No. 799,067. PATENTED SEPT. 12, 1905.

H. LENTZ.

TURBINE LOCOMOTIVE.

APPLICATION FILED JULY 19, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

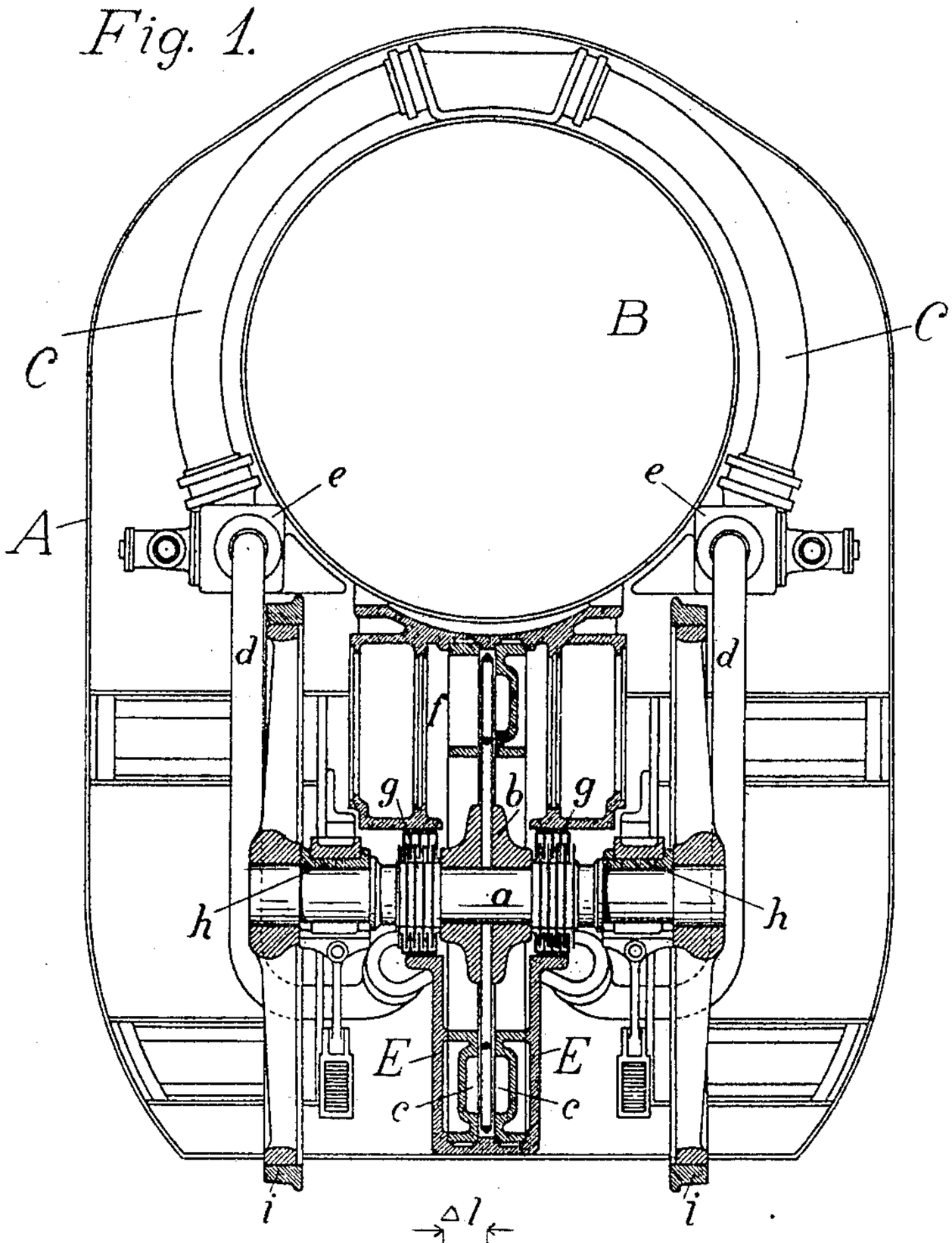
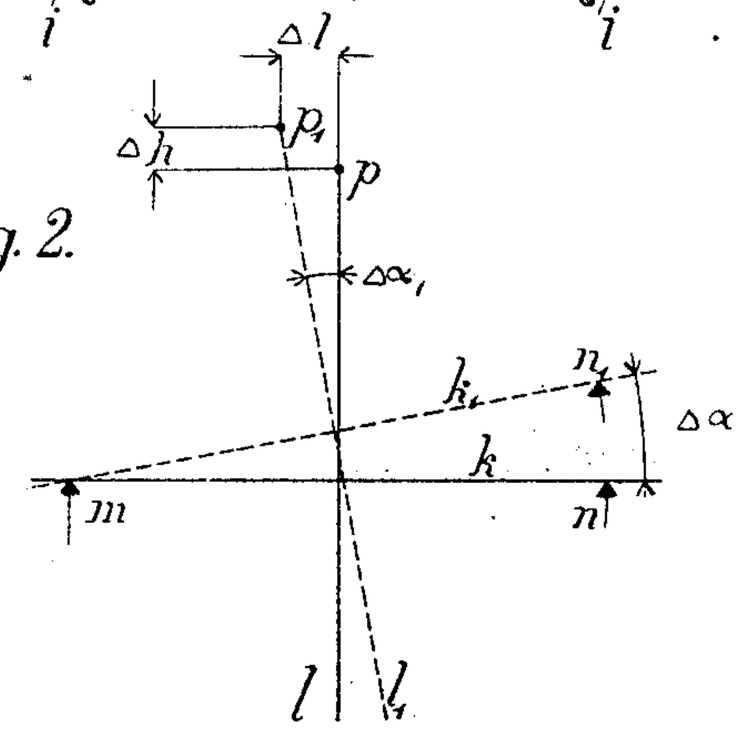


Fig. 2.



WITNESSES;

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2 SHEETS—SHEET 2.

Fig. 3.

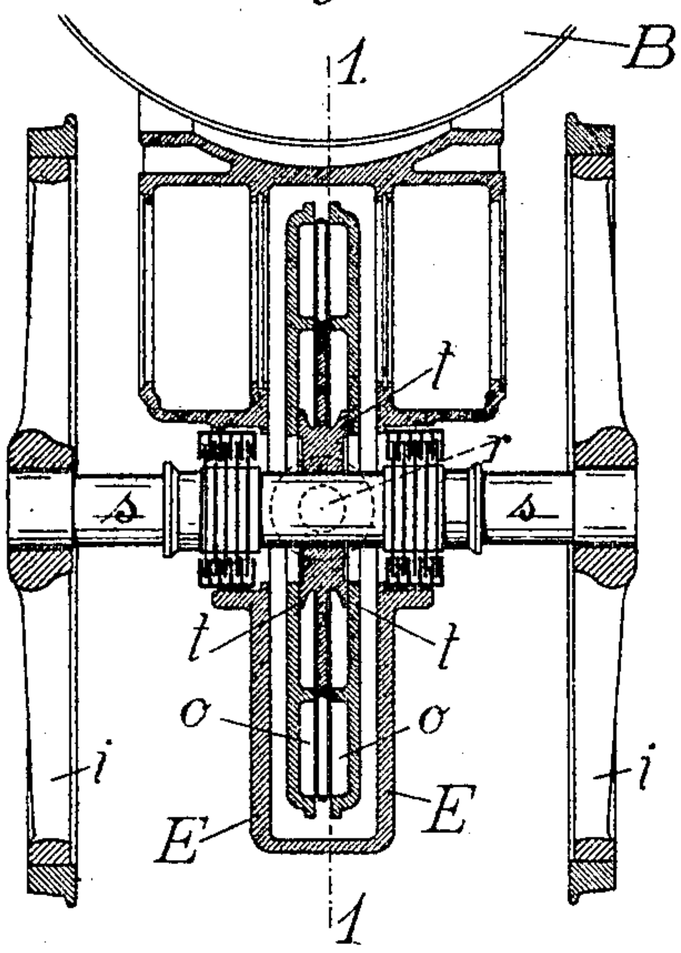


Fig. 4.

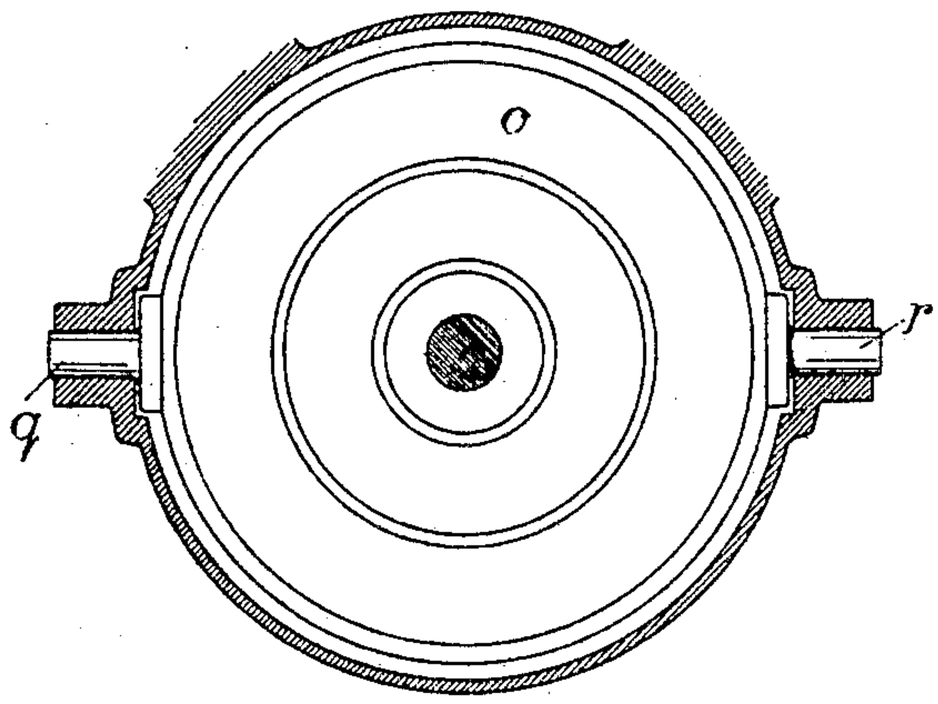
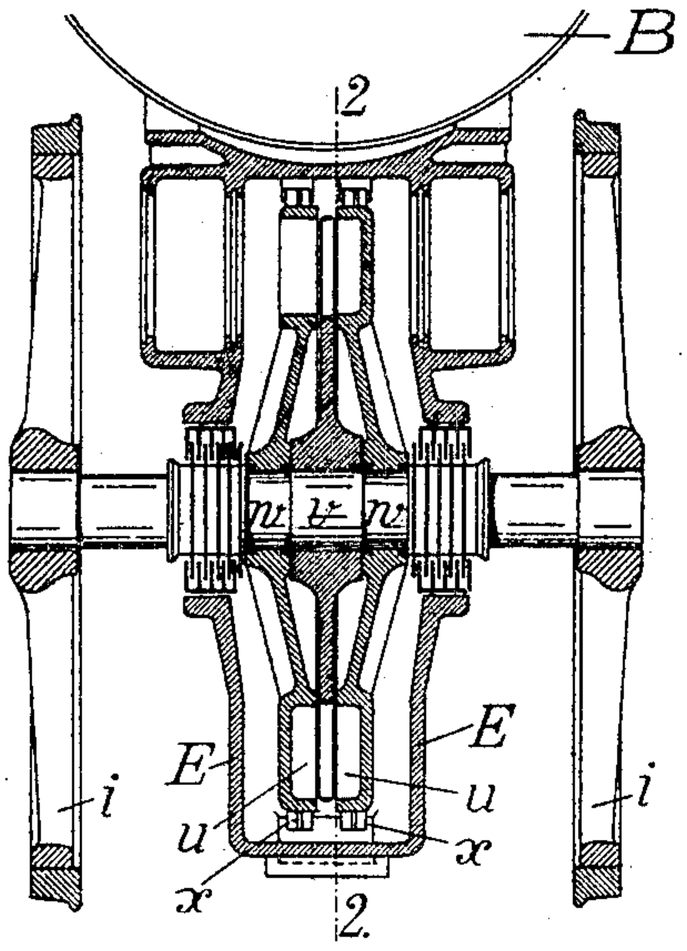
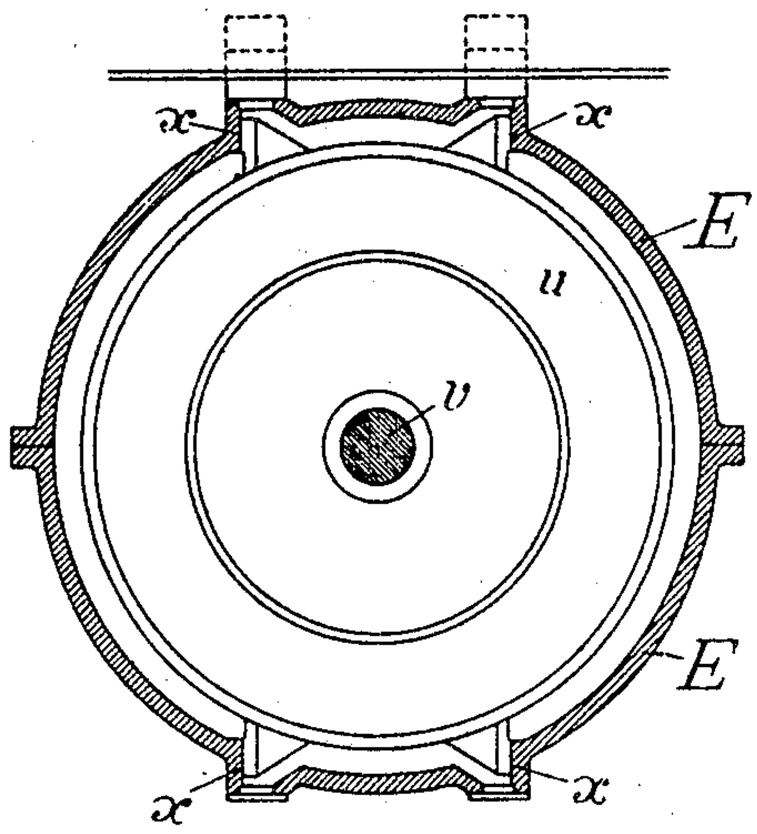


Fig. 5.

Fig. 6.





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TURBINE-LOCOMOTIVE.

No. 799,067. Specification of Letters Patent. Patented Sept. 12, 1905.

Application filed July 19, 1905. Serial No. 270,329.

To all whom it may concern:

Be it known that I, HUGO LENTZ, a subject of the German Emperor, residing at 10-11 Potsdammerstrasse, Berlin, Germany, have invented a new and useful Turbine-Locomotive; and I do hereby declare the following to be a full, clear, and exact description of the same.

This invention relates to improvements in turbine-engines, especially when employed in connection with locomotives, and results in important advantages and economies in construction and use of such engines.

In the operation of locomotives by means of turbine-engines it is important to connect as directly as possible the running-wheel or running-wheels of the turbine-engine to the traction-wheel or traction-wheels of the locomotive and to also relieve the driven axle of the weight of some of the parts of the turbine-engine. These two advantages are secured by my improvements. Another important result attained by the employment of these improvements is permitting the driven axle of the locomotive while relieved of the dead-weight of the engine and its connections to rise and fall and to be twisted or strained, owing to curves and inequalities of the rails or to the presence of obstacles, without being disconnected from the running-wheel and its guide means.

In the accompanying drawings I have shown several embodiments of my present improvements.

Figure 1 indicates a cross-section of a locomotive, showing the driving-wheels and the parts of the turbine-engine in cross-section, while the running-axle is shown by full lines. Fig. 2 is a diagram intended to illustrate movements of the running-axle and corresponding displacement of turbine running-wheel during the travel of the locomotive. Fig. 3 illustrates a modification of the apparatus shown in Fig. 1. Fig. 4 illustrates details of Fig. 3. Fig. 5 illustrates a third embodiment of my improvements, and Fig. 6 illustrates a detail of Fig. 5.

The several embodiments of my improvements illustrated in the different drawings have one common and preferred feature which is characteristic of my present invention—that the running-wheel of the turbine-engine and the guide means therefor (when used) may move independently of the turbine-casing and have a varying relation with respect thereto. A second novel feature characteristic of the several illustrated embodiments of my invention is that the working shaft (a running-axle is illustrated) has a free rocking movement within or through the walls of the turbine-casing.

So far as I am aware prior to my invention it has not been proposed either to have the guide means of a turbine-engine movable independently of the turbine-casing in order to have the guiding means maintain a permanent relation to the running-wheel nor has it been proposed to have the shaft driven by the running-wheel mounted so as to have free rocking movements with respect of the turbine-casing.

Referring to Fig. 1, A indicates a locomotive-frame, and B indicates a steam-generator of any desired type mounted thereon. C C are pipes leading steam from the generator to regulating boxes or chambers *e e*, from whence the steam is delivered by pipes *d* and *d* to one or more nozzles, which guide the injection of the steam against the impact-faces of paddles or against blades carried by and driving a running-wheel *b*. For simplification of drawings I have shown only one such running-wheel *b*. Following out the well-known modifications a succession of running-wheels may be employed. E indicates the casing of the turbine-engine, and *b* indicates the running-wheel directly secured to a shaft *a*, which constitutes the driving-axle of the locomotive and carries the flanged driving-wheels *i i* at its ends. The axle passes through the usual journals *h* and axle-boxes fitted for rising and falling movements in the pedestals or other parts of or accessories to the locomotive-frame. Inasmuch as the turbine-casing E is shown as being rigidly connected to the locomotive-frame and the running-wheel *b* is shown as rigidly connected with the axle *a*, it will be obvious that the said axle must, in order to yield to running strains and inequalities of travel, have a free rocking movement within said casing, and in view of the fact the turbine-casing will preferably (as shown) be located midway of both wheels *i* the axle must be permitted to have such free rocking movements in both shells or side walls of the turbine-casing. For this purpose the openings in the casing-walls are larger than the axle's diameter, preferably in all directions, and it is therefore necessary to provide a special construction and arrange-

ment of packing between the walls of the casing and the axle which will not interfere with the rocking movements of the axle *a* or other running-shaft which is driven by the turbine-engine. The packing arrangement preferred by me for such purpose, as illustrated in Figs. 1, 3, and 5, will comprise a flanged tubular box or ring, having a plurality of packing-rings, which closely fit the inner wall of such box or ring, and a plurality of packing-rings, placed alternately with respect of the first-named rings, surrounding and tightly engaging the axle *a*. Two sets of packing devices are preferably employed by me, as indicated especially at *g g*, Fig. 1. As a result of the described arrangement of parts, the axle will have free rising and falling movements, as well as responding to twisting strains due to running around curves, over rail ends, raised fish-plates, and running over obstructions, such as sticks, stones, bolts, &c. It is obvious also that my improvements provide not only for rocking movements of the axle, but for the rising and falling simultaneously of both ends, which constantly occurs during the speeding of the locomotive. The running-wheel *b*, being fixed to said axle, will constantly drive the axle, irrespective of its rocking, twisting, or other movements, and suitable arrangements will be provided whereby the jet or jets of steam from the supply-nozzle or supply-nozzles will be continuously directed in the most effective manner against the impact-faces of the paddles. Such arrangement will preferably comprise means whereby the nozzle or nozzles or the discharge end or ends thereof will rise and fall or oscillate with the running-wheel. Preferably, also, the running-wheel *b* will be reversible by being provided with reversible paddles or otherwise, or separate reversing means may be provided, in order that the locomotive may run in either direction.

The most effective form of turbine-engine, as is well known, employs means commonly called "guide means," which either direct a jet of steam from wheel to wheel of a multistage turbine or repeatedly return the jet of steam to the paddles of the same running-wheel, thereby in any event securing the effects due to repeated injections of steam against the impact-faces of the turbine-paddles. My invention also comprises the employment of guiding means for the purposes stated and the so combining of such guiding means with the running-wheel or running-wheels as to rise and fall therewith and to constantly maintain the effective position and relation of the guiding means to the running-wheel. To this end I provide guiding means which will have a movement—sliding, oscillatory, or otherwise—independently of the turbine-casing and carry such guiding means either on the running-wheel or the axle driven thereby, so as to cause the relation of the turbine-paddles and guiding means to be substantially invariable. The guiding means will preferably be carried by a suitable frame and will be restrained against rotative movements tending to the running-wheel by any proper devices which may be provided upon the turbine-casing. Referring now to Fig. 1, it will be seen that the guide means *c* are arranged on opposite sides of the running-wheel *b* and secured on frames, which are in turn fitted upon the hubs between which the running-wheel is clamped. The arrangement is of course one which permits the running-wheel to rotate freely of both guide means.

Fig. 2 is a diagram illustrating the turning movement of the shaft or axle *a* when one wheel runs over a stepped fish-plate or other rail obstruction or inequality. *n* and *m* represent the supporting-points, (synonymous with the wheels *i i* of Fig. 1,) and *k* represents the shaft (axle *a* of Fig. 1) upon which the running-wheel (represented by *l*) is fixed. If now it is imagined that the axle *k* is turned or rocked so as to assume the position of dotted line *k'* and the supporting-point *n* is in the position *n'*, the highest point *p* of the running-wheel line will be shifted to *p'* and the running-wheel will assume the position of the dotted line *l'*. The angle of rotation of shaft *k* is then equal to the angle of the running-wheel center plane.

Referring to Fig. 3, I have shown a form of my present invention in which the running-wheel is provided with projecting parts *t*, which may be continuous ribs and which move the guide means *o* to the extent desired. Such guide means may, as shown in Fig. 4, be mounted upon a frame provided with pivots *q* and *r*, constituting the points of oscillation of the frame and which are journaled directly in the turbine-casing or in parts carried thereby. The frame shown in Fig. 3 has a central opening *s* through which the axle *a* or other running-shaft revolves.

Another embodiment of my invention is shown in Figs. 5 and 6, wherein the guide means consists of two frames at opposite sides of the running-wheel, both said frames being positively carried by the axle *a a*, bearings or bushings *w* being fitted between the frames and the axle. In the said Figs. 5 and 6 the guide means (carried by the running-axle) is adapted to have a sliding engagement with the turbine-casing, so as to restrain the guide means against rotation, while permitting it to readily rise and fall with the axle. Especially referring to Fig. 6, it will be seen that I may provide a frame carrying guide means with projecting portions *x*, having smooth faces which rub against faces formed upon recessed parts at top and bottom of the casing.

The combining of the guiding means with the running-wheel permitting said guiding means to be movable within the turbine-cas-

ing results in a suitable adjustment in relation to the running-wheel, and when the driving-axle rotates in the vertical plane, as well as during the rising and falling motions and the twisting and straining effects, the tendencies to destruction of the running-wheel and guiding means and the disturbances in operation therewith connected are prevented.

What I claim is—

1. In combination a locomotive-frame, a turbine-casing secured thereto, a shaft passing through said casing and mounted for free rocking movements therein, a traction-wheel connected with said shaft, and a running-wheel provided with paddles within the casing and connected to the driving-shaft.

2. In combination a locomotive-frame, a turbine-casing secured thereto, a shaft passing through said casing and mounted for free rocking movements therein, a traction-wheel connected with said shaft, and a running-wheel provided with paddles within the casing and rocking with the shaft.

3. In combination, a locomotive-frame, a turbine-casing secured thereto, a shaft passing through said casing and mounted for free rocking movements therein, a traction-wheel connected with said shaft, a running-wheel provided with paddles and a guide means therefor both within the casing and rocking with the shaft.

4. In combination, a locomotive-frame, a turbine-casing secured thereto, a shaft passing through said casing and mounted for free rocking movements therein, a traction-wheel connected with said shaft, a running-wheel provided with paddles within the casing and rocking with the shaft and guiding means for said wheel mounted to maintain its working position relative thereto during the rocking movement of said shaft.

5. In combination, a locomotive-frame, a turbine-casing connected thereto, a shaft passing through said casing and mounted for free rocking movements therein, a traction-wheel connected with said shaft, a running-wheel provided with paddles within the casing and a guiding means for said wheel having a freely-movable engagement with the turbine-casing.

6. In combination a locomotive-frame, a turbine-casing connected therewith, a shaft passing through said casing and mounted for free rocking movements therein, a traction-wheel connected with said shaft, a running-wheel provided with paddles within the casing and a guiding means for said wheel comprising a frame having a sliding engagement with the turbine-casing.

7. In combination, a locomotive-frame, a turbine-casing connected therewith, a shaft passing through said casing and mounted for free rocking movements therein, a traction-wheel connected with said shaft, and a running-wheel provided with paddles within the casing and directly carried by the shaft.

8. In combination, a locomotive-frame, a turbine-casing connected therewith, a shaft passing through said casing and mounted for free rocking movements therein, a traction-wheel connected with said shaft, a running-wheel provided with paddles and a guiding means therefor both being within the casing and directly carried by the shaft.

9. In combination, a locomotive-frame, a turbine-casing rigidly connected therewith, a shaft passing through said casing and mounted for free rocking movements therein, a traction-wheel connected with said shaft, a running-wheel provided with paddles within the casing rigidly connected to said shaft, and guiding means for said running-wheel carried by the said shaft which rotates therethrough.

10. In a turbine-engine, a casing, a rotatable shaft therein, a running-wheel provided with paddles and rigidly carried by said shaft and a guiding means for said wheel connected with and movable independently of said casing.

11. In combination, a locomotive-frame, a turbine-casing connected therewith, a running-axle passing through said casing and having a free rocking movement therein, a running-wheel provided with paddles within the casing and directly connected with the axle and springs-support interposed between the axle-boxes and the locomotive-frame for relieving the axle of the dead-weight of the turbine-casing.

12. In a turbine-engine, a casing, a rotatable shaft mounted for free rocking movements in the casing, a running-wheel provided with paddles and connected with said shaft, and packings between said shaft and casing comprising a plurality of packing parts adapted to maintain a shifting contact during the running of the engine.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HUGO LENTZ.

Witnesses:
WOLDEMAR HAUPT,
HENRY HASPER.