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HEATING OF TURBINE PARTS.

APPLICATION FILED JAN. 24, 1910.

966,588.

Patented Aug. 9, 1910.

3 SHEETS—SHEET 1.

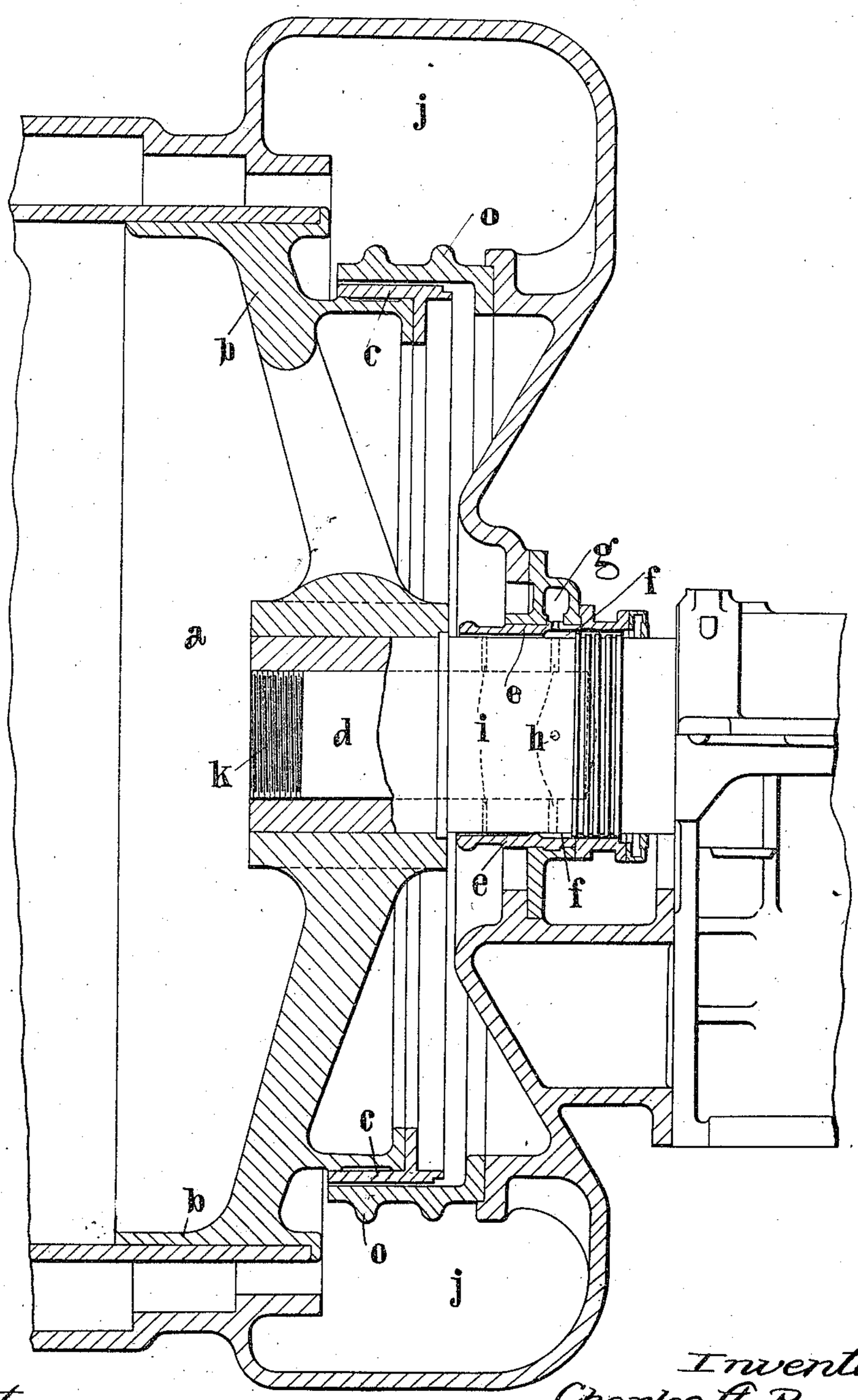

Fig. 1.

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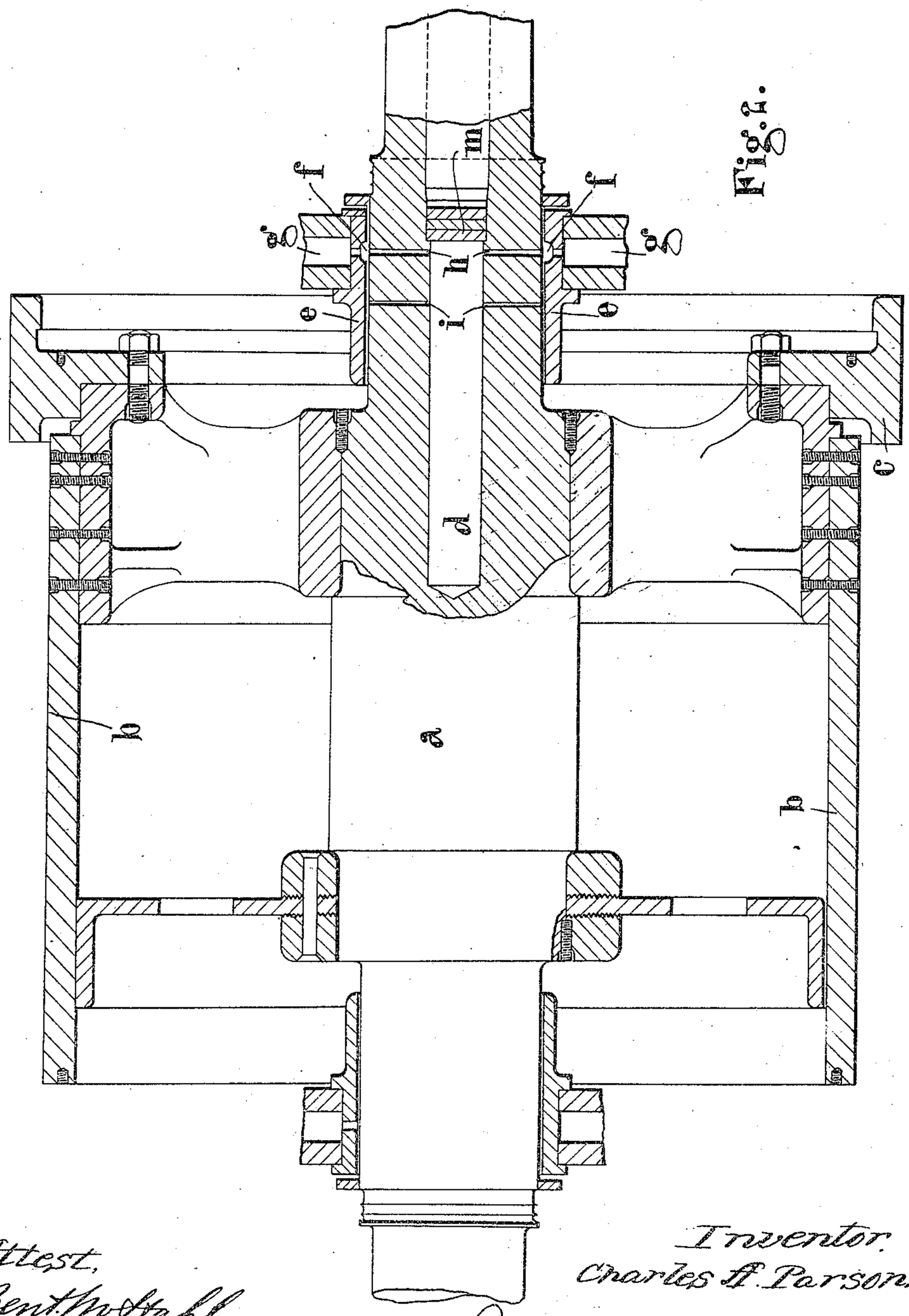
3 SHEETS—SHEET 2.

Fig. 2.



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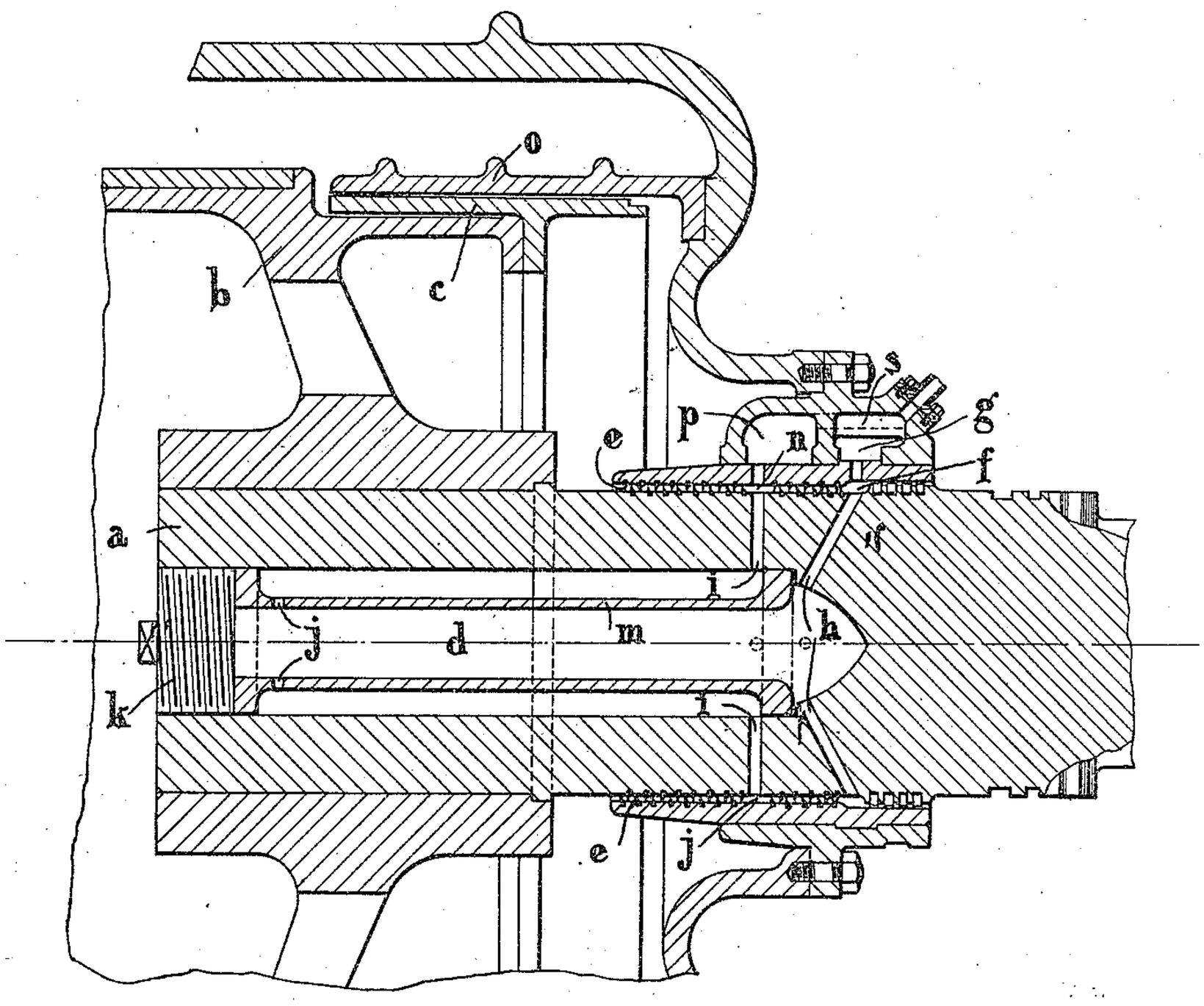

Fig. 3.

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UNITED STATES PATENT OFFICE.

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HEATING OF TURBINE PARTS.

966,588. Specification of Letters Patent. Patented Aug. 9, 1910.

Application filed January 24, 1910. Serial No. 539,812.

To all whom it may concern:

Be it known that I, CHARLES ALGERNON PARSONS, C. B., a subject of the King of Great Britain and Ireland, residing at Heaton Works, Newcastle-upon-Tyne, in the county of Northumberland, England, have invented certain new and useful Improvements Relating to the Heating of Turbine Parts, of which the following is a specification.

This invention relates to the control of the heating of parts of turbines which may be subjected to unequal temperature.

The object of the invention is to provide for the heating of the spindle of a turbine in order that a predetermined clearance may be maintained during working in the labyrinth packings of the gland and dummy piston carried by the spindle.

In steam turbines in which a dummy piston is carried in proximity to a packing gland I have proposed before in my Patent No. 858205 to form the end of the spindle hollow, this hollow portion being within the drum and connected to the steam supply chamber by means of hollow spokes.

The present invention consists in extending the hollow spindle chamber into the part of the spindle in the gland and connecting the chamber with a lantern space of the gland so that a transference of the fluid used for heating the spindle shall take place between the hollow spindle chamber and the lantern space of the gland. It is preferable to provide the chamber with outlet passages into a part of the turbine at a lower pressure than that existing in the lantern space so that a circulation of steam through the spindle chamber shall be insured.

The invention also consists in the devices hereinafter indicated.

It is usual in practice to admit steam to the packing gland of a condensing turbine before admitting it to the turbine itself; but since in turbines as hitherto used the mass of metal of the gland was much less than the mass of the part of the spindle in the gland, unequal heating of these parts occurred for a considerable time after starting; by my invention the steam is admitted in the usual manner but without causing substantial unequal heating between the parts above mentioned.

Referring now to the accompanying drawings:—Figure 1 represents a section through the inlet end of a steam turbine suitable for marine propulsion the spindle being heated according to the present invention. Fig. 2 represents a turbine rotor, the spindle of which is also heated according to the present invention. Fig. 3 shows another arrangement by which steam is circulated within the turbine spindle.

In carrying the invention into effect according to one construction as shown in Fig. 1, the end of the spindle, *a*, upon which the rotor wheel, *b*, and dummy piston, *c*, are carried, is provided with a hollow chamber, *d*, which extends into the part of the spindle, *a*, which is surrounded by the packing gland, *e*. The packing gland is formed with a small annular chamber, *f*, which is connected to a lantern space, *g*, supplied (by means not shown) with steam at a suitable pressure. This annular chamber, *f*, communicates with the interior of the spindle, *a*, by a convenient number of radial holes, *h*, in the spindle. It will be understood that on the inner side of the annular gland chamber, *f*, suitable labyrinth packings are provided and on the other side similar or Ramsbottom packings; these packings are however only shown in Fig. 3 of the drawings. The spindle, *a*, is provided with other radial holes, *i*, preferably smaller than the first mentioned holes, *h*, at a point near the inner end of the gland, *e*, or at a part opening directly into the interior of the drum or balancing piston chamber so that steam passed from the lantern space, *g*, into the interior of the spindle, *a*, by the holes, *h*, shall pass out through the second set of holes, *i*, into the interior of the drum which is at a lower pressure than the lantern space, *g*, of the gland, *e*. The chamber, *d*, in the spindle, *a*, is closed in any suitable manner say by a screwed plug engaging with the threaded part, *k*.

In the construction of turbine rotor, shown in Fig. 2, the spindle, *a*, extends the whole length of the rotor and the chamber, *d*, is closed by a plug, *m*, as shown. Further description of the spindle heating means is not necessary as it is similar to that already described, parts similar in this figure being indicated by the same reference letters.

In some cases when the steam is supplied to the gland some time before it is admitted to the turbine supply chamber, *j*, the expansion of the spindle, *a* under the influence of

the steam admitted at the gland causes the packing at the dummy piston, *c*, to open somewhat beyond the predetermined amount. Under the usual working conditions the pressure in the turbine supply chamber, *j*, is however only a few pounds higher than that existing in the lantern space, *g*, of the gland and therefore, when the working fluid is admitted to the turbine the dummy cylinder, *o*, is exposed to practically the same temperature as the spindle, *a*, and consequently the parts carrying the dummy packing rings expand to a similar amount as the spindle thus adjusting the clearance at the dummy packing rings. If however, the pressure in the turbine supply chamber, *j*, is higher or lower than that in the lantern space, *g*, the equalization of the expansion may still be obtained by suitably increasing or diminishing the distance to which the chamber, *d*, extends in the spindle, *a*. The size of the chamber may also be adjusted to provide for the difference of temperature of the fluid supplied to the turbine and of the fluid used for heating the spindle.

This invention may be applied to either high pressure or low pressure turbines.

The invention is of particular value in marine steam turbines used in conjunction with a thrust bearing.

According to the modification shown in Fig. 3 the steam is drawn from the turbine supply pipe forward of the stop valve controlling the supply of steam to the turbine or from another independent source of suitable pressure and is then led direct by way of the lantern space *g* annular space, *f*, in the gland packing, *e*, and the passages *h* into the hollow spindle, *d*. In order that the steam or other heating fluid may pass from end to end of the hollow spindle, *a*, a tube *m* is preferably placed therein and being formed with holes or openings *j*, at its innermost end causes the steam to pass axially within the tube and then through the holes, *j*, into the annular passage between the tube *m* and the spindle. The steam then passes by way of the passages *i* in the spindle to an annular space, *n*, in the gland packing *e* from whence most of the steam passes to another lantern space *p* which is connected with the exterior of the casing by a passage *s*, shown in dotted lines. Thus it will be seen that by connecting the passage *s* with a turbine stage of lower pressure than exists within the gland packing, *e*, steam or other heating fluid can circulate through the gland and hollow spindle.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In combination in a turbine a dummy piston, a spindle, a gland packing therefor, means for establishing a flow of hot fluid through said gland packing and spindle whereby a predetermined clearance is maintained during working in said gland and dummy piston.

2. In combination in a turbine a dummy piston, a spindle and a casing, a labyrinth packing gland between said spindle and casing, a hollow chamber in said spindle and a lantern space in said gland, means connecting said lantern space with the hollow spindle chamber so that a transference of heating fluid shall take place between the hollow spindle chamber and the lantern space of the gland whereby a predetermined clearance is maintained during working in the labyrinth packing of the gland and dummy piston.

3. In combination in a turbine a dummy piston, a spindle and a casing, a labyrinth packing gland between said spindle and casing, a hollow chamber in said spindle and a lantern space in said gland, means connecting said lantern space with the hollow spindle chamber and means connecting said chamber with a point of lower pressure than said lantern space whereby a transference of heating fluid from said gland through the chamber is established so that a predetermined clearance is maintained during working in the labyrinth packing of the gland and dummy piston carried by the spindle.

4. In combination in a turbine a dummy piston a spindle and a casing, a labyrinth packing gland between said spindle and casing, a hollow chamber in said spindle and a lantern space in said gland, radial holes through said spindle connecting the lantern space and hollow spindle chamber so that a transference of heating fluid shall take place between the hollow spindle chamber and the lantern space of the gland whereby a predetermined clearance is maintained during working in the labyrinth packing of the gland and dummy piston.

5. In combination in a turbine a dummy piston, a spindle and a casing, a labyrinth packing gland between said spindle and casing, a hollow chamber in said spindle and a lantern space in said gland, radial holes through said spindle connecting said lantern space with the hollow spindle chamber, and radial holes in said spindle connecting the hollow chamber with a point of lower pressure than said lantern space whereby a transference of heating fluid from said gland through the chamber is established so that a predetermined clearance is maintained during working in the labyrinth packing of the gland and dummy piston carried by the spindle.

6. In combination in a turbine a dummy piston, a spindle and a casing, a labyrinth packing gland between said spindle and casing, said spindle having a hollow chamber and the gland having a lantern space therein, means within said hollow spindle to

cause the heating fluid to pass from end to end of the spindle chamber, radial holes through said spindle connecting said lantern space with the hollow spindle chamber, and radial holes in said spindle connecting the hollow chamber with a point of lower pressure than said lantern space whereby a transference of heating fluid from said gland through the chamber is established thus maintaining a predetermined clearance during working in the labyrinth packing of the gland and dummy piston carried by the spindle.

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

CHARLES ALGERNON PARSONS.

Witnesses
FREDERICK GORDON HAY BEDFORD,
ALBERT WILLIAM PARR.