E. F. EDGAR.

STEAM TURBINE.

APPLICATION FILED MAY 31, 1910.

980,503.

Patented Jan. 3, 1911.

3 SHEETS—SHEET 1.

Fig. 2.

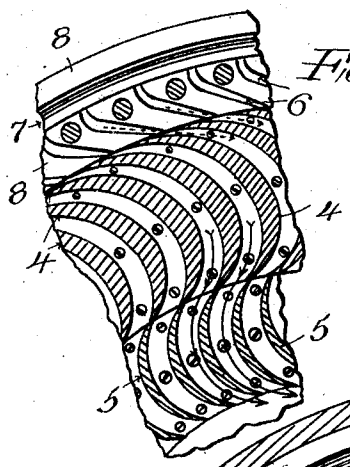

Fig. 1.

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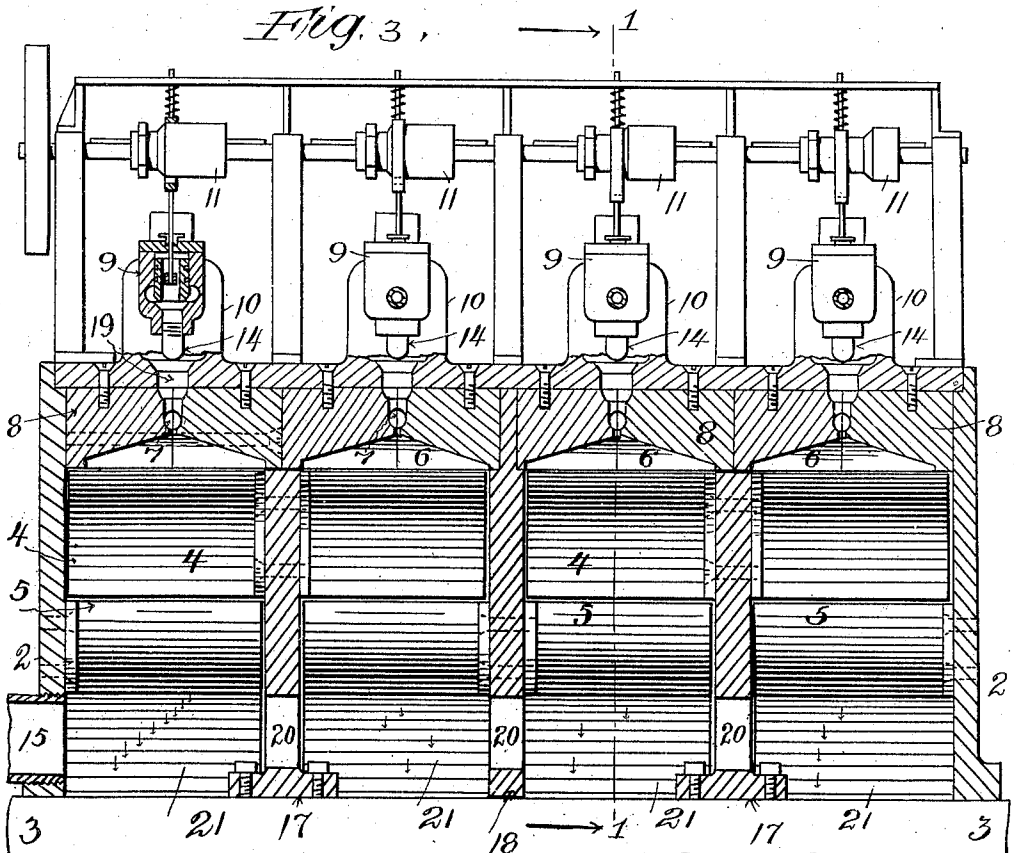
3 SHEETS—SHEET 2.

Fig. 3.



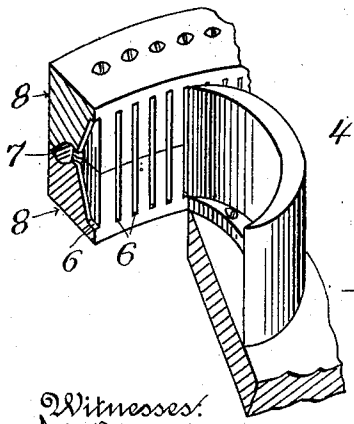


Fig. 4.

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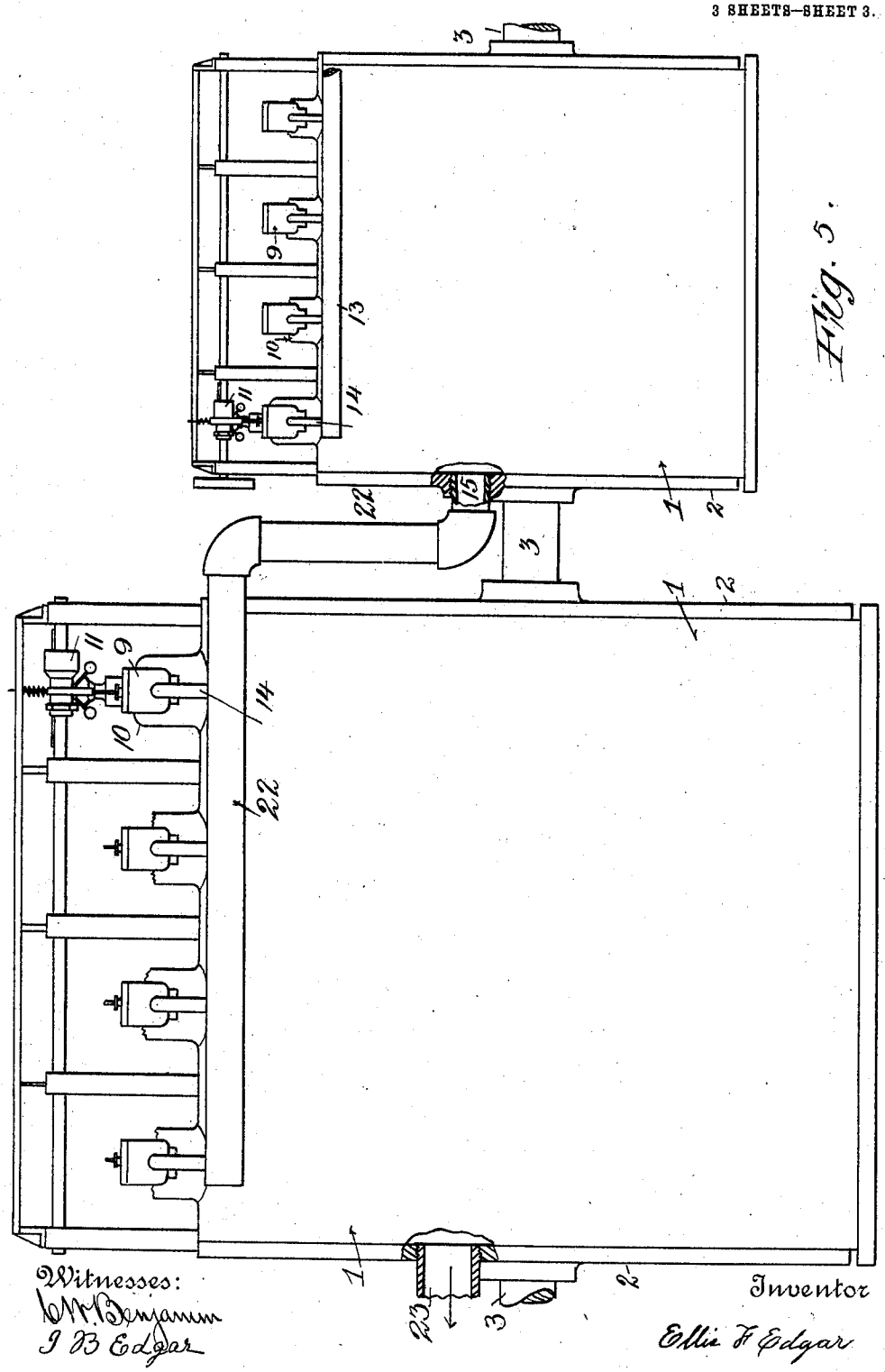

Fig. 5.

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UNITED STATES PATENT OFFICE.

ELLIS F. EDGAR, OF WOODBRIDGE, NEW JERSEY.

STEAM-TURBINE.

980,503. Specification of Letters Patent. Patented Jan. 3, 1911.

Application filed May 31, 1910. Serial No. 564,036.

To all whom it may concern:

Be it known that I, ELLIS F. EDGAR, citizen of the United States, and resident of Woodbridge, in the county of Middlesex and State of New Jersey, have invented certain new and useful Improvements in Steam-Turbine Engines, of which the following is a specification.

Figure 1 is an end elevation, part in section and part in full, section taken at line 1 in Fig. 3. Fig. 2 is an enlarged detail section view through steam chest casing, steam chest guides, moving blades and stationary blades. Fig. 3 is a side elevation view, part in section and part in full. Fig. 4 is a detail view of steam chest and casing with a section through one of the guides and showing the mouth of several other guides also one of the moving blades. Fig. 5 is a side elevation in full of a compound turbine engine embodying the features hereinafter described.

The valves and guides here shown are set forth and claimed in Patent No. 943,922, December 21, 1909, also in Patent No. 952,791, March 22nd, 1910 to E. F. Edgar.

My object in designing this steam turbine was to produce a turbine engine capable of using a steam pressure up to five thousand pounds or more with economy as hereinafter set forth.

Details of construction.—1, outside side casing; 2, outside end casing; 3, driving shaft; 4, moving blades; 5, stationary blades; 6, steam guides from steam chests to moving blades; 7, steam chest; 8, steam chest casing or ring; 9, first valve delivering boiler pressure; 10, ball governor cut-out valve; 11, opening and closing cam to valve 9; 12, ball governor to valve 10; 13, main feed line from steam generator to valve 9; 14, steam connection from valve 9 to valve 10; 15, steam exit; 16, steam connection from main line 13 to valve 9; 17, driving wheel connected to driving shaft and having the moving blades 4 at its outer periphery; 18, partition supporting stationary blades 5; 19, chamber connecting valve 10 to steam chest 7; 20, steam openings through driving wheels 17, and partition 18 in exhaust steam chamber 21; 21, exhaust steam chamber; 22, steam line connecting exhaust steam from exhaust port 15 to the valves on the compounding cylinder; 23, exhaust from the compound cylinder.

General description.—This steam turbine comprises a driving shaft with one or more driving wheels attached to said driving shaft, preferably more than one. In small engines there would be only one, unless the construction or size could be carried out better with more than one. These driving wheels have blades termed the moving blades, secured on one or both sides of said driving wheels and may be at the outer periphery of said driving wheels, as shown in this case, one on each side of said driving wheel, or they may extend through said driving wheel and be bolted or riveted by a flange to said driving wheel to stiffen them to prevent their moving and the stationary blades on the outer ends may be secured to the end casing, the others being secured to stationary walls or partitions, one being shown in this case holding the two center rows of stationary blades as shown in Fig. 3, the partition being numbered 18. In a very large turbine the driving wheels might have two rows of the moving blades on each side of said driving wheel and a row of stationary blades on each side of said driving wheel between the rows of moving blades, and another row of stationary blades or abutments to receive the steam as it passes off of said moving blades to the exhaust chamber. I do not confine myself to the exact method shown in this case of having the steam chest and guides to the moving blades located at the outer periphery of the moving blades just inside the outer casing, and the exhaust chamber being around the driving shaft as I might put the steam chest in this place or at the inner side of the moving blades and have the exhaust just inside the outer casing the exhaust steam might strike against the inner wall of the outer casing, but preferably I would have the steam chest as shown in a heavy casing or ring located just inside the outer casing and preferably I would construct for each steam chest a casing composed of a ring made in two halves and bolted together as shown in Fig. 4. These steam chest casings or rings can be made of cast steel or forged steel, or other material having the steam chest and guides cast or pressed in the ring either when being cast or forged. In this manner of construction these casings or rings can be made to stand a very high working pressure and after the steam comes out of the mouth of the guides on the moving blades in sheet form, the pressure can be regulated

at almost any desired point according to the size of the guides and the ratio of the opening from the guide to the steam chest to the area of the guide and the mouth of the guide.

Fig. 2 shows the passage of the steam from the steam chest through the moving blades and the stationary blades from the guides connected to the steam chest, preferably I would have this steam chest and these guides extend all the way around on one side of the moving blades and preferably on the outer side as shown. My object of making my guides terminate in a long narrow mouth and from multiple steam chests with numerous guides to each steam chest and preferably one guide to each blade all the way around the driving wheel, delivering the steam in these numerous thin sheets onto blades of large area and preferably the space between the moving blades being contracted on the sides next to the guides, is to divide the steam in sheet form over the large area and expanding it as it moves not only through the guides, but through the moving blades as shown in Fig. 2. In this manner I am enabled to use the high pressure carried in the steam chest and obtain an economical use of the steam, as it is impossible for any of the steam to escape without passing over the blades and after the steam exhausts from stationary blades 5 to the exhaust steam chamber, 21, the pressure is so reduced, it is not necessary to have a heavy outer casing to this engine. I would simply secure the steam chest casing or rings by bolts to the outer casing to hold them in their place. If more power is desired from this engine it can be obtained by either raising the pressure at the steam generator and in steam chest 7, or by increasing the openings from guides 6 to steam chest 7; either will develop more power and will increase the pressure of the exhaust steam in chamber 21 which can be utilized by passing the exhaust steam through exhaust connection 15 to pipe line 22 which is connected to the valves of a compound cylinder, containing valves, driving wheels and blades, the same as the first high pressure cylinder as shown and as I will hereinafter describe. All the areas through the valves, guides and blades will be of larger area so that when the steam finally passes out of the exhaust connection 23 of the compound cylinder preferably to a condenser the pressure can be reduced at this point to any desired pressure, as the pressure going into exhaust chamber 21 can be regulated as I have just set forth and further, one or more of said driving wheels in the first or high pressure cylinder can be operated and the exhaust from the same can be worked through one or all of the driving wheels in the compound cylinder.

This engine is designed especially to give high economy with varying loads. High economy may be obtained at one quarter, half or full load in the following manner. As in the case of a battleship or cruiser when running at only ten knots an hour, only a sufficient number of the driving wheels would be used to carry the load as each set of moving blades is supplied by an independent steam chest, an independent set of guides and each steam chest has its two valves, the primary valve 9, which is operated by an opening, and closing cam that delivers steam at boiler pressure to valve 10, which is preferably operated by a ball governor, which in the case of a vessel pitching in a rough sea and the screws starting to race these governors will quickly close the valves as they are perfectly balanced valves, and these valves can be set to be closed at different speeds, so that in the multiple steam chest type only a sufficient number of these valves will close automatically to meet the emergency, sufficient number of valves 9 having been opened to take care of the desired speed. In this manner I always have boiler pressure operating on the load whatever it may be, thereby obtaining economy that cannot be obtained by a pulsating system. If the speed of the vessel is increased to twenty knots, more of valves 9 are opening, steam passing from valves 9 to valves 10, and so on to the moving blades operating as many sections of the moving blades as is necessary for the load. Valves 10 are only emergency valves to prevent racing of the engine by a sudden cut-off of the load. With this combination this engine is capable of producing a horse power at five thousand working pressure from less than seven thousand B. T. U's.

I do not confine myself to the exact form of securing both the moving blades and the stationary blades as shown as I might secure my moving blades to driving wheels connected to the driving shaft by gearing. Preferably I would close the space between the moving blades at the ends.

What I claim as new and desire to secure by Letters Patent is:—

1. A steam turbine engine having one or more ring casings, each ring casing having a steam chest and spreader guides formed therein, said guides being connected to said steam chests by one small orifice to each guide and said guides having converging nozzles terminating in a long narrow mouth, said guides so formed as to spread the steam in a thin sheet at the mouth of said guides leading to long moving blades, said long moving blades, so arranged as to form long diverging nozzles between said long moving blades, all substantially as shown and described and for the purpose set forth.

2. A steam turbine engine having one or more ring casings, each ring casing having a steam chest and spreader guides formed

therein, said guides being connected to said steam chests by one small orifice to each guide and said guides having converging nozzles terminating in a long narrow mouth, said guides so formed as to spread the steam in a thin sheet at the mouth of said guides leading to long moving blades, said long moving blades so arranged as to form long diverging nozzles between said long moving blades the exhaust of which is connected to a compound cylinder of similar construction but of larger area all substantially as shown and described and for the purpose set forth.

Signed at New York in the county of New York and State of New York this 27th day of May A. D. 1910.

ELLIS F. EDGAR.

Witnesses:
I. B. EDGAR,
R. B. EDGAR.