

July 15, 1924.

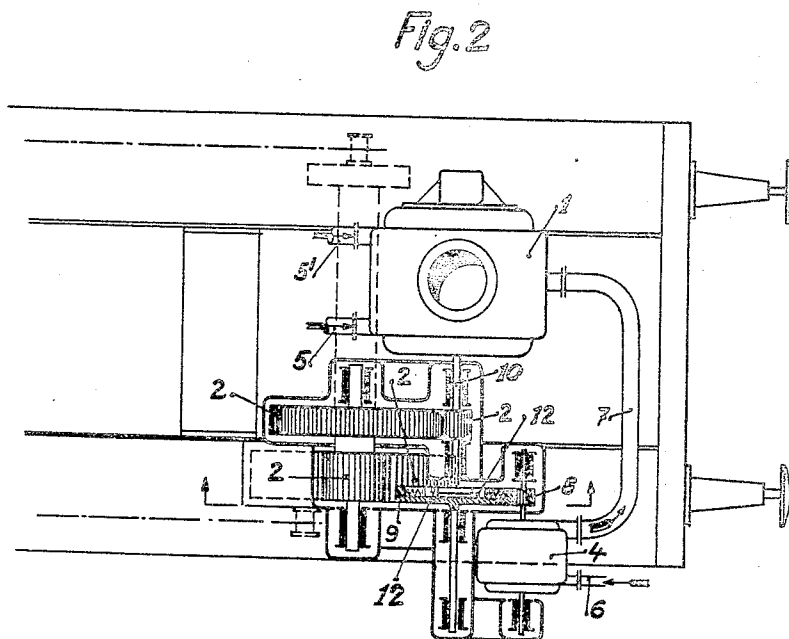
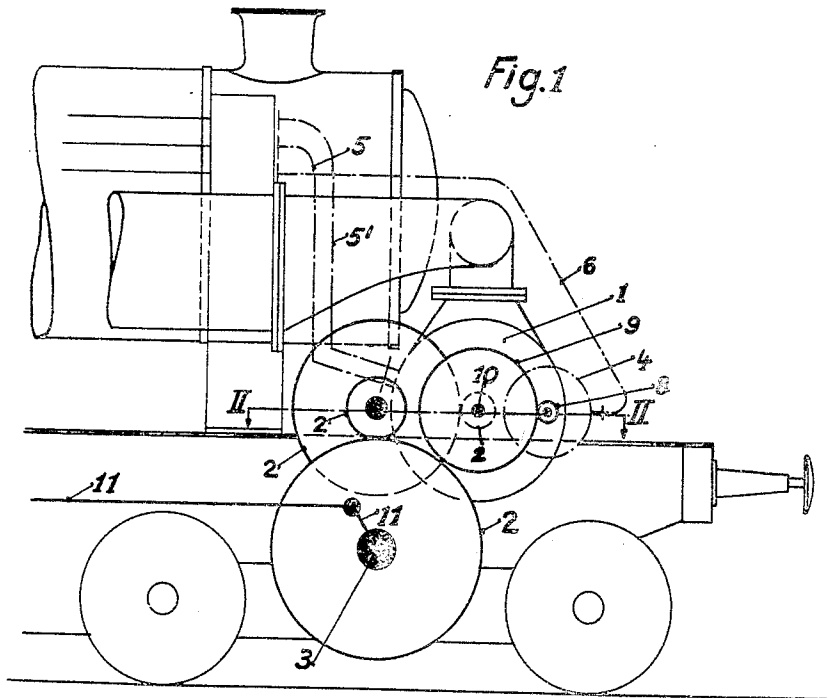
1,501,604

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TURBINE DRIVEN LAND VEHICLE

Filed March 17, 1922

3 Sheets-Sheet 1



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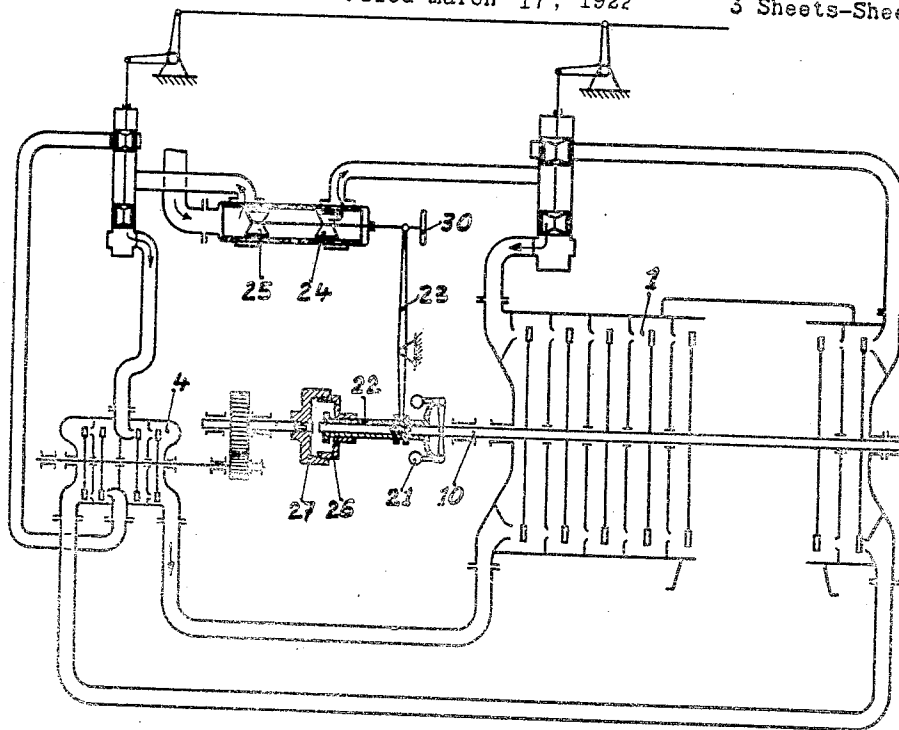


Fig. 3

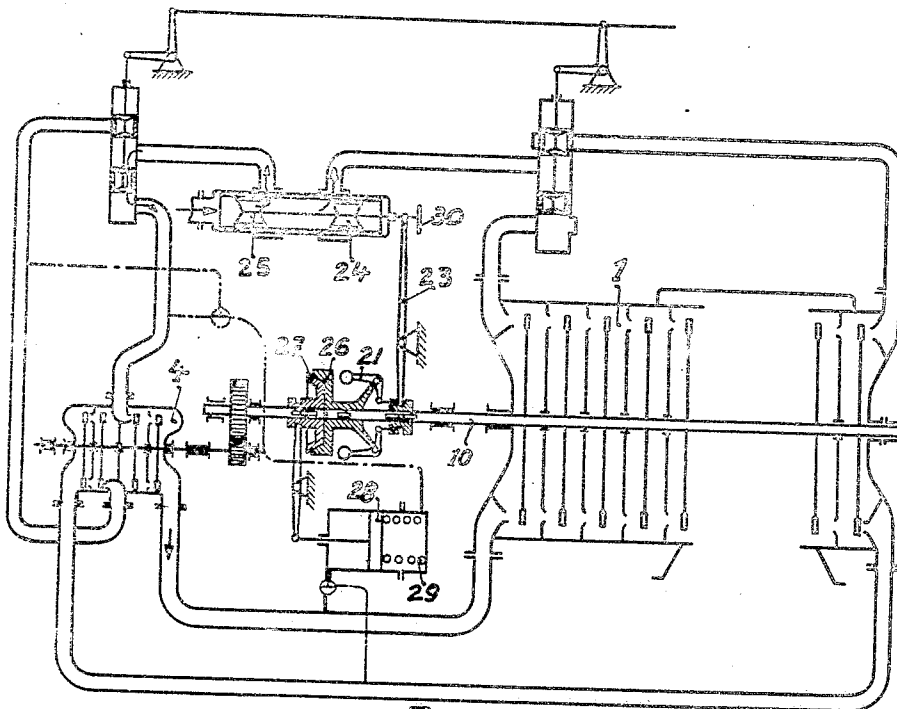


Fig. 4

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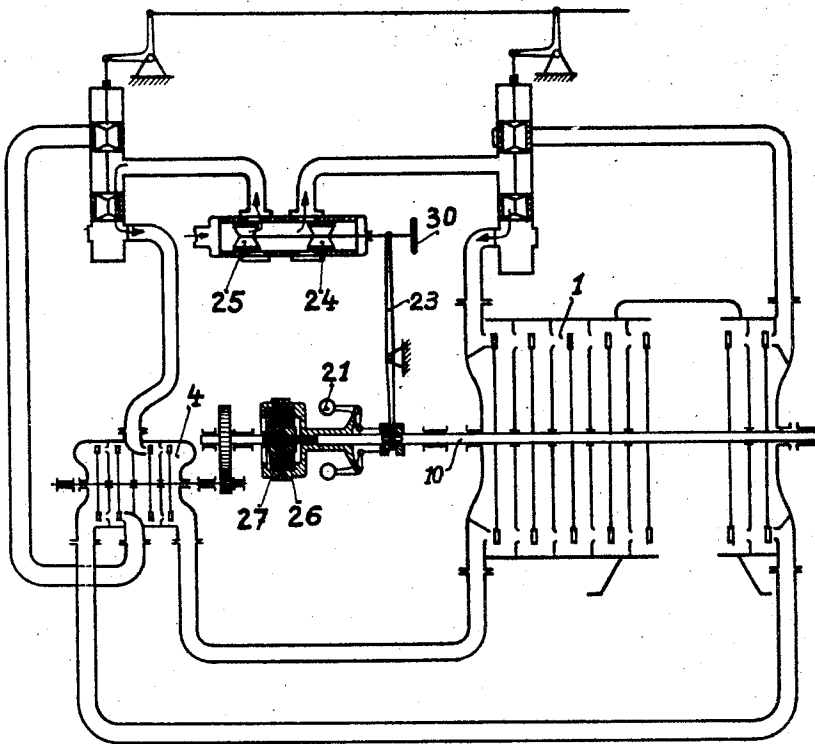


Fig. 5

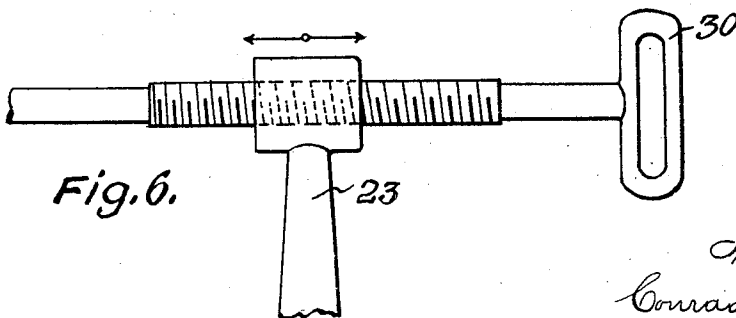


Fig. 6.

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UNITED STATES PATENT OFFICE.

CONRAD KOHLER, OF ZURICH, SWITZERLAND.

TURBINE-DRIVEN LAND VEHICLE.

Application filed March 17, 1922. Serial No. 544,544.

To all whom it may concern:

Be it known that I, CONRAD KOHLER, a citizen of the Republic of Switzerland, residing at Zurich, Switzerland, have invented certain new and useful Improvements in Turbine-Driven Land Vehicles, of which the following is a specification, reference being had therein to the accompanying drawing.

It is a known fact that with land vehicles such as those for rail and road and which are driven by turbines, for instance with steam turbine locomotives, the efficiency during the starting period is very low. A great quantity of steam is consumed without having in return a notable output. The amount of work derived from the steam is thus small. The reason for this fact is that during the starting period the ratio between the circumferential speeds of the turbines and the velocity of the steam is too small. As is well known, the efficiency of the turbine depends, however, on said ratio. The same drawback results as soon as the running speed of the locomotive drops below a certain degree owing to excessive load of the train or heavy gradients.

The object of the present invention is to secure a land vehicle of the above described type in which a good utilization of the steam is attained during the starting period as well as when the vehicle travels at a speed that is below a certain normal running speed, the vehicle thus consuming during these working conditions moderate quantities of steam. To this end according to the invention the vehicle besides having a main turbine for the normal running is provided with an additional turbine for the starting and for the running at speeds that are below a determined running speed. Said additional turbine actuates the driving axles through a larger transmission ratio than the main turbine so that, for a determinate quantity of steam, the additional turbine exerts a greater pulling force on the circumference of the driving wheels than the main turbine, the additional turbine being cut out as soon as a sufficiently high running speed is attained.

With such a vehicle the additional turbine that operates the driving axles through a greater transmission ratio than the main turbine runs at the beginning of the starting period with a much greater speed than the main turbine. The circumferential

speed of the additional turbine is therefore very soon comparatively great so that even with a low running speed of the vehicle its efficiency is relatively high. When a determined running speed is exceeded then the main turbine also runs at a circumferential speed at which the efficiency of the main turbine is high and a good utilization of steam in the main turbine results, whilst the efficiency of the additional turbine then starts to decrease as its optimum circumferential speed has been exceeded; therefore the additional turbine is cut out of operation when said running speed of the vehicle is attained so that only the main turbine drives the vehicle.

The vehicle may preferably be so designed that during the starting period and during the running of the vehicle below a determined speed the additional turbine actuates the shaft of the main turbine by means of a transmission gearing, the main turbine working on the driving axles in a known manner, such as by means of a transmission gearing.

Preferably the disconnecting or cutting out of the additional turbine may be automatically effected when a sufficiently high running speed of the vehicle is reached. The additional turbine may work in series with the main turbine, so that the steam leaving the additional turbine flows over into the main turbine. The automatic cutting in and out of the additional turbine working in series with the main turbine may be effected by means of a speed governor co-operating with the shaft of the main turbine, which governor, for instance, causes the steam supply to the additional turbine to be interrupted as soon as the latter runs at a certain speed. Furthermore, means may be provided that cause the disconnection of the additional turbine as soon as its power drops below a given quantity, or the disconnection of the additional turbine may be dependent upon the amount of power supplied to the main turbine so that it is cut out as soon as it does not deliver any power to the main turbine.

If it is desired an astern turbine may be arranged working on the shaft of the additional turbine.

Constructional examples of the object of the invention are shown in the accompanying drawing, in which:

Fig. 1 is a side elevation of the front part of the locomotive, and

Fig. 2 shows partly a plan view of the turbine, the boiler being removed, and partly a section along line II—II of Fig. 1.

Figs. 3-5 illustrate diagrammatically several constructional forms of arrangements for automatically disconnecting under determined working conditions the additional or pilot turbine, consisting of a forward driving and a reversing turbine from the main turbine which also consists of an ahead and an astern turbine. In the Figs. 3-5 the gearing transmitting the power from the main turbine to the lay shaft, which may be arranged in the same manner as is shown in Fig. 2, is omitted for the sake of clearness. Fig. 6 is a detail view of the handle 30 and its relation to lever 23.

Referring to the drawings, 1 denotes the main turbine which actuates by the interposition of a transmission gearing 2 a lay-shaft 3, from which the driving power is transmitted, by means of a parallel crank 11, to the driving axles. The main turbine receives live steam by a conduit 5 for travelling ahead and by a conduit 5' for reversing its movement. 4 denotes an additional turbine to which live steam is supplied by means of a conduit 6. The discharge end of this additional turbine 4 is connected up to the main turbine 1 by a conduit 7. By the interposition of a toothed gearing 8, 9, of which the part 9 is designed to form part of a clutch for establishing a driving connection between turbine 4 and shaft 10, the additional turbine 4 actuates the shaft 10 of the main turbine 1. The coupling comprises spring loaded jaw members 12 which are moved radially by the action of the centrifugal force when a determined number of revolutions per minute of wheel 9 and shaft 10 is reached. The additional turbine 4 actuates the driving axles through a larger transmission ratio than the main turbine 1.

The main turbine 1 serves to drive during the normal running and the additional turbine 4 serves for starting the locomotive and for the drive when the locomotive runs below a determined speed, whereby in consequence of the larger transmission ratio with which it actuates the driving axles, the additional turbine exerts, for the same quantity of steam, a greater pulling force than the main turbine 1 and produces an operation of the vehicle with a better efficiency than would be the case if under the above mentioned working conditions the main turbine 1 were to drive the locomotive. In consequence of the provision of the coupling 9, 12 the cutting out of the additional turbine is automatically effected as soon as a sufficiently high running speed is attained after the starting

and the cutting in occurs as soon as the running speed of the locomotive drops below a determined figure owing to the excessive load of the train or heavy grades.

If the additional turbine works in series with the main turbine in the manner illustrated, which manner of connection is, however, not absolutely necessary, it is advisable to connect the means serving for the automatic cutting in and out of the additional turbine to the device governing the admission of steam to the additional turbine and to the main turbine. Arrangements of this type are illustrated in Figs. 3-5, in which the main turbine as well as the additional turbine consists of a forward driving and a reversing turbine. With the arrangement shown in Fig. 3 a speed-governor 21 that forms at the same time part of a disengageable coupling 26, 27 is mounted on the shaft 10 of the main turbine 1; the governor 21 being connected by means of a sleeve 22 and a lever 23 to the valves 24, 25 controlling the admission of steam to the main turbine and to the additional turbine. This speed governor 21 may in this case operate to shut off steam from the main and simultaneously admit steam to the auxiliary turbine, and vice versa.

As is shown in Fig. 4 the second operative part 27 of the above mentioned coupling 27, 26 may also be operatively connected to a piston 28, one side of which is acted upon by a spring 29 and by the pressure present in the inlet branch of the additional turbine 4 whilst the other side of said piston is influenced by the pressure present in the discharge branch of said turbine, the coupling being cut out and the additional turbine becoming inoperative as soon as its drop of pressure, i. e., the difference between said pressures, becomes zero.

The automatic cut out of the additional turbine 4 may also be effected subject to the amount of power transmitted to the main turbine, so that the additional turbine is cut out as soon as it does not transmit any power to the main turbine.

An arrangement of this type is illustrated in Fig. 5. As soon as the additional turbine 4 does no longer transmit power to the main turbine 1 it starts to lag. Thereby a distancing of the coupling parts 27, 26, which co-operate with left and right hand threaded parts, is effected.

If it is desired a manually actuated valve 30 (Figs. 3-5) may be provided that controls simultaneously the steam admission to the additional turbine and to the main turbine so that upon a manual displacement of said valve when a determined running speed has been reached, the additional turbine may be cut out.

The additional turbine may be fitted to any vehicle adapted for propulsion on land that is driven by turbines, for instance, to automobiles.

5 I claim:

1. A land vehicle, comprising in combination, a main turbine adapted to drive the vehicle under normal running conditions, an additional turbine supplied only with live steam serving to drive the vehicle during the starting period and during the running of the vehicle at speeds below a determined running speed and transmitting its driving power through a larger transmission ratio than the main turbine for the purpose of obtaining a better utilization of the energy inherent to the steam, and means for cutting said additional turbine in and out during the respective running conditions.

2. A vehicle for rail and road, comprising in combination, a main turbine, a transmission gearing interposed between the driving axles and said main turbine, the latter being adapted to actuate thereby the driving axles during normal running of the vehicle, an additional turbine, a transmission gearing interposed between said main turbine and said additional turbine the latter serving to actuate the driving axles during the starting period and during the running of the vehicle at speeds below a determined running speed through a larger transmission ratio than the main turbine, and means for cutting in and out said additional turbine during the respective running conditions.

3. A vehicle for rail and road, comprising in combination, a main turbine, a transmission gearing interposed between the driving axles and said main turbine, the latter being adapted to actuate the driving axles of the vehicles during normal running of the vehicle, an additional turbine, a transmission gearing interposed between said main turbine and said additional turbine the latter serving to actuate the driving axles of the vehicle during the starting period and during the running of the vehicle at speeds below a determined running speed through a larger transmission ratio than the main turbine, and means for automatically cutting out said additional turbine when a determined running speed of the vehicle is attained.

4. A land vehicle comprising in combination, a main turbine adapted to actuate the driving axles during normal running of the vehicle, an additional turbine supplied only with live steam said additional turbine being arranged in series with the said main turbine and being the primary element to which steam is supplied, said additional turbine being supplied with steam only during the starting period and during the running of the vehicle at speeds below a determined running speed and transmitting its driving

power through a larger transmission ratio than the main turbine for the purpose of obtaining a better utilization of the energy inherent to the steam, and means for cutting said additional turbine in and out during the respective running conditions.

5. A vehicle for rail and road, comprising in combination a main turbine, a transmission gearing interposed between the driving axles and said main turbine, the latter being adapted to actuate the driving axles of the vehicle during normal running of the vehicle, an additional turbine working in series with said main turbine and being the primary element to which steam is supplied, a transmission gearing interposed between said main turbine and said additional turbine the latter serving to actuate the driving axles of the vehicle during the starting period and during the running of the vehicle at speeds below a determined running speed through a larger transmission ratio than the main turbine, and a speed governor arranged on the shaft of the main turbine and causing a closing of the steam-admission to the additional turbine as soon as said additional turbine runs at a determined speed.

6. A vehicle for rail and road, comprising in combination, a main turbine, a transmission gearing interposed between the driving axles and said main turbine, the latter being adapted to actuate the driving axles of the vehicles during normal running of the vehicle, an additional turbine working in series with said main turbine and being the primary element to which steam is supplied, a transmission gearing interposed between said main turbine and said additional turbine the latter serving to actuate the driving axles of the vehicle during the starting period and during the running of the vehicle at speeds below a determined running speed through a larger transmission ratio than the main turbine, clutch means interposed in the drive between the additional turbine and the main turbine, and a speed governor arranged on the shaft of the main turbine controlling the steam admission to the main turbine and to the additional turbine and causing a closing of the steam admission to the latter and the disengagement of said clutch means as soon as the additional turbine runs at a determined speed.

7. A land vehicle comprising in combination, a main turbine for driving the vehicle under normal running conditions, an additional turbine exhausting into said main turbine, said additional turbine supplied only with live steam for starting the vehicle and operating it below normal speed, and power transmitting mechanism of large ratio of transmission between said additional turbine and vehicle, and means

to mechanically disconnect the additional turbine when the vehicle has been brought up to normal speed.

8. A land vehicle, comprising in combination, a main turbine, a lay shaft driven thereby during normal running of the vehicle, means operatively transmitting the power of said lay shaft to the driving axles of the vehicle, an additional turbine arranged to drive said lay shaft during the starting period and during the running of

the vehicle at speeds below a determined running speed and transmitting its driving power to said shaft through a larger transmission ratio than the main turbine for the purpose of obtaining a better utilization of the energy inherent to the steam, and means for rendering the additional turbine operative and inoperative during the respective running conditions.

In testimony whereof I affix my signature.
CONRAD KOHLER.