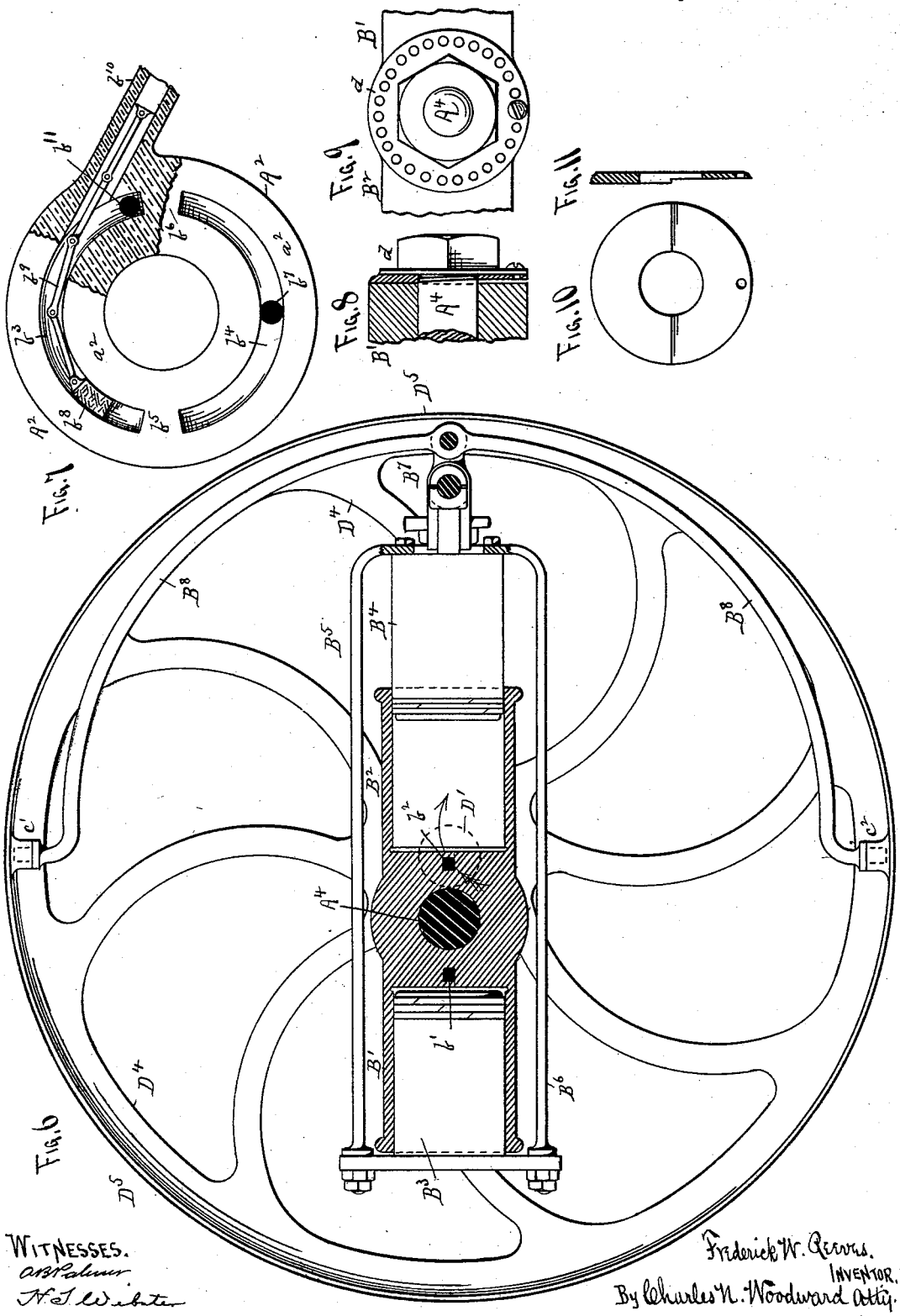

WITNESSES.
A. B. Palmer
H. T. Webster

Frederick W. Reeves.
INVENTOR.
By Charles N. Woodward Atty.

UNITED STATES PATENT OFFICE.

FREDERICK W. REEVES, OF ST. PAUL, MINNESOTA.

RECIPROCATING ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 523,053, dated July 17, 1894.

Application filed April 13, 1894. Serial No. 507,349. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK W. REEVES, a citizen of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in Reciprocating Rotary Steam-Engines, of which the following is a specification.

This invention relates to reciprocating rotary steam engines, and consists in the construction, combination, and arrangement of parts, as hereinafter shown and described, and specificaliy pointed out in the claims.

In the drawings,—Figure 1 is a side elevation. Fig. 2 is a detached detail illustrating the construction of the governor. Fig. 3 is a plan view in longitudinal section through the cylinders, and driving drum. Fig. 4 is a detached detail illustrating a modification in the construction. Fig. 5 is a detached sectional detail illustrating the manner of constructing the flexible coupling between the cylinders and the driving drum. Fig. 6 is a side elevation in longitudinal section through the cylinders. Fig. 7 is an enlarged sectional detail of the steam passage illustrating the manner of constructing the governor valve mechanism. Figs. 8, 9, 10 and 11 are detached sectional details of the mechanism for equalizing the pressure between the cylinders and the steam head.

A′ is the base frame supporting a "head" A^2 by a standard A^3, the head having a stud A^4 forming the center upon which a double cylinder $B' B^2$ revolves, as shown. The double cylinder is formed with a face a' working steam tight against a face a^2 on the head A^2, and each cylinder provided with a port $b' b^2$, connecting the interior of the cylinders with the face a', as shown.

Within the face a^2 of the head A^2, are formed two segmental steam passages $b^3 b^4$, concentric to the stud A^4 and over which the ports $b' b^2$ travel, as the cylinders revolve, the two parts of the steam passages being separated at their ends by blocks b^5 b^6 forming "cut offs," as shown in Fig. 7. The steam is arranged to enter the passage b^3 near one end, as shown at b^{11}, and the exhaust is arranged to be discharged from the passage b^4, as shown at b^7.

B^3 B^4 represent the pistons, connected by straps B^5 B^6 so that they move in unison, one being at the extreme inward end of its stroke when the other is at the extreme outward end of its stroke, and vice versa.

D′ is a shaft mounted by suitable bearings D^2 and standards D^3 upon the base A′, and set with its center the distance of one half the stroke of the pistons B^3 B^4, to one side of the center of the stud A^4, as shown, and having a wheel D^4 mounted on the end next the cylinders, the wheel D^4 having a rim D^5 partially inclosing the cylinders, as shown.

The piston B^4 is connected by a flexible joint B^7 to a bail or curved connecting rod B^8, the latter in turn swiveled by its ends c' c^2 into the interior of the rim D^5, at points at right angles to the joint B^7, as shown.

The cylinders are held in place upon the stud by a nut d having a suitable spring or other washer, by which the necessary adjustment may be secured to keep the faces a' a^2 in their proper steam tight relations.

Fitting steam tight within the steam passage b^3 is a governor valve b^8, connected by flexible connections to a rod b^9 passing out through a stuffing box b^{10} in the "head" A^2, and adapted to be actuated through a system of levers $E' E^2$ and rock shaft E^3 by a governor E^4, the governor suitably supported by a frame E^5 from the standard D^3, or other stationary portion of the engine, and adapted to be revolved from the shaft D′ by a belt E^6, or by other suitable means.

The governor valve b^8 and the lever by which it is actuated will be so arranged that when the governor balls are depressed, the valve b^8 will be held at the farthest point away from the steam inlet b^{11}, while the levers and balls will be so arranged that the elevation of the balls to their highest working point will cause the valve b^8 to be moved far enough toward the steam inlet to nearly if not quite close it, so as to reduce the steam inlet to the smallest possible limit. By this arrangement the size of the steam space will be altered automatically and the length of the steam inlet passage increased or decreased, and the length of time which the working cylinder is permitted to take steam correspondingly increased or decreased, and as this increase and decrease is regulated by the position of the governor balls, whose position is in turn regulated by the speed of the

engine, a perfect speed governor is thereby insured.

The cylinders are shown in Figs. 1 and 6 "on the center" for convenience of illustration, but when at right angles to this position, the reciprocating motion of the cylinders exerts a leverage upon the shaft equal to one half the stroke of the piston, and by this means the reciprocating motion of the cylinder is utilized to produce the requisite rotary motion to the shaft D'.

The construction of the engine is very simple and compact and being composed of few parts is not liable to get out of order. It will run at a very high speed, and by the combined action of the governor valve b^8 and the cut off blocks b^5, b^6, the steam is used to the highest degree expansively, and therefore with great economy.

The joint B^7 will be formed with a ball and socket union, as shown in Fig. 5, so as to possess sufficient flexibility to compensate for any lack of adjustment or alignment between the shaft D' and stud A^4. The ball or curved connecting rod B^8 is also an important feature in this connection, as by its form and method of arrangement it will permit a considerable degree of variance in the alignment of the two centers D' and A^4 without effecting their perfect coaction. While the curved connecting rod connection B^8 is the preferable method of arrangement, the cylinder B^2 may be united directly to the rim D^4 as shown in Fig. 4, if preferred, but the results and mode of operation will be substantially the same in both arrangements shown.

The rod b^9 of the governor valve where it passes through the stuffing box b^{10} is of the same area in cross section as the governor valve, so that the pressure of the steam will be equalized, and will not press with any more force against the governor valve than against the rod.

Having thus described my invention, what I claim as new is—

1. In a reciprocating rotary steam engine, two cylinders extending in opposite directions and adapted to revolve about a common center and each provided with a steam port, steam passages over which said ports revolve to alternately admit and cut off the steam, pistons working in said cylinders and coupled to move in unison, a shaft journaled to one side of the center of said cylinders and having a drum or pulley, and a curved connecting rod adapted to connect said drum and one of said pistons, substantially as and for the purpose set forth.

2. In a reciprocating rotary steam engine, two cylinders extending in opposite directions and adapted to revolve about a common center and each provided with a steam port opening through a face a', a stationary head having a face a^2 against which said face a' works steam tight, steam passages b^2 b^3 having cut off blocks between their ends and adapted to alternately admit and cut off the steam from said cylinders, pistons working in said cylinders and coupled to move in unison, a shaft journaled to one side of the center of said cylinders and having a drum or pulley, means for connecting one of said pistons to said drum or pulley, a governor valve b^8 working in the steam inlet passage, and a governor adapted to automatically adjust the position of said governor valve with relation to the speed of the engine, substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

FREDERICK W. REEVES.

Witnesses:
C. N. WOODWARD,
H. S. WEBSTER.