

No. 785,802.

PATENTED MAR. 28, 1905.

C. S. DRUMMOND.

STEAM TURBINE.

APPLICATION FILED FEB. 27, 1906.

4 SHEETS—SHEET 1.

Fig. 1.

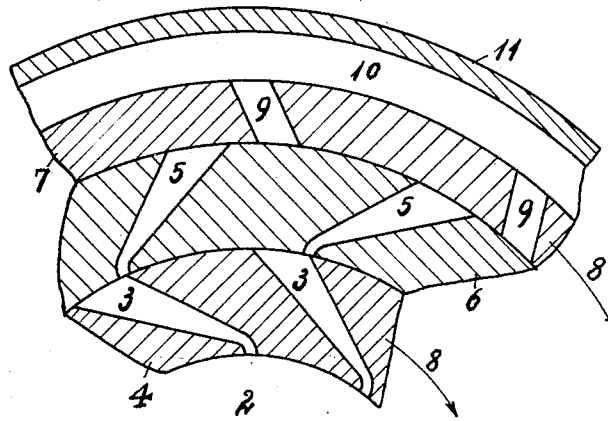
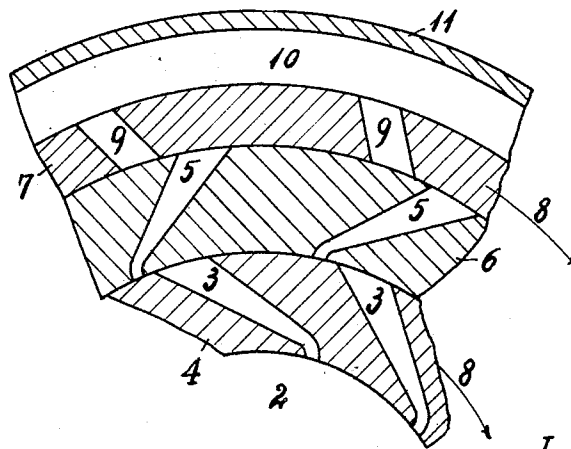


Fig. 2.



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4 SHEETS—SHEET 2.

Fig. 4.

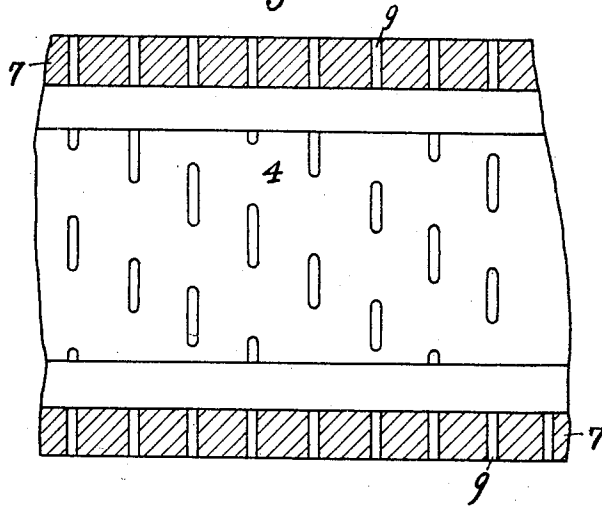
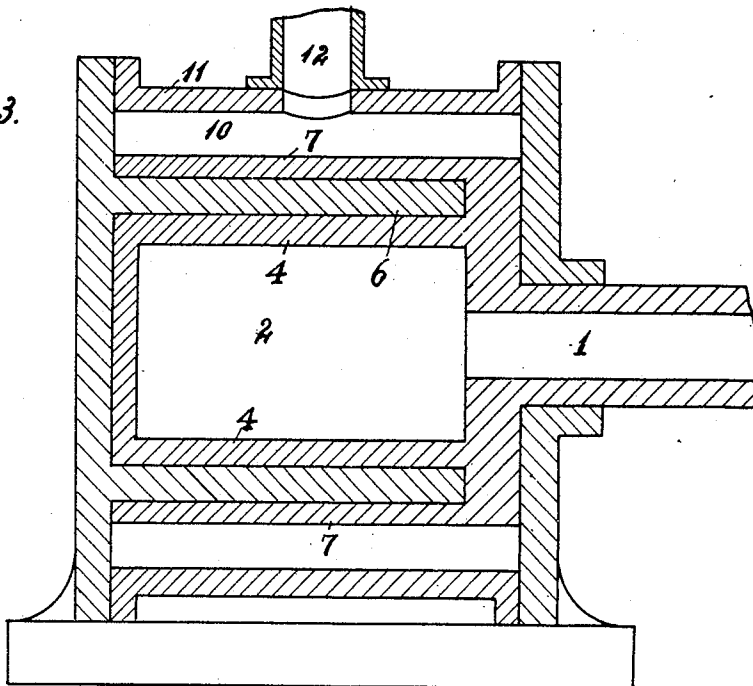


Fig. 3.



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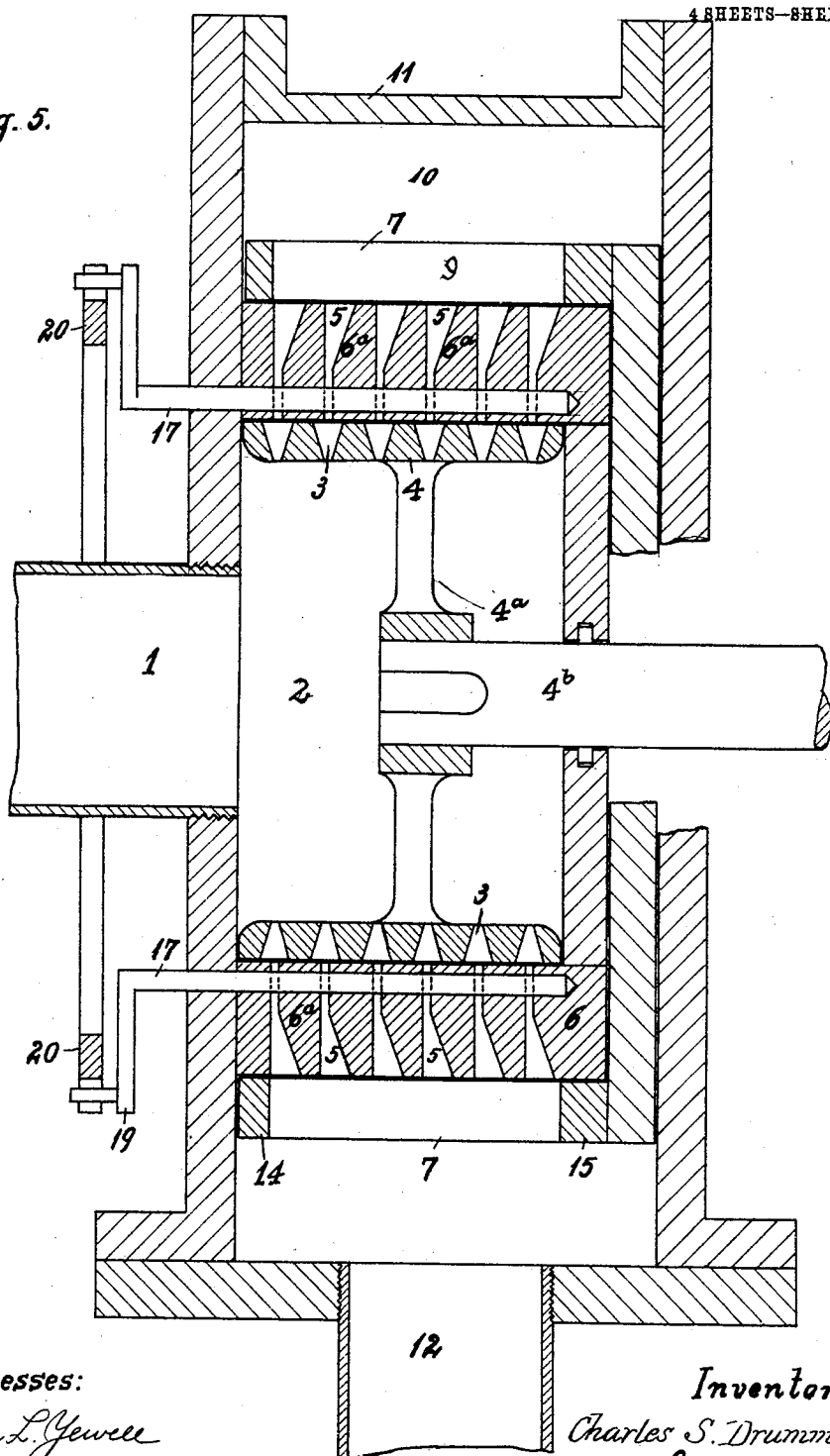
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4 SHEETS—SHEET 3.

Fig. 5.



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4 SHEETS—SHEET 4.

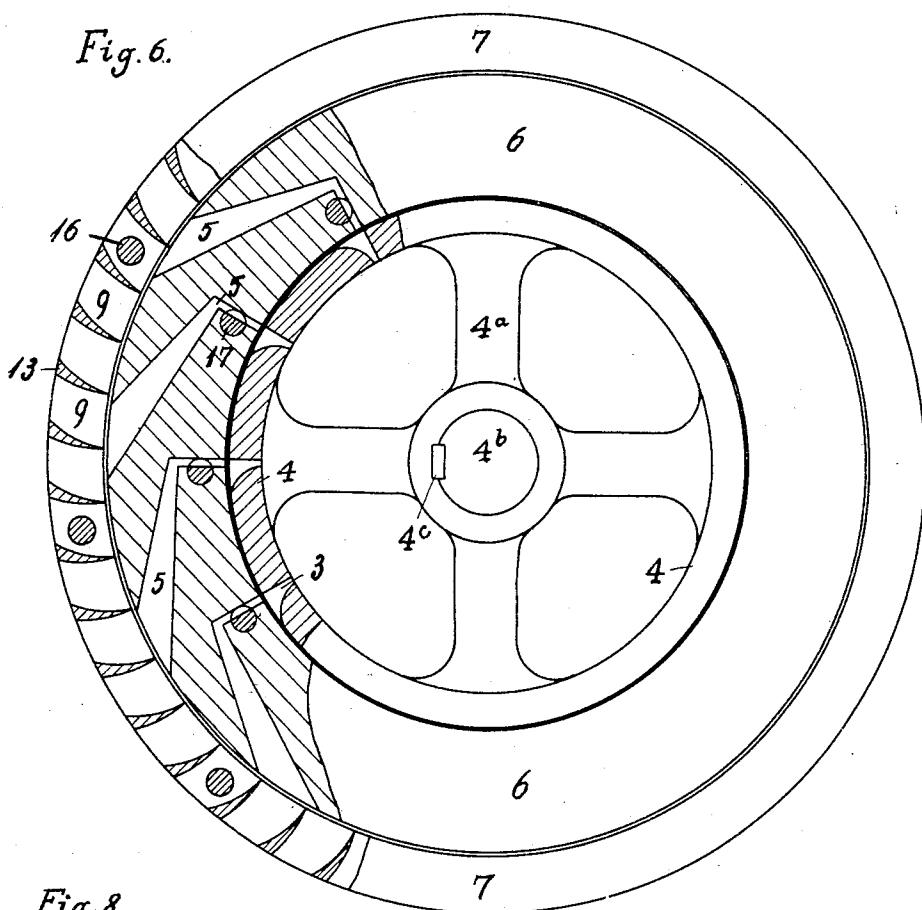


Fig. 8.

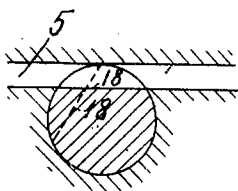
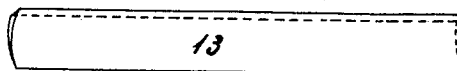


Fig. 7.



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UNITED STATES PATENT OFFICE.

CHARLES SINCLAIR DRUMMOND, OF LONDON, ENGLAND.

STEAM-TURBINE.

SPECIFICATION forming part of Letters Patent No. 785,802, dated March 28, 1905.

Application filed February 27, 1905. Serial No. 247,398.

To all whom it may concern:

Be it known that I, CHARLES SINCLAIR DRUMMOND, a subject of the King of Great Britain, and a resident of No. 23 St. Mary Axe, London, E. C., in the county of Middlesex, England, have invented certain new and useful Improvements in Steam-Turbines, of which the following is a specification.

My invention relates to improvements in steam-turbines by which great efficiency and cheapness of construction are obtained.

The accompanying drawings, which form a part of this specification, illustrate the invention as follows:

Figure I is a part-vertical section at right angles to the shaft, the relative positions of the two elements of the turbine being such that steam is admitted from the passages 3 to the passages 5. Fig. II is also a part-vertical section at right angles to the shaft; but the relative positions of the elements in this figure are such that communication between passages 3 and 5 is cut off. Fig. III is a vertical section through the center of the shaft in the case where what is termed the "simplex" element is fixed and only what is termed the "duplex" element is movable. Fig. IV is a partial longitudinal section of the duplex element, the central drum being shown in elevation. Fig. V is a vertical section in the plane of the axis of the shaft of the turbine. Fig. VI is a vertical section in a plane at right angles to the axis of the shaft, and Figs. VII and VIII are details of the turbine.

For convenience of drawing I have not shown the steam-passages in the drum in Fig. III, and in Figs. I and II, I have only shown two of the steam-passages in each of the drums.

Referring now to the figures, 1 is a tubular shaft through which the steam is admitted to the central steam-space 2, from which it issues through passages 3 in the wall of the inner drum 4 of the duplex element. Assuming the two elements to be in the relative positions shown in Fig. I and that steam is turned on, it rushes into the passages 3 and expands somewhat. Part of it goes on into the passages 5 of the intermediate drum 6, which constitutes the simplex element. This tends to move drum 4 and with it the other drum, 7, of

the duplex element in the direction of the arrows 8. When relative movement of the two elements has taken place through a given angular distance, so as to bring the parts into the positions shown in Fig. II, it will be seen that communication between the passages 3 and 5 has been cut off, but that a part of the steam which was in passages 3 has expanded into passage 5 and that the pressure now exists in both passages. Further angular movement in the same direction brings the exhaust-passages 9 opposite the passages 5, and steam escapes from 9 into the exhaust-space 10, which is surrounded by the casing 11, in which is the exhaust-pipe 12.

I contemplate using high pressure of steam in my invention.

It will be noted that the passages 3 and 5 increase in cross area as they extend outward from the center and that the inner ends of the passages 5, although farther from the center than the outer ends of the passages 3, are much smaller than the said outer ends of the passages 3. It will also be noted that the passages 9 are of the same size throughout their length, although not necessarily so. The effect of these forms and arrangements is that a positive action is obtained instead of a mere blow-through, as in ordinary steam-turbines where all the steam-passages may coincide.

The effect of making drums 4 and 7 integral with one another or rigidly connected one to another, so as to revolve at the same angular velocity, is to insure proper timing among the steam-passages 3, 5, and 9, and this will take place whether one element only rotates or both elements rotate in opposite directions. When the two elements are designed both to rotate and in opposite directions, I connect them together by gearing, so that they may rotate at the same rates or at rates having a definite relation one to the other. By this means a proper timing of the meeting or junction of the steam-passages is effected. If the drums were allowed to rotate without a definite ratio of speed, they might get out of step and the timing of the meeting of the steam-passages be destroyed.

By the "simplex" element I mean that element which has only one drum, and by the

"duplex" element I mean that element which has two drums, these being either integral or rigidly connected to one another.

Referring now to Figs. V, VI, VII, and VIII, 1 is the steam-inlet opening into the steam-space or steam-chest 2. This inlet or pipe is made very large and so as to constitute as direct a connection as possible with the steam-space of the boiler, so as to maintain the steam-pressure in the steam-chest 2 at the highest possible limit consistent with convenience. 3 3 are the passages in the inner drum 4, and they are preferably of the form illustrated. The said drum has radial limbs or spokes 4^a, by means of which it is mounted on the shaft 4^b and attached thereto by the key 4^c. 5 5 are the passages in the intermediate drum 6, which constitutes the simplex element. 7 is the outer drum, in which are the exhaust-passages 9. These passages in the particular form illustrated consist of the spaces between the bars 13, which extend between the rings 14 and 15 of the outer drum. These rings are bound together at intervals by the bolts 16, thus holding the bars 13 in position, the ends of the said bars being let into depressions in the rings 14 and 15, the said depressions corresponding in shape with the ends of the bars, so that the latter fits snugly in the said rings. The shape of the bars 13 will be understood from the perspective view thereof, Fig. VII. 10 is the exhaust-space surrounded by the casing 11, and 12 the exhaust-pipe, as before. The shapes of the steam-passages 3 and 5 in Figs. V and VI will be noted, these being the shapes which I prefer of all those I have experimented with. The passages 5 would be rather difficult to bore out if the drum 6 were a solid casting; but I get over this difficulty by building up the said drum of separate rings 6^a and casting these with channels on one surface thereof, the said surface being in the case illustrated that surface which is toward the left when the rings are mounted as seen in Fig. V. When so mounted that the channeled surface of one ring is placed in contact with the flat surface of the next ring, and so on, the channels then constitute the steam-passages 5, being made of the proper shape. Another advantage resulting from constructing the drum of separate rings as aforesaid is that engines of different power may conveniently be built up in this way. This is effected by simply increasing the number of rings, and consequently the length of the drum. It will be obvious that this method is not confined to the drum 6.

The power of the engine can also be varied by opening or closing a varying number of the passages 5. A convenient way of doing this is illustrated in Figs. V and VI. A number of holes are bored through the rings in a direction normal to their planes, and in these are inserted the rods 17. These rods are cut away at intervals, so as to enable the rods to act as cocks or taps, as is more fully illus-

trated in Fig. VIII. When the rod is in the position shown in this figure in full line, it will be seen that its cut or flat 18 registers with the passage 5 and that steam can now pass through the said passage. When, however, the rod 17 is turned angularly, so that the cut or flat 18 is in the direction shown by the dotted line, then the steam-passage 5 is closed, and no steam can pass through that passage. These rods therefore constitute a governing device, and for convenience of manipulation they may be cranked, as at 19, and connected with a ring 20, any movement of which ring round its axis will turn the rods 17 round their axes and open or close the passages 5 either wholly or to any desired extent.

I make my inner drum and my intermediate drum to fit closely, so that when relative movement takes place they are in actual rubbing contact with one another. By this means a positive cut-off of the steam is obtained instead of a blow-through of the steam, such as occurs in ordinary steam-turbines.

I look upon the provision of a central steam-chest such as I have illustrated as of great importance, as it allows of the admission of steam to the passages as nearly as possible at boiler-pressure.

In comparing my steam-turbine with others the inner drum 4 may be looked upon as fulfilling the functions of a system of nozzles, the system of nozzles being in this case a rotating one. Similarly the inner drum 6 may be looked upon as fulfilling the functions of the reacting system of an ordinary steam-turbine—that is to say, the system upon which the steam impinges after issuing from the nozzles.

I find it convenient, although by no means necessary, to make the bars 13 of phosphor-bronze and in some cases to make the rings 6^a of this metal.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A steam-turbine comprising a central steam-chest and two relatively rotatable elements, one consisting of two rigidly-connected concentric drums provided with ports, the ports of the inner drum flaring outwardly, and the other element consisting of a single drum intermediate between the rigidly-connected drums and provided with outwardly-flaring passages, substantially as described.

2. A steam-turbine comprising a central steam-chest, and two relatively movable elements one consisting of two rigidly-connected concentric drums provided with ports, the ports of the inner drum flaring outwardly, and the other element consisting of a single drum intermediate between the rigidly-connected drums and provided with outwardly-flaring passages, the ports of the inner drum being so spaced as to close the steam-passages to the intermediate drum at regular intervals, substantially as described.

3. A steam-turbine comprising a central steam-chest, a rotating member consisting of two rigidly-connected concentric rotating drums provided with ports, the ports of the inner drum flaring outwardly, and a stationary drum intermediate between the two rotating drums and provided with outwardly-flaring passages, substantially as described.

4. A steam-turbine comprising a central steam-chest, a rotating member consisting of two rigidly-connected concentric rotating drums provided with ports; the ports of the

inner drum flaring outwardly; and a stationary drum intermediate between the two rotating drums and provided with outwardly-flaring passages; and regulating throttle-valves for the steam-passages in the stationary drum, substantially as described.

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

CHARLES SINCLAIR DRUMMOND.

Witnesses:

SIDNEY THOMAS COOKMAN,
H. D. JAMESON.