No. 779,771. PATENTED JAN. 10, 1905.

A. R. DODGE.

ADJUSTABLE PACKING FOR TURBINES.

APPLICATION FILED AUG. 8, 1903.

Fig. 1.

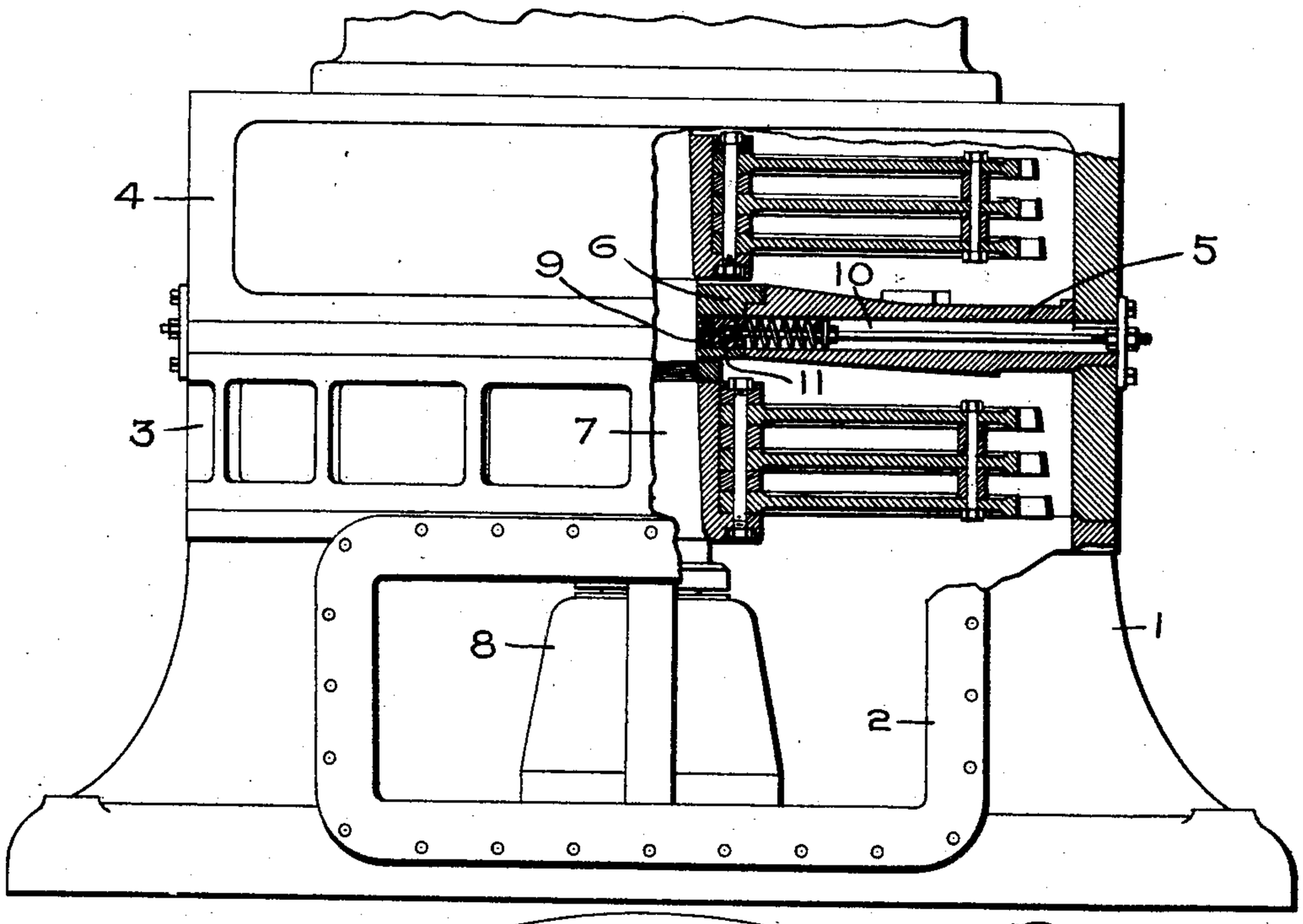

Fig. 2.

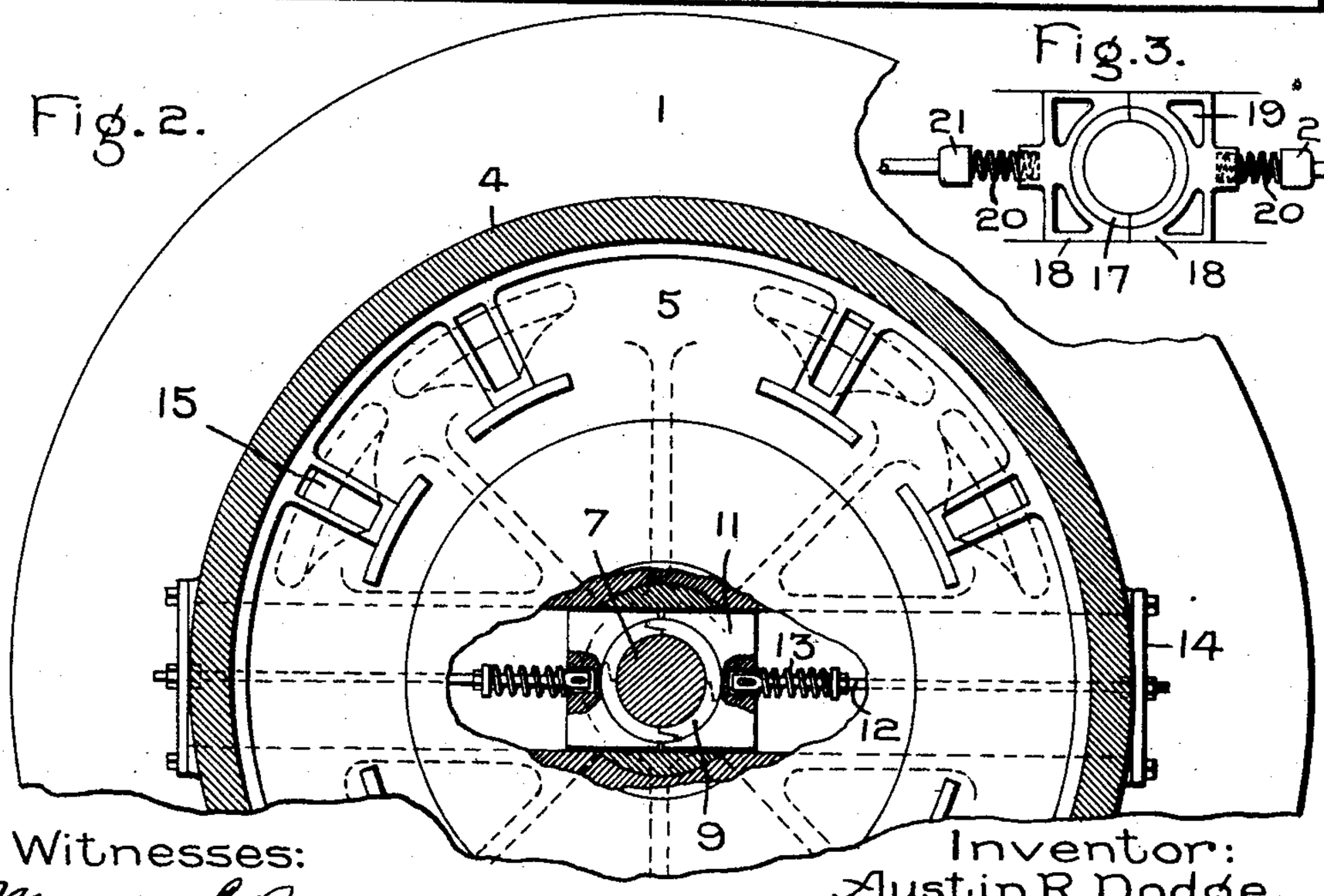

Fig. 3.

Witnesses:
Marcus L. Byng.
Alex. F. Macdonald.

Inventor:
Austin R. Dodge,
by Albert G. Davis
Atty.

PHOTO-LITHOGRAPHED BY SACHETT & WILHELMS LITHO. & PTG. CO. NEW YORK.

No. 779,771. Patented January 10, 1905.

UNITED STATES PATENT OFFICE.

AUSTIN R. DODGE, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ADJUSTABLE PACKING FOR TURBINES.

SPECIFICATION forming part of Letters Patent No. 779,771, dated January 10, 1905.

Application filed August 8, 1903. Serial No. 168,794.

To all whom it may concern:

Be it known that I, AUSTIN R. DODGE, a citizen of the United States, residing at Schenectady, in the county of Schenectady and State of New York, have invented certain new and useful Improvements in Removable and Adjustable Packings for Multistage Turbines, of which the following is a specification.

In elastic-fluid turbines it is necessary to use packings around the wheel-shaft between stages to prevent leakage. These packings are subject to wear and are also liable to give trouble, due to various causes. In order to reduce the size of the turbine as a whole, the shells for the different stages are usually made in the form of a long cylinder with one or more diaphragms or partitions for dividing the interior into wheel compartments or stages. The casing or shell is usually made in sections for convenience of manufacture and handling. The main shaft passes through the diaphragm or diaphragms, and the packings are usually supported by the latter, since they are fixed in position. The diaphragms and packings being within the casing with wheels on both sides thereof, up to the present time it has been impossible to get at a packing to adjust or repair it without removing an end of the casing and at least one wheel. In some instances where a dynamo is mounted on top of the casing or shell or is in line therewith this also has to be removed. It is evident that in these constructions nothing can be done to the packing in the way of adjusting or repairing it while the machines are in operation and also that they are a source of considerable expense and cause a good deal of trouble and delay. This means that the system into which the turbine enters is more or less crippled for the time being when the packing is to be fixed, depending upon the number of machines and the load conditions.

The present invention overcomes the objections above referred to by mounting the packings in such manner that they can be adjusted from a point outside of the casing or removed through suitable conduits or passages while the machine is idle or in operation under certain conditions, as desired, and this without in any way disturbing the wheels and casing or shell or the dynamo where such a machine is used.

I provide the turbine with as many wheels as is desired and inclose them in separate compartments, the number of wheels in each compartment being varied to suit the conditions for which the turbine is designed. Between adjacent wheels is a diaphragm or partition, and the number of diaphragms varies with the number of wheels or groups of wheels employed. Between the wheel-shaft and each of the high-pressure diaphragms is arranged a packing, which is preferably made as light as possible so as to have small inertia. With the lower-pressure stages these packings are not so important and in certain instances may be omitted. Located opposite each packing is a conduit or passage which may with advantage be formed in the diaphragms. These conduits or passages are of sufficient size to permit the insertion of a packing-ring, which may advantageously be made of carbon, together with a suitable holder for securing it in place. I find it best to make the packing-ring and its holder in two parts and insert them from opposite sides of the casing or shell through similar conduits or passages. In order to balance the pressures on opposite sides of the segmental packing-ring, steam or other fluid may be admitted to the casing. The outer end of each conduit is closed by a detachable cover-plate. The segments of the packing-ring are pressed against the shaft by suitable means. I have found springs to be satisfactory for this purpose. I adjust the packings from a point at or near the outer surface of the shell or casing of the machine. In the present embodiment this is accomplished by means of radially-extending rods which pass through the cover-plates and have adjusting-nuts; but the invention is not limited to the specific means shown. When the packings are worn, they are removed and recut to the desired shape. It is important to adjust the packings from time to time to prevent leakage from one wheel-compartment to another, thereby maintaining the high efficiency of the machine. Ordinarily the machine would be

shut down to remove the packings; but where a given stage is working at atmospheric pressure it can be done while the machine is in operation.

In the accompanying drawings, which represent one embodiment of my invention, Figure 1 is an elevation of a multistage turbine with certain of the parts broken away to illustrate the interior thereof. Fig. 2 is a transverse section, and Fig. 3 is a detail view, of a modified form of packing-support.

1 represents the base of the machine, which is connected with a condenser by means of a neck 2. Mounted on the top of the base is a sectional casing, which in this instance comprises two cylindrical portions 3 and 4. Situated between the portion of the casing is a diaphragm 5, whose sides are subjected to different pressures. This diaphragm serves to divide the casing into separate chambers or compartments, and a wheel is located in each of the compartments. The upper end of the casing is closed by a suitable top or cover, and the lower end opens directly into a condenser-chamber formed in the base, into which the bucket-wheel discharges steam. The wheels may be of any suitable character, and the number of rows of buckets thereon can be varied at will. In the present instance a jet-machine is shown with three rows of wheel-buckets per stage, it being understood that the necessary intermediate buckets and nozzles are also provided. The diaphragm is provided with top and bottom shoulders which engage the inner surfaces of the casing-sections, and the parts are united in any suitable manner. The particular means employed to support the diaphragm is, however, immaterial. The center of the diaphragm is bored out to receive the flanged sleeve 6, and the latter surrounds the main shaft 7, which carries the wheels and is supported in a step-bearing 8. The sleeve acts as a guide for the segmental detachable packing-ring 9, which engages with the shaft and prevents the leakage of fluid from one wheel chamber or shell to the other. The diaphragm is provided with conduits or passages 10. In the present instance two of these conduits are shown, which extend in opposite directions from the wheel-shaft. They are of such size that the packing-ring 9 and the holder 11 can be removed or adjusted from the outside of the wheel casing or shell. In the present illustration the holders are provided with flat top and bottom surfaces and parallel side walls, which surfaces and walls engage with the sleeve 6 and are guided thereby.

The packing-ring 9 may be made in as many segments as is desired. In the present instance two segments are shown with the ends arranged to overlap; but a different number of segments can be used and any other form of joint between the adjacent ends of the ring-segments.

Extending through each of the conduits is a rod 12, that is loosely connected to the packing-ring holder 11. For the purpose of maintaining the packing-ring in contact with the shaft a spring 13 is provided, that engages a stationary abutment on one end and with a holder at the other. A lost-motion connection comprising a slot and pin loosely connects the rod with the holder and permits of slight independent movements of the packing-ring and sleeve under the action of the spring. The outer end of the rod passes through a cover-plate 14, that is bolted to a finished face on the wheel-casing. The outer end of the rod is screw-threaded, and adjusting-nuts are provided on each side of the plate. By adjusting the rod longitudinally the tension of the spring 13 can be varied at will, and in this manner the packing-ring can be adjusted the required amount. When it becomes desirable to remove one or both portions of the packing-ring, one or both of the cover-plates 14 are removed, together with the nut on the outer end of the rod 12, after which the packing-ring and its holder can be removed through the conduits or passages. The interior of the conduits is unfinished in order to reduce expense. The sleeve 6, however, is provided with the necessary finished surfaces, which guide the holder and packing. By reason of this arrangement the machine-work is reduced to a minimum.

In Fig. 2 the steam-chests 15, which deliver steam to the nozzles 16, (shown by dotted lines,) are so spaced that the conduit 10 passes between them. In the present illustration four of these steam-chests are shown on one side of the center; but the number can be varied at will.

In Fig. 3 the packing-ring 17 is made in two parts with butt-joints instead of in four parts with overlapping ends, as in the other figures. The parts of the holder 18 are made as light as possible by coring out openings 19. In each section of the holder is formed a socket which supports the spring 20. The opposite end of the spring engages with an abutment 21, which is adjustable from a point at or near the periphery of the casing. With this arrangement the spring forms the sole connection between the abutment and the holder. A hook or similar device may be employed to remove the packing when necessary.

In accordance with the provisions of the patent statutes I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. An elastic-fluid turbine, comprising a

shaft and two or more wheels mounted thereon, a casing or shell therefor, and a diaphragm or partition located between the wheels and dividing the casing into compartments, in combination with a packing for preventing the passage of fluid from one side of the diaphragm or partition to the other, and a means for adjusting the packing from a point outside of the casing.

2. An elastic-fluid turbine, comprising a shaft and wheels mounted thereon, a casing or shell therefor having a peripheral opening, and a diaphragm located between adjacent wheels, in combination with a packing for preventing the passage of fluid from one side of the diaphragm to the other which is removable through the opening in the casing.

3. An elastic-fluid turbine, comprising a shaft and wheels mounted thereon, a casing or shell therefor having a peripheral opening, and a diaphragm located between adjacent wheels, in combination with a packing for preventing the passage of fluid from one side of the diaphragm to the other, and a conduit which registers with the opening in the outer wall of the casing through which the packing is adjustable and removable.

4. An elastic-fluid turbine, comprising a shaft and wheels mounted thereon, a casing or shell therefor, and a diaphragm located between adjacent wheels, in combination with a packing for preventing the passage of fluid from one side of the diaphragm to the other, and a conduit formed in the diaphragm through which the packing is removable.

5. An elastic-fluid turbine, comprising a shaft and wheels mounted thereon, a casing or shell therefor, and a diaphragm located between adjacent wheels, in combination with a divided packing for preventing leakage between shells, and oppositely-extending conduits, through which the packing may be removed.

6. An elastic-fluid turbine, comprising a shaft and wheels mounted thereon, a casing or shell therefor, and a diaphragm located between adjacent wheels, in combination with a divided packing entirely inclosed by the casing for preventing leakage between shell-compartments, and oppositely-extending means for adjusting the packing from the outside of the wheel casing or shell.

7. In an elastic-fluid turbine, the combination of a diaphragm having oppositely-extending conduits, a divided packing-ring which is inserted in place through the conduits, and a guide for the packing which is carried by the diaphragm.

8. In an elastic-fluid turbine, the combination of a diaphragm, a conduit extending from the center of the diaphragm to the edge, a packing-ring, a guide therefor, and a means located in the conduit for moving the ring.

9. In an elastic-fluid turbine, the combination of a diaphragm having oppositely-extending conduits formed therein, a slotted sleeve located at the center of the diaphragm, a segmental packing-ring and holder guided by the sleeve, and means for moving the ring and holder which pass through the conduits and are accessible from the edge of the diaphragm.

10. In an elastic-fluid turbine, the combination of a diaphragm or partition, a conduit extending from the center of the diaphragm toward the edge, a packing-ring which is removable through the conduit, and a cover-plate for closing the outer end of the conduit.

11. In a turbine, the combination of a casing having one or more openings in its outer surface, a diaphragm which divides the casing into compartments, and a packing-ring that is supported by the diaphragm and is removable through the opening or openings in the casing.

12. In a turbine, the combination of a wheel-shaft, a packing therefor, a casing inclosing the packing and wheel-shaft and provided with a peripheral opening through which the packing can be adjusted and removed, and an adjustable means located within the casing which constantly urges the packing into close contact with the shaft.

13. An elastic-fluid turbine comprising a bucket-wheel, a shaft, and a casing which incloses the wheel, in combination with a packing for the shaft, located within the casing, and a passage extending through the outer wall of the casing through which the packing can be manipulated.

14. An elastic-fluid turbine comprising bucket-wheels, a shaft, a casing which incloses the wheels, and a separator between the wheels, in combination with a packing wholly supported by the separator, and means extending to the outside of the casing for adjusting the packing.

15. In a multistage turbine, the combination of bucket-wheels, a casing which surrounds the wheels, a partition located between the wheel-bodies, which divides the casing into compartments, a packing entirely supported by the partition, and a means for compensating for wear of the packing, accessible from the outside of the casing.

In witness whereof I have hereunto set my hand this 6th day of August, 1903.

AUSTIN R. DODGE.

Witnesses:
W. H. CHAPMAN,
W. J. GAVIN.