

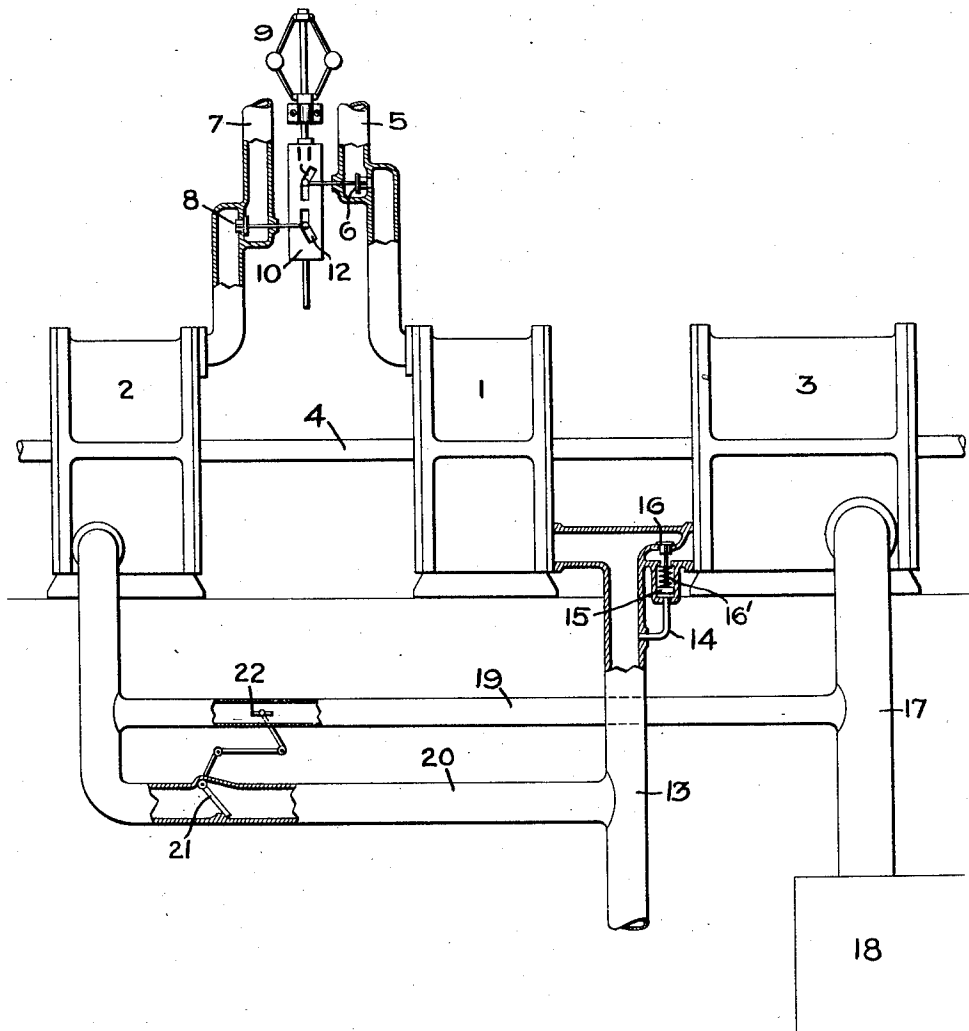
J. WILKINSON.  
EXTRACTING STEAM FROM TURBINES.  
APPLICATION FILED OCT. 29, 1912.

1,063,487.

Patented June 3, 1913.

2 SHEETS—SHEET 1.

*Fig. 1.*



Witnesses  
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2 SHEETS—SHEET 2.

5 P.M. 1400 K.W.

Fig. 2.

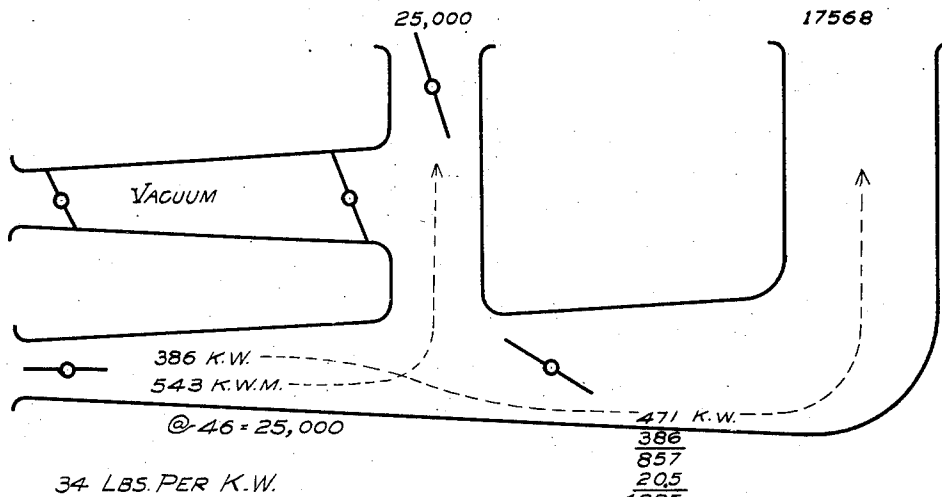
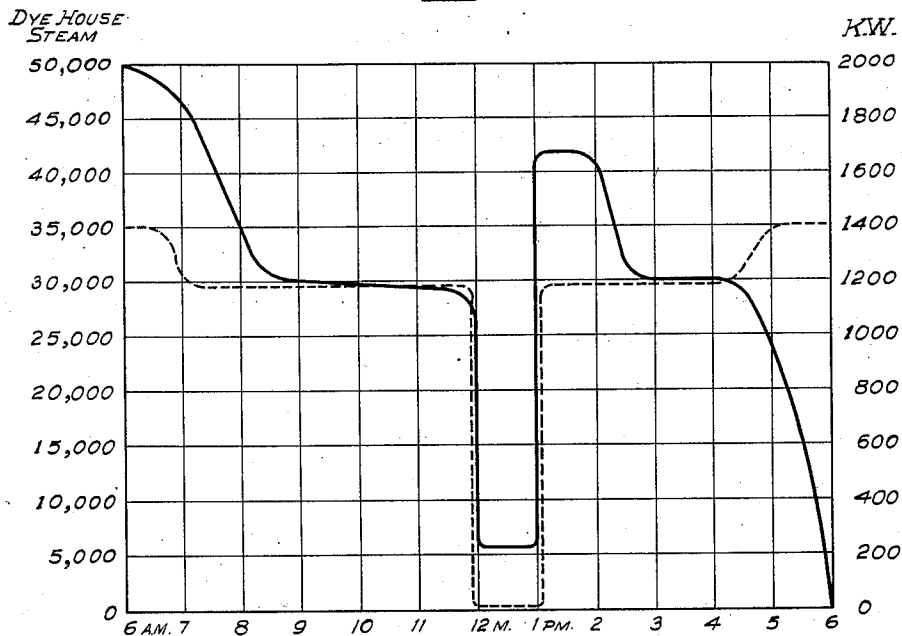


Fig. 3.

$\frac{386}{857}$   
 $\frac{205}{4285}$   
 $\frac{1714}{17568.5}$



Witnesses

*Charles H. Ellis*  
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# UNITED STATES PATENT OFFICE.

JAMES WILKINSON, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## EXTRACTING STEAM FROM TURBINES.

1,063,487.

Specification of Letters Patent.

Patented June 3, 1913.

Application filed October 29, 1912. Serial No. 728,373.

*To all whom it may concern:*

Be it known that I, JAMES WILKINSON, a citizen of the United States, residing at Boston, county of Suffolk, State of Massachusetts, have invented certain new and useful Improvements in Extracting Steam from Turbines, of which the following is a specification.

This invention relates to what are known as "tapped" or "extraction" turbines, that is to say, those from which steam is extracted, after passing one or more of the high pressure stages, for the purpose of supplying various industrial systems or appliances.

The object of the invention is to provide an installation which will automatically carry a varying load, both of turbo-generated electrical energy, and of industrial consumption of steam. To accomplish this economically and efficiently the turbine is arranged to run either non-condensing or condensing, and to change automatically from one condition to the other, with varying demands upon it. To get the best effect, the high pressure end is divided into two sections, which come into action in succession; the second section running idly in a vacuum when not at work. The low pressure end becomes operative only when the demand for industrial steam is low.

In the accompanying drawings, Figure 1 is a diagrammatic illustration of my improved tapped turbine; Fig. 2 is a diagram showing the relation of parts under a certain condition of operation; and Fig. 3 is a chart showing curves of consumption of steam and electricity during a day's run of a factory, and illustrating the variations in service which my invention is designed to meet.

In Fig. 1 it is assumed that 1, 2 and 3 represent respectively two high pressure sections and the low pressure section of a steam turbine, the bucket wheels in all three sections being mounted on a common shaft 4, which carries any desired load, such as an electric generator. The high pressure section 1 is supplied with steam through a main 5 controlled by some kind of valve gear, such for instance as a throttle 6. The other high pressure section is similarly supplied through a main 7 and valve gear 8. These valves are under control of a speed governor 9 which is arranged to open the throttle 6

before it opens the throttle 8, and to close them in reverse order. The mechanism for producing this effect is indicated conventionally in the drawing by the plate 10 containing cam slots 11, 12, which act directly upon the stems of the valves, as the plate is raised and lowered by the speed governor. The tap or extraction pipe 13, which supplies steam to the heating, cooking or industrial system leads off from the section 1. A small pipe 14 branches from said extraction pipe and conveys the pressure therein to a movable abutment 15, which is connected to a check valve 16, normally seated by a spring 16', and controlling a passage from the high pressure section 1 to the low pressure section 3. A conduit 17 connects the section 3 with the condenser 18. A branch conduit 19 runs to the conduit 17 from the second high pressure section 2, the latter being also connected by a pipe 20 with the extraction pipe 13. A self-closing check valve 21 controls the latter pipe, being so arranged as to be opened by fluid pressure exhausting through said pipe 20 to the industrial system, said valve being closed by its own weight. In opening, the valve 21 automatically closes the condenser conduit 19, by its connections with a valve 22 in that conduit; said valve being automatically opened when the check valve closes.

The chart, Fig. 3, shows that in the case of the factory illustrated, during the early morning and late afternoon hours the electrical load is heavier than through the day. In fact, it remains about the same from a little after seven a. m. to a little after four p. m. The industrial consumption of steam is heaviest early in the morning, when the apparatus is warming up. About half past eight it settles down to a pretty steady load which keeps up until about half past four p. m. when it drops off rapidly, becoming zero at six p. m. During the noon hour, from twelve to one o'clock, the demand for current is practically nil, and the steam consumption very low; rising suddenly at one o'clock to an extra height for about an hour while the apparatus is warming up again. The heavy electrical load at early morning and at night will cause the speed governor 9 to open up both throttle valves and admit steam to both of the high pressure sections 1 and 2. The exhaust from section 1 passes directly into the extraction pipe 13, while

that from section 2 reaches said pipe through the branch pipe 20. In so doing it opens the check valve 21 and closes the valve 22 in the branch conduit 19, preventing the exhaust from section 2 from going to the condenser 18. When the excessive demand for industrial steam drops off, the lessened flow in the pipe 13 will allow the check valve 21 to close, which opens valve 22 and puts section 2 in communication with the condenser. The rising pressure in the extraction pipe due to the lessened demand, will lift the abutment 15 and open the valve 16, allowing part of the exhaust from section 1 to flow through the low pressure section 3. The speed governor 9 will presently close the throttle 8, and the bucket wheels in section 2 will run idle in a vacuum, by reason of the opened connection with the condenser. When the industrial apparatus shuts down at night, the check valve 21 will remain closed, and the turbine will run condensing using either one or both sections 1 and 2 as the load may require.

Fig. 2 shows the situation at five p. m. when the demand for industrial steam has dropped to say 25,000 pounds and the electrical load has risen to its peak value of 1400 K. W. and the turbine is running condensing, section 1 developing 929 K. W. and using 42,568 pounds of steam, while the low pressure section 3 is developing 471 K. W. on the 17,568 pounds left after 25,000 pounds have been taken by the industrial system. This 25,000 pounds represents 543 of the 929 K. W. developed by section 1, the remaining 386 K. W. combining with the 471 K. W. developed by section 3, to give a total of 857, which shows an efficiency of 20.5 pounds per K. W. for the combined high and low pressure unit, and on the same ratio, a total efficiency for the entire machine of about 34 pounds per K. W.

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. A steam turbine comprising two high pressure sections and a low pressure section, means for extracting steam for industrial purposes from one of said high pressure sections, and means for automatically connecting said section to the low pressure section when the demand for industrial steam drops to a predetermined amount.

2. A steam turbine comprising two high pressure sections and a low pressure section, means for supplying steam to said high

pressure sections in succession, a pipe for extracting steam from the first of said high pressure sections, and means for automatically connecting said section with the low pressure section when the demand for industrial steam lessens.

3. A steam turbine comprising two high pressure sections and a low pressure section, speed responsive means for admitting steam to said high pressure sections in succession, a pipe for extracting steam for industrial purposes leading from the first of the high pressure sections, a pipe connecting the second high pressure section with said extracting pipe, a condenser connected to the low pressure section and to the second high pressure section, and means for automatically controlling said pipes.

4. A steam turbine comprising two high pressure sections and a low pressure section, speed responsive means arranged to admit steam to said high pressure sections in succession, a connection between the first high pressure and the low pressure sections, a pipe for extracting steam for industrial purposes leading from said first high pressure section, a valve responsive to pressure in said pipe and controlling the connection to the low pressure section, and a branch pipe between said pipe and the second high pressure section.

5. A steam turbine comprising two high pressure sections and a low pressure section, speed responsive means arranged to admit steam to said high pressure sections in succession, a connection between the first high pressure and the low pressure sections, a pipe for extracting steam for industrial purposes leading from said first high pressure section, a valve responsive to pressure in said pipe and controlling the connection to the low pressure section, a branch extraction pipe between said pipe and the second high pressure section, and a check valve in said branch extraction pipe.

6. A steam turbine comprising two high pressure sections and a low pressure section, speed responsive means arranged to admit steam to said high pressure sections in succession, a connection between the first high pressure and the low pressure sections, a pipe for extracting steam for industrial purposes leading from said first high pressure section, a valve responsive to pressure in said pipe and controlling the connection to the low pressure section, a branch extraction pipe between said pipe and the second high pressure section, a condenser connected to the low pressure section, and a branch conduit from said second high pressure section to said condenser.

7. A steam turbine comprising two high pressure sections and a low pressure section, speed responsive means arranged to admit steam to said high pressure sections in suc-

cession, a connection between the first high  
pressure and the low pressure sections, a  
pipe for extracting steam for industrial pur-  
poses leading from said first high pressure  
5 section, a valve responsive to pressure in  
said pipe and controlling the connection to  
the low pressure section, a branch extraction  
pipe between said pipe and the second high  
pressure section, a condenser connected to  
10 the low pressure section, a branch conduit  
from said second high pressure section to

said condenser, a throttle valve in said con-  
duit, and a check valve in the branch ex-  
traction pipe which operates reciprocally  
with said throttle valve.

In witness whereof, I have hereunto set  
my hand this 26th day of October, 1912.

JAMES WILKINSON.

Witnesses:

BERTHA A. LORD,  
N. L. GANNON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,  
Washington, D. C."