W. H. EYERMANN.

RADIAL FLOW STEAM TURBINE.

APPLICATION FILED DEC. 10, 1909.

952,318. Patented Mar. 15, 1910.

2 SHEETS—SHEET 1.

Fig.1.

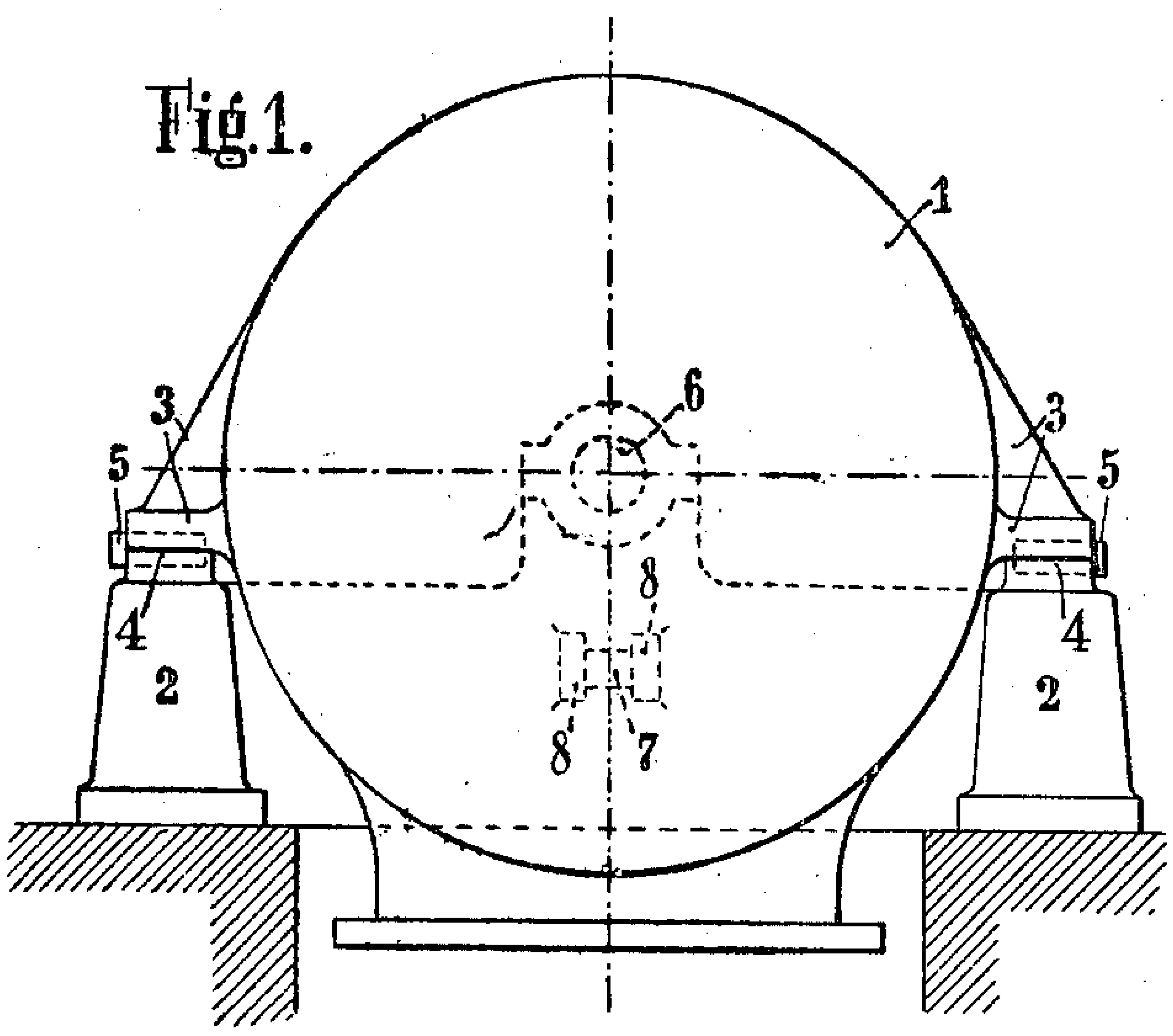


Fig.2.

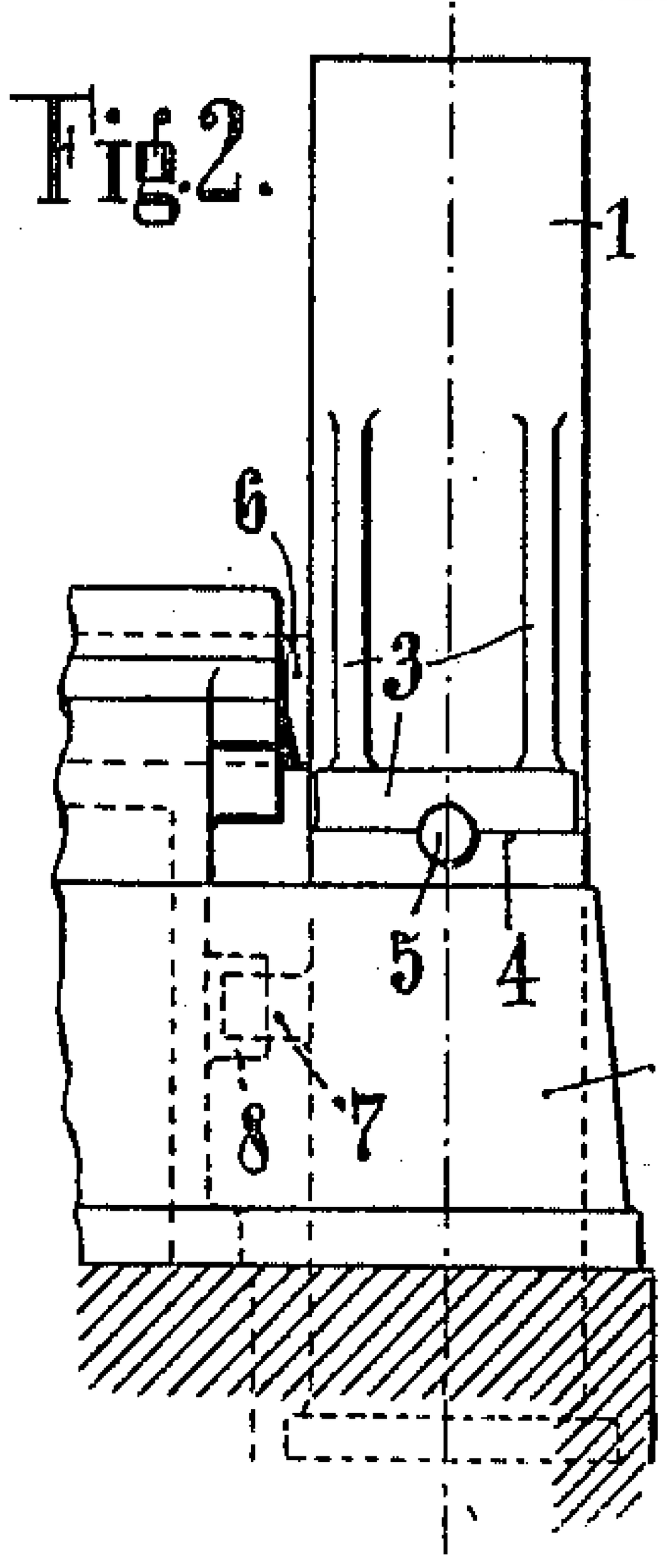


Fig.3.

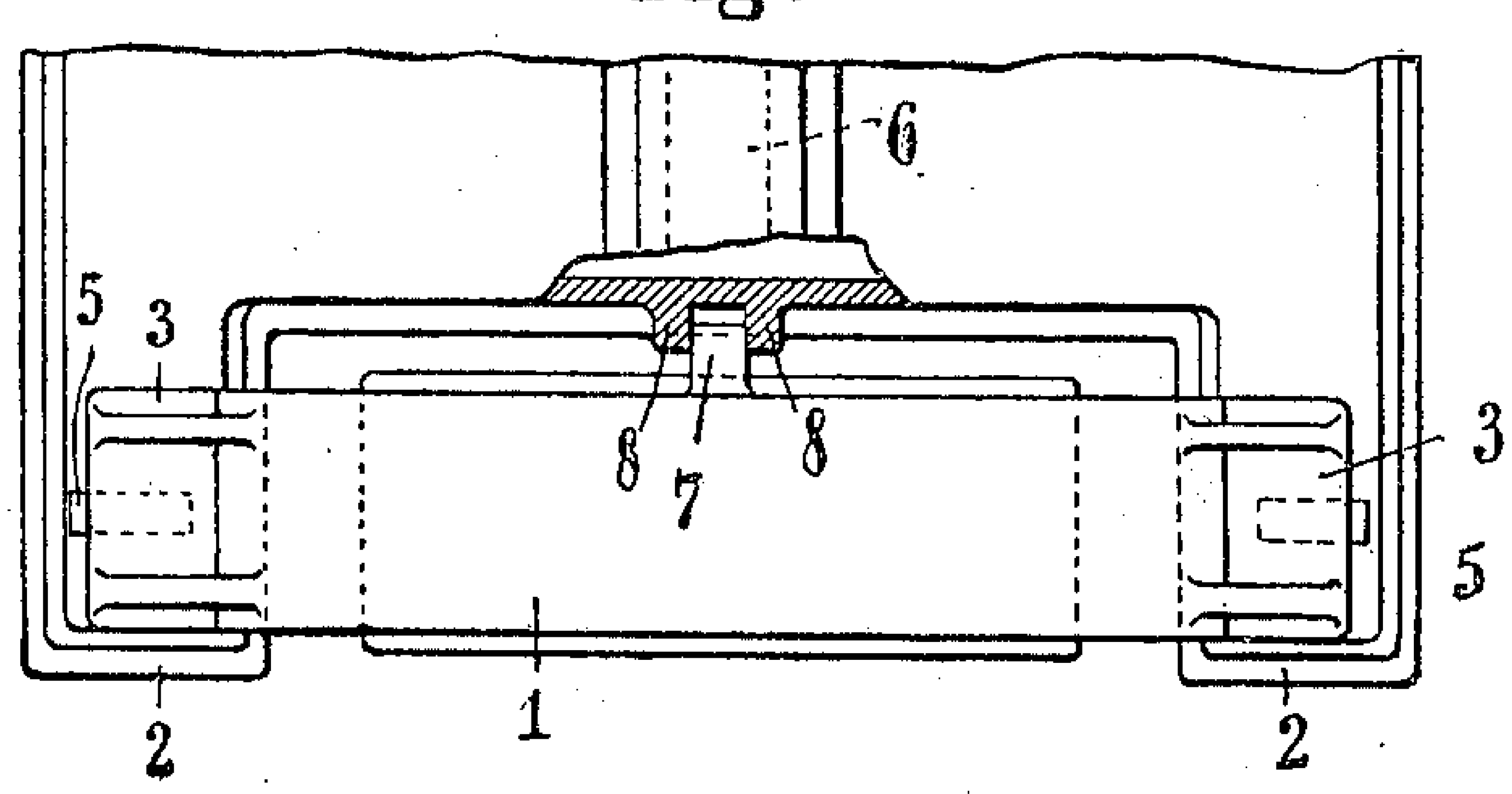
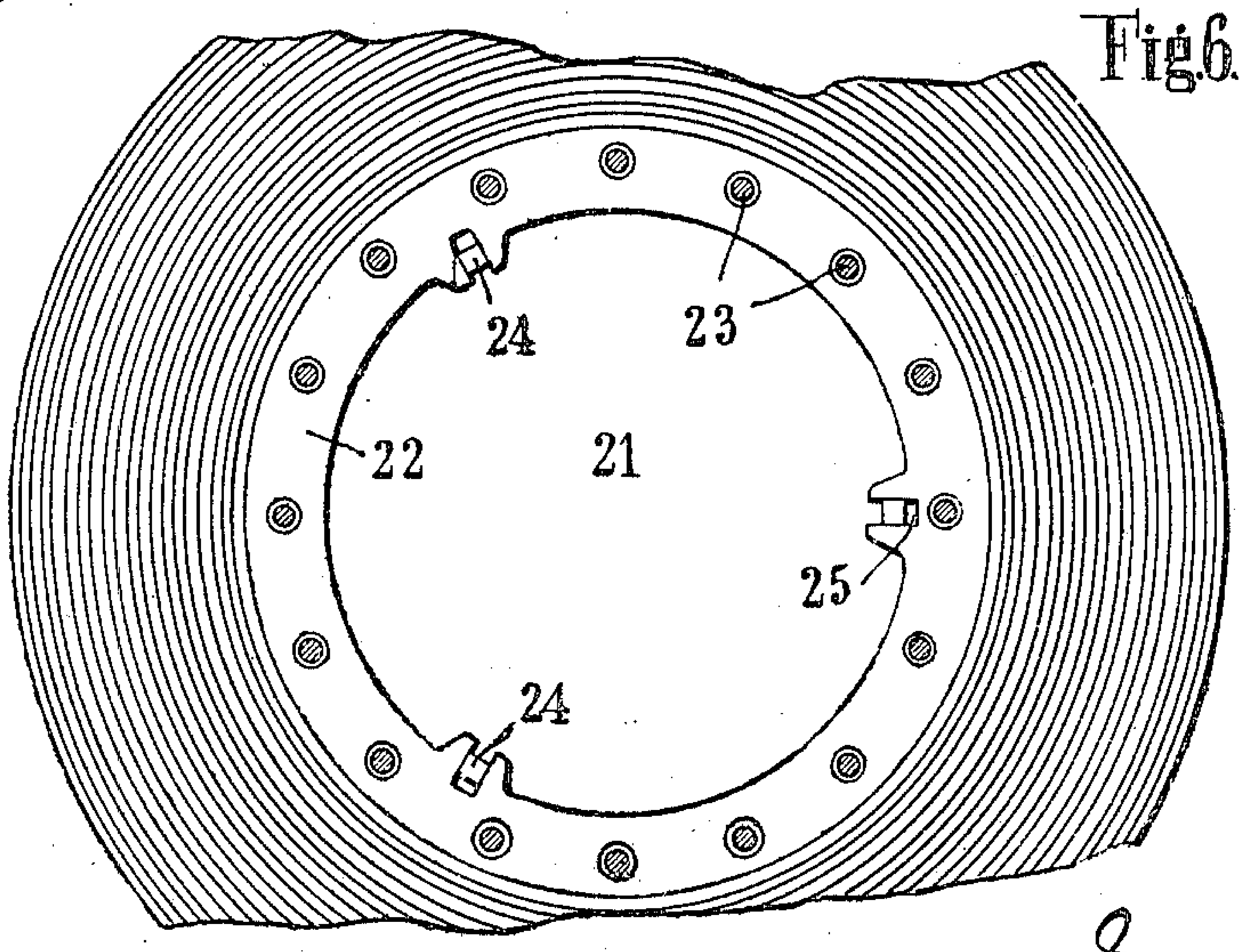


Fig.6.



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2 SHEETS—SHEET 2.

Fig.5.

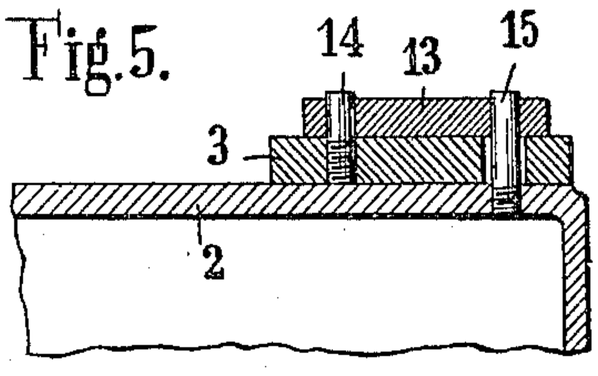
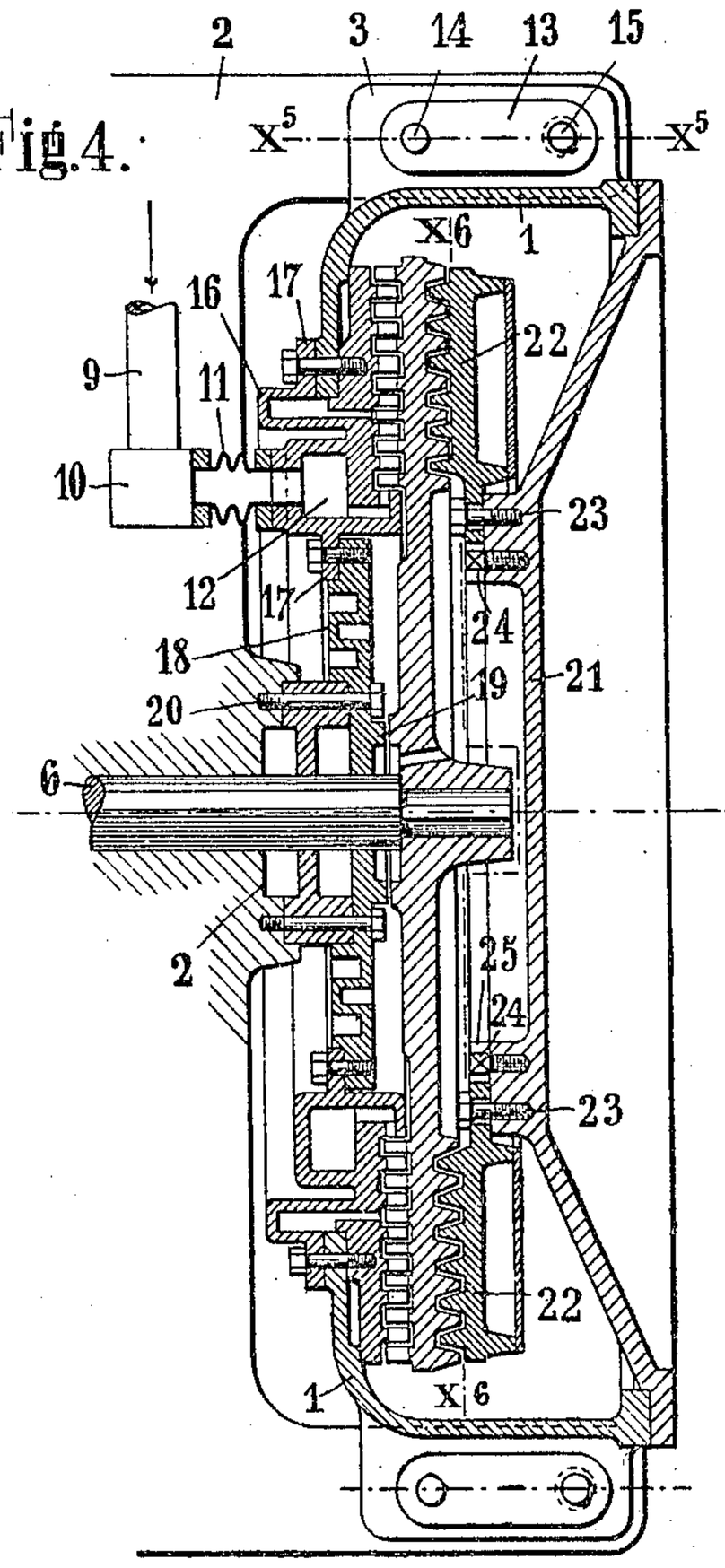


Fig.4.



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RADIAL-FLOW STEAM-TURBINE.

952,318. Specification of Letters Patent. **Patented Mar. 15, 1910.**

Application filed December 10, 1909. Serial No. 532,444.

To all whom it may concern:

Be it known that I, WILHELM HEINRICH EYERMANN, engineer, a subject of the German Emperor, and resident of Holsteinische-strasse 4, Deutsch Wilmersdorf, near Berlin, Germany, have invented new and useful Improvements in or Relating to Radial-Flow Steam-Turbines, of which the following is a specification.

This invention relates to radial flow steam turbines and has particular reference to a new construction for equalizing tensions and strains by rendering possible an expansion in a radial direction of the casing which, as is well known, has a different temperature from that of the frame and more particularly from that of the steam distributing chamber preferably connected to the casing, without an axial movement of the casing taking place relatively to the turbine wheel supported in the machine frame. The casing, owing to its heating, has a tendency to expand radially outward from the center of the shaft. This causes on the one hand a movement relatively to the colder frame on which it is supported, and on the other hand produces tensions or strains which have the tendency to tear off the casing from the stuffing box part. These drawbacks are avoided by the casing being adjustably mounted on its support or seat on the frame in such a manner that, taking the central plane of the wheel as a fixed plane, it can move relatively to the casing, while on the other hand connections are arranged between the casing and the stuffing box part, which makes a radial movement possible.

A construction according to this invention is illustrated in the accompanying drawing, in which—

Figure 1 is a diagrammatic elevation of the frame and of the turbine casing. Fig. 2 is a side elevation, and Fig. 3 a plan, partly in horizontal cross-section. Fig. 4 is a horizontal cross-section through another construction according to this invention. Fig. 5 is a section in the direction of the line x^5—x^5 of Fig. 4, and Fig. 6 a partial section on line x^6—x^6 of Fig. 4.

In the construction shown in Figs. 1–3, the turbine casing 1 is mounted on the machine frame or bedplate 2 in such a manner that the former is provided with brackets 3 resting on bearing surfaces 4 of the bedplate 2. These surfaces resting on each other are provided with exactly coinciding semi-circular openings into which is introduced a pin 5 of completely circular cross-section. The part 4 is also provided with bolts 15^a, which pass through slots in the brackets 3, which prevent said parts from being separated from each other but permit a movement in the longitudinal direction of the pin 5. It will be seen that when this method of connection is used the casing 1 can expand radially without exercising a pressure on the bedplate 2. In order to keep the shaft 6 exactly central, the casing is provided at any point, preferably below the shaft 6, with one or more projections or guide blocks 7 which slide vertically in a guide groove 8 of the bedplate. As the bolts 5 are approximately in the horizontal plane of the shaft 6, while the guide block 7 is vertically below the shaft 6, there will be no appreciable relative movement of the axes of the casing 1 and of the bedplate 2, when the casing 1 expands relatively to the bedplate 2.

In the construction illustrated in Figs. 4–6 is shown another method of connecting the bedplate and the casing, and the steam supply parts of the casing are connected to the latter, and the stuffing box or the part of the same forming the valve plate is connected to the bedplate and to the casing cover in such a manner that one part can always move radially relatively to the other. In this construction steam enters at 9, a regulating valve 10, and thence through a metal hose connection or a spring pipe 11; passes into the casing part 12, thence into the turbine vanes or buckets, the said part 12 being naturally much hotter than the other parts of the casing 1. The casing 1 rests with brackets 3 on the bedplate 2 which is connected to the casing by means of links 13. The bracket 3 is connected by means of a pivot pin 14 to the link 13, and the latter by means of a pin 15 to the bedplate. The bolt 15 passes through a longitudinal slot of the bracket 3. It follows therefrom that the casing 1 cannot move on the bedplate 2 in the direction of the turbine axis 6, but a movement of the casing in the radial direction can take place owing to the bracket 3 moving on the bedplate 2, while it is prevented from moving longitudinally by the link 13. In reality the bolt 14 turns relatively to the bolt 15 in a circle described about the center of the bolt 15. The axial

movement of the bolt 14 is, however, infinitesimal, and only the radial movement need be considered.

The casing part 12 which forms the chamber for the steam admitted, and thus is the hottest, is connected to the casing part 1 by means of a practically axial, comparatively long and thin connecting part 16, the flanges 17 of which are, on the one hand, connected to the casing, and on the other hand to a central plate 18. This connecting part can only transmit the heat badly from the casing part 12 to the casing part 1, but makes possible a great expansion of the inner hotter part relatively to the outer colder part, the central position being at the same time maintained. The stuffing box part 19, which in the present example is formed like a valve plate, is connected by means of bolts 20 to the bedplate 2 or to a separate part of the bedplate forming a bearing. On the other hand, the said valve plate forms the central portion of the already mentioned central plate 18 provided with central corrugations or grooves and thus making possible a slight radial movement. In that way no strains producing shifting are transmitted to the valve plate 19, so that good working of the valve is insured. But even in case there is no valve plate 19, the method of connection indicated by means of the central plate is of great importance, as in that way the central position of the stuffing box is insured. The casing cover 21 is also connected, in the manner forming the substance of this invention, to the ring 22 forming the "labyrinth" packing. To that end the ring 22 is connected to the casing cover 21 by means of bolts 23 which make possible a certain play in the radial direction. In order to obtain an exactly central position of the two parts, one part, for instance the casing cover 21, is provided with guide bolts 24 engaging with guide slots 25 in the other part.

Claims.

1. In a radial flow steam turbine, the combination of a bed-plate, a turbine casing provided with brackets, said brackets resting upon said bed-plate and adapted to slide thereon, and connections between said brackets and said bed-plate, permitting the radial expansion or contraction of said casing, substantially as described.

2. In a radial flow steam turbine, the combination of a bed-plate, a turbine casing provided with brackets, said brackets resting upon said bed-plate and adapted to slide thereon, connections between said brackets and said bed-plate, permitting radial expansion and contraction, said bed-plate being provided with a stuffing box capable of moving radially by expansion, to compensate for the strains caused by heating, substantially as described.

3. In a radial flow steam turbine, the combination of a bed-plate, a turbine casing provided with brackets, said brackets resting upon said bed-plate, and adapted to slide thereon, and links and bolts yieldingly connecting said bed-plate to said brackets, substantially as described.

4. In a radial flow steam turbine, the combination of a bed-plate, a turbine casing supported thereon, a stuffing box adjustably connected to said casing, and a steam distributing chamber between said casing and said stuffing box, so arranged as to permit radial movement of the parts, substantially as described.

5. In a radial flow steam turbine, the combination of a bed-plate, a turbine casing yieldingly supported thereon, a steam distributing chamber, and a central plate having thin grooved walls connecting said casing to said distributing chamber, substantially as described.

6. In a radial flow steam turbine, the combination of a bed-plate, a turbine casing provided with brackets yieldingly supported on said bed-plate, a stuffing box, a steam distributing chamber, and a thin walled grooved plate connecting said stuffing box with said chamber, substantially as described.

7. In a radial flow steam turbine, the combination of a bed-plate, a turbine casing having brackets movably supported on said bed-plate, a ring carrying a labyrinth packing, and yielding connections between said ring and said casing, substantially as described.

Dated this 26th day of November 1909.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two witnesses.

WILHELM HEINRICH EYERMANN.

Witnesses:
WOLDEMAR HAUPT,
HENRY HASPER.