

Feb. 12, 1935.

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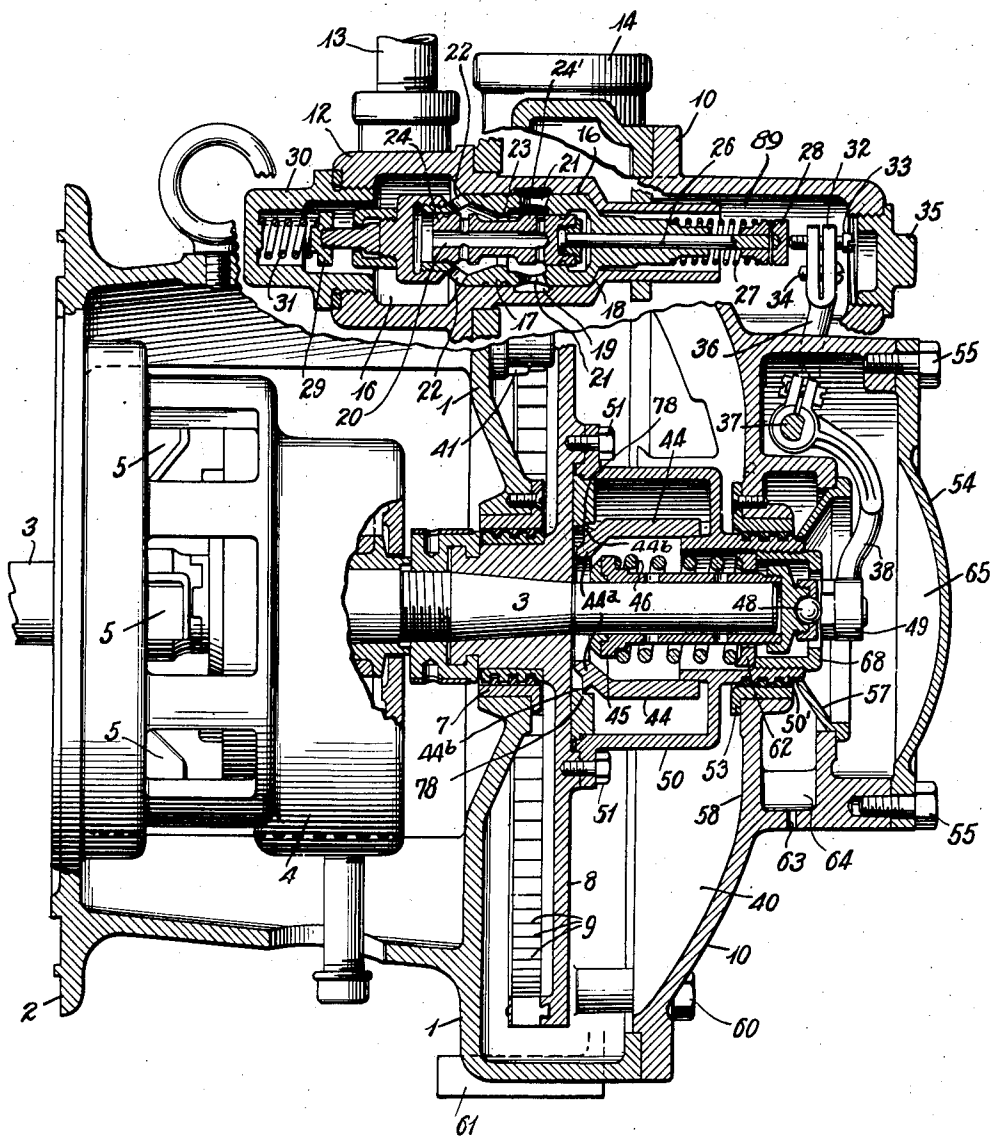
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PRIME MOVER

Filed July 13, 1933

3 Sheets-Sheet 1

*Fig. 1.*



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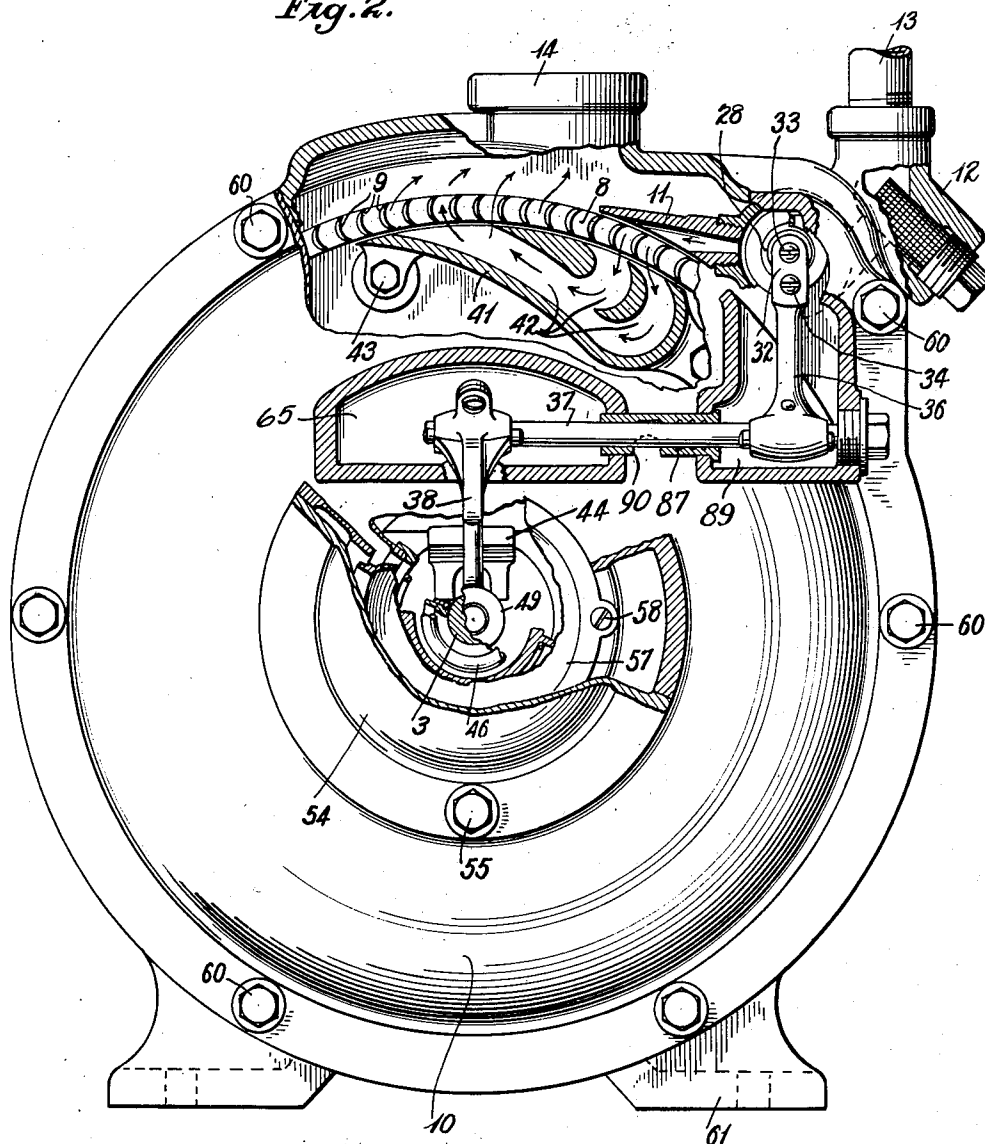
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*Fig. 2.*



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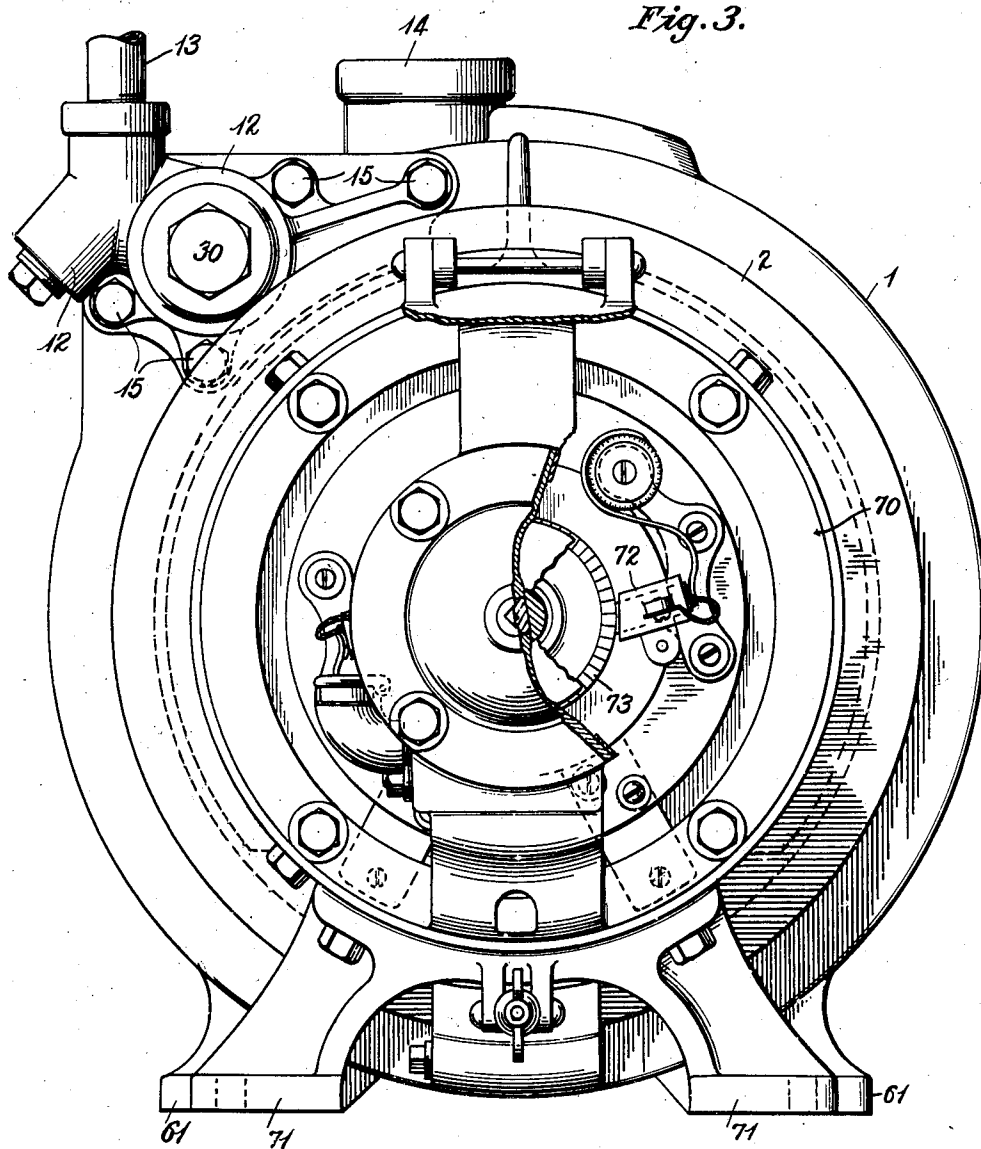
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## UNITED STATES PATENT OFFICE

1,990,872

## PRIME MOVER

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Application July 13, 1933, Serial No. 680,317

21 Claims. (Cl. 253—52)

This invention relates to improvements in turbines and especially to a type of turbine which is frequently combined with a generator to form a turbo-generator unit.

It is one object of this invention to design the operative elements of a steam turbine so that a most efficient operation may be obtained thereby.

It is a further object of the invention to simplify the maintenance required by a turbine unit. The adjustment as well as the removability of several elements in the turbine unit may be conveniently made, according to the instant invention, without dismantling other elements of the unit.

It is a further object of the invention to so improve the design of the governor element which is associated with turbines of the type according to the instant invention that a sticking thereof is prevented, and a frequent cleaning thereof, necessitated by impurities in the water forming the actuating fluid, is obviated.

Other objects and purposes will appear from a more detailed description of the invention taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a sectional view of the turbine unit with certain parts in elevation;

Fig. 2 is a right end view of Fig. 1, and

Fig. 3 is a left end view thereof.

In Fig. 1, the turbine casing, generally designated as 1, is integral with a wall 2 onto which is attached the electric generator unit 70 (Fig. 3), the output of which is utilized for the energization of locomotive headlights or other energy consuming elements. The shaft 3 which extends along the turbine unit and the electric generator is supported in the bearing 4 as well as in a bearing, not shown, at the remote end of the electric generator, 70, having ventilating blades 5. The turbine wheel, composed of a frame 8 and a series of blades or buckets 9, is rigidly fixed to shaft 3 and is suitably designed for rotation in a bearing bush 7 fixed to the end wall of the turbine casing 1. The turbine casing is completed by a turbine head or cover 10 which is detachably fixed to the casing 1 by means of several bolts 60.

The turbine wheel 8 is rotated by means of a stream of an actuating fluid such as steam issuing from the nozzle 11 (Fig. 2) against the blades 9. To more efficiently utilize all the available energy, a guiding element 41 having channels 42 therein is fixed by means of bolts 43 to the casing 1. These channels redirect the steam exhausted from the wheel at one point to the

wheel at another point, before the final passage of the steam from the exhaust chamber through outlet 14. The nozzle 11 is removably fixed in a valve unit 12, which is bodily detachable from the turbine casing by the removal of four bolts 15 (Fig. 3). A pipe 13 is connected to the inlet socket of the valve unit for supplying steam to the steam chest 16 and from there through the valve to the nozzle. The valve unit 12 is formed with a chamber 16 in the interior thereof in which is fitted a slidable shell 17. The latter has a shoulder 18 which is maintained pressed against a corresponding slope on the inside of valve unit 12 by means of a spring 31 in a recessed nut 30 operating against a seat 29 connected with the shell 17. The spring may be removed independently of the unit by the withdrawal of the recessed nut 30. The complete valve assembly embodied in the shell 17 may then be withdrawn from the jacket of the valve unit 12 for cleaning or replacement without removing the steam pipe 13. An annular recess 19 on the inside of the valve unit 12 is in alignment with apertures 21 in the hollow portion of shell 17, which in turn are in communication with the steam chamber 16 by means of apertures 22 in the shell. A plunger 20 at the end of stem 27 is operative in the bore of shell 17 and has enlarged portions 24, 24' cooperating with a constricted portion 23 in the bore of shell 17 to variably control the amount of steam passing from the chamber 16 to the annular recess 19 which communicates with the nozzle 11. The steam passage in the interior of shell 17 is normally maintained open to a predetermined amount by the tension of spring 27, fixedly seated at one end to the shell 17, against the head 28, connected to the plunger stem 26. Upon an increase in the speed of rotation of the turbine wheel, the governor mechanism described hereinafter operates the plunger 20 through the control lever 36 with its adjusting screw 33 against the tension of spring 27 to throttle the passage of steam to the nozzle 11. Should this plunger become inoperative for any reason, the lever 36 acts upon the shell 17 through the intermediary of spring 27 to cause a shifting of the shell against the force exerted by spring 31 to carry the apertures 21 in the shell out of alignment with the recess 19 in the valve unit to cause a throttling of the steam to the point where the rotation of the turbine wheel is within the desired limit.

In order to vary the effect of the governor mechanism upon the valve, the adjusting screw 33 may be rotated by the removal of cap 35 from

the turbine head 10 even while the machine is running. This is possible because the end of the valve unit is disposed in an auxiliary casing which is separate from the exhaust steam chamber. The adjustment is set permanently in the split end of lever 36 by a tightening of screw 34.

The improvement in machines of this type is readily apparent by an examination of Figs. 1 and 3 wherein the simple detachability of the valve unit 12 together with the nozzle 11 is illustrated. Thereby defective parts may be easily replaced and nozzles may be interchanged without difficulty. Furthermore, because of the easy detachability of the valve unit or of the valve assembly only, without requiring the dismantling of any other part of the machine, the cleaning thereof is rendered very simple.

In order to exercise control upon the valve supplying steam to the nozzle, a governor mechanism is mounted upon shaft 3 and exercises the desired control upon the valve in accordance with the speed of the shaft. In Fig. 1 the governor mechanism includes a plurality of angularly shaped weights 44, which are pivoted at 44b in bearings 78 fixed to the wheel, and which are capable of assuming different positions in accordance with the centrifugal force exerted thereby in the course of rotation of the wheel 8 and the shaft 3. The short arms 44a of the weights 44 operate against a sleeve 45 shiftable on shaft 3. The force exerted by the centrifugal action of the weights 44 is imposed upon sleeve 45 against the tension of a spring 46 surrounding the sleeve. The effect of spring 46 may be adjusted by the shifting of the collar 62 against which one end of the spring is seated. This adjustment may be made by rotating nut 68 into the end 50' of the housing described below. The end of sleeve 45 is fitted as a thrust bearing 48 exerting a pressure against the extremity 49 of lever 38 which is fixedly attached at its other end to a shaft 37 journaled in the turbine head 10. An increase in speed of shaft 3 effects an axial displacement of sleeve 45 by means of the weights 44 acting thereon. The thrust exercised by the sleeve 45 is in turn imparted to lever 38, shaft 37, and lever 36 which, as explained above, causes a throttling of the steam by the valve unit, which in turn exercises its effect to decrease the speed of the wheel until a desired condition of equilibrium is reached.

Heretofore, the impurities in the water in some localities, and consequently in the generated steam, caused sticking and faulty operation of the governor elements. To overcome these defects, a cleaning of the governor was frequently necessary, representing a great expense and loss in time. According to the invention, an auxiliary protective housing 50 surrounds the operative parts of the governor and protects them from the action of the steam in the exhaust chamber 40. This housing or casing is detachably connected to the wheel 8 by means of bolts 51 and is rotatable therewith. The housing 50 may contain a lubricating oil which assures a smooth functioning of the operating parts of the governor mechanism. The extension 50' of the housing, having bearing rings therein, is rotatable in a bearing bush 53 fixed onto partition 58 in the turbine head 10, operating in the manner of a stuffing box for the steam in the exhaust steam chamber 40. Beyond the partition 58 is formed a chamber 64, maintained at atmospheric pressure by means of a port 63 therein. A dust-tight compartment is formed at the end of the

turbine head by means of a disc 57 enclosing the chamber 64. A cap or cover 54 is secured to the end of the turbine head by means of bolts 55 to complete the dust-tight compartment 65 in which is disposed the lever 38 operated upon by the thrust bearing 48 of sleeve 45. In view of the interposition of the chamber 64 at atmospheric pressure between the exhaust steam chamber 40 and the dust-tight compartment 65, no packing is necessary for the parts working in conjunction with sleeve 45. If any steam should pass the journal bearing 53 in partition 58, it would exhaust to the atmosphere before it could pass into the compartment 65 and from there to the operating parts of the governor mechanism. The interposition of chamber 64, although desirable, is not essential for the obtaining of the many advantages resulting from the instant invention. In order to prevent any steam leakage around the valve from affecting the governor parts, the shaft 37 passes through a close fitting portion 87 of the housing between the auxiliary housing 65 and the auxiliary housing 89 formed in the lid 10. A relief port 90 adjacent the rock shaft 37 prevents any leakage steam from the valve unit from passing on to the auxiliary housing 65 with likely admittance into the governor mechanism casing 50.

The turbine head 10 may be removed by means of bolts 60 to gain access to the turbine wheel 8 and the governor housing 50 when repairs upon those elements are necessary. The complete transmission mechanism between the governor and the valve is removable with the head 10. On the other hand, when the adjustment of the governor spring 46 is desired, the cap 54 only need be removed to gain access to the corresponding adjusting mechanism.

In Figs. 1 and 2 are shown the supporting feet 61 for the turbine casing 1, which are in alignment with the feet 71 (Fig. 3) supporting the electrical generator unit. In view of the fact that the instant invention is not concerned with the electrical features, the generator is only generally illustrated in Fig. 3 at 70, having the brushes 72 cooperating with the commutator 73 in the manner well known in that art.

Having described my invention,

1. In a machine of the class described, a casing, a shaft rotatably mounted in said casing, an impulse wheel mounted on said shaft, a valve unit in said casing, an inlet port in said unit for steam, an outlet in said casing for exhaust steam, a nozzle communicating with said valve unit directing steam upon said impulse wheel, said valve unit comprising throttling means for controlling the flow of steam from said inlet port to said nozzle, a governor mechanism mounted for rotation within said casing at one side of said impulse wheel, transmission means for controlling said throttling means intermediate said valve unit and governor mechanism, and a housing connected to said impulse wheel and rotatable therewith enclosing said governor mechanism within said casing to exclude the exhaust steam from said mechanism, said housing adapted to contain a lubricating medium for said governor mechanism.

2. In a machine of the class described, a casing, a shaft rotatably mounted in said casing, an impulse wheel fixed to said shaft, a valve unit in said casing, an inlet port in said unit for steam, an outlet in said casing for exhaust steam, a nozzle removably mounted in said unit terminating adjacent said impulse wheel, an assembly

in said valve unit for controlling the flow of steam from said inlet port to said nozzle, readily detachable means connecting said valve unit, with said assembly and nozzle mounted therein, to one end of said casing, means adjacent said readily detachable means permitting the easy withdrawal of said valve assembly only, a governor mechanism mounted within said casing, and a transmission system for controlling said valve assembly adjacent the end of the casing opposite the detachable connecting means, between said valve assembly and governor mechanism.

3. In a machine of the class described, a casing, a shaft rotatably mounted in said casing, an impulse wheel fixed to said shaft, a nozzle for directing steam onto said impulse wheel, a valve for controlling the supply of steam to said nozzle, an outlet in said casing for exhaust steam, a centrifugally operated governor mechanism mounted within said casing upon one side of said wheel, comprising a tensioned sleeve slidable on said shaft and a thrust bearing at the end of said sleeve, a removable head for said casing adjacent the end of said shaft, said head having a partition therein for defining the exhaust steam chamber, a journal bearing in said partition, a housing fixed to said impulse wheel separating said governor mechanism from said exhaust steam chamber and extending through said journal bearing, a dust-tight compartment formed on the opposite side of said partition, said thrust bearing extending therein, and transmission means in said dust-tight compartment for controlling said valve, one element of said transmission means abutting against said thrust bearing.

4. In a machine of the class described, a casing, a shaft rotatably mounted in said casing, an impulse wheel fixed to said shaft, a nozzle for directing steam onto said impulse wheel, a valve for controlling the supply of steam to said nozzle, an outlet in said casing for exhaust steam, a centrifugally operated adjustable governor mechanism mounted within said casing upon one side of said wheel, comprising a tensioned sleeve slidable on said shaft and a thrust bearing at the end of said sleeve, a removable head for said casing adjacent the end of said shaft, said head having a partition therein for defining the exhaust steam chamber, a journal bearing in said partition, a housing fixed to said impulse wheel separating said governor mechanism from said exhaust steam chamber and extending through said journal bearing, a dust-tight compartment formed on the opposite side of said partition, said thrust bearing extending therein, transmission means in said dust-tight compartment for controlling said valve, one element of said transmission means abutting against said thrust bearing, and a detachable cover on said head for gaining access to said dust-tight compartment to effect the adjustment of said governor mechanism.

5. In a machine of the class described, a casing, a shaft rotatably mounted in said casing, an impulse wheel fixed to said shaft, a nozzle for directing steam onto said impulse wheel, a valve for controlling the supply of steam to said nozzle, an outlet in said casing for exhaust steam, a centrifugally operated governor mechanism mounted within said casing upon one side of said wheel, comprising a tensioned sleeve slidable on said shaft and a thrust bearing at the end of said sleeve, a removable head for said casing adjacent the end of said shaft, readily detachable means

for fixing said head to said casing, said head having partitions therein for partially forming the exhaust steam chamber of said casing, a dust-tight compartment and a chamber at atmospheric pressure intermediate said chamber and compartment, transmission means in said dust-tight compartment for controlling said valve, one element of said transmission means abutting against said thrust bearing, and a housing containing a lubricating medium fixed to said impulse wheel separating said governor mechanism from said steam chamber to exclude from said mechanism the steam therein.

6. In a machine of the class described, a casing, a shaft rotatably mounted in said casing, an impulse wheel fixed to said shaft, a nozzle for directing steam onto said impulse wheel, a valve for controlling the supply of steam to said nozzle, an outlet in said casing for exhaust steam, a centrifugally operated governor mechanism mounted within said casing upon one side of said wheel comprising a tensioned sleeve slidable on said shaft and a thrust bearing at the end of said sleeve, a removable head for said casing adjacent the end of the shaft, readily detachable means for fixing said head to said casing, said head having partitions therein for partially forming the exhaust steam chamber of said casing, a chamber at atmospheric pressure and a dust-tight compartment, a lever in said dust-tight compartment for controlling said valve pivotally mounted on said head, one end of said lever abutting against said thrust bearing, a readily detachable cover on said head for gaining access to said dust-tight compartment and said controlling lever therein, and a housing fixed to said impulse wheel separating said governor mechanism from said steam chamber to exclude from said mechanism the steam therein.

7. In a machine of the class described, a casing, a shaft rotatably mounted in said casing, an impulse wheel fixed to said shaft, a nozzle for directing steam onto said impulse wheel, an outlet in said casing for exhaust steam, a valve for controlling the supply of steam to said nozzle, a centrifugally operated governor mechanism mounted within said casing upon one side of said wheel comprising a tensioned sleeve slidable on the free end of said shaft and a thrust bearing at the end of said sleeve, a removable head for said casing adjacent the end of the shaft, readily detachable means for fixing said head to said casing, said head having partitions therein for partially forming the exhaust steam chamber of said casing, a chamber at atmospheric pressure and a dust-tight compartment, transmission means in said dust-tight compartment for controlling said valve, one element of said transmission means abutting against said thrust bearing, and a housing fixed to said impulse wheel separating said governor mechanism from said steam chamber and extending through said exhaust steam chamber, said chamber at atmospheric pressure, and into said dust-tight compartment.

8. In a machine of the class described, a casing, a shaft rotatably mounted in said casing, an impulse wheel fixed to said shaft, a nozzle for directing steam onto said impulse wheel, an outlet in said casing for exhaust steam, a valve for controlling the supply of steam to said nozzle, a centrifugally operated governor mechanism mounted on said shaft upon one side of said wheel comprising a plurality of angular weighted levers pivoted adjacent said wheel, a sleeve slidable on the free end of said shaft, spring means for press-

ing said sleeve against said levers and a thrust bearing at the end of said sleeve beyond said shaft, a removable head for said casing having a portion thereof extending beyond said shaft and thrust bearing, readily detachable means for fixing said head to said casing, said head having partitions therein for partially forming the exhaust steam chamber of said casing, a chamber at atmospheric pressure and a dust-tight compartment, a lever in said dust-tight compartment for controlling said valve pivotally mounted on said head, one end of said lever abutting against said thrust bearing, a readily detachable cover on said head for gaining access to said dust-tight compartment and said controlling lever therein, a housing containing a lubricating medium detachably fixed to said impulse wheel separating said governor mechanism from said steam chamber and extending through said exhaust steam chamber, said chamber at atmospheric pressure, and into said dust-tight compartment, and adjusting means fitted in said housing and accessible in said dust-tight compartment upon the removal of said cover for adjusting the tension of the spring means of said governor mechanism.

9. In a device of the class described, a rotary unit comprising an impeller and shaft driven thereby; means including a valve for directing a controlled flow of steam to said impeller; two casings, one within the other, the outer casing being stationary and housing said impeller, the inner casing being a rotary one mounted on said rotary unit; said outer casing having a bush providing an opening therethrough and said inner casing having a hollow hub extending through said bush to the outside of said outer casing; a governor mechanism comprising a rotary group of elements mounted on said rotary unit and a transmission mechanism interposed between said rotary group of elements and said valve; said rotary group of elements being housed in said inner casing, said hollow hub providing an opening to establish operative engagement between said rotary group of elements and said transmission mechanism.

10. In a device of the class described, a rotary unit comprising an impeller and shaft driven thereby; means including a valve for directing a controlled flow of steam to said impeller; two casings, one within the other, the outer casing being stationary and housing said impeller, the inner casing being a rotary one mounted on said rotary unit; said outer casing having a bush providing an opening therethrough and said inner casing having a hollow hub extending through said bush to the outside of said outer casing; a governor mechanism comprising a rotary group of elements mounted on said rotary unit including a shiftable sleeve mounted on said shaft, and a transmission mechanism interposed between said sleeve and said valve; said rotary group of elements being housed in said inner casing, said hollow hub providing an opening to establish operative engagement between said rotary group of elements and said transmission mechanism.

11. A device as described in claim 9, in combination with a housing covering said transmission mechanism, in which housing terminate said bush and said hollow hub, and means within said housing forming a partition between said transmission mechanism and the outer terminus of the contact surfaces between said bush and said hub, said housing being provided with relief ports behind said partition means to permit escape to the atmosphere of steam leaking from

said outer casing between said contact surfaces.

12. A device as described in claim 9, in combination with a housing covering said transmission mechanism, in which housing terminate said bush and said hollow hub, and means within said housing forming a partition between said transmission mechanism and the outer terminus of the contact surfaces between said bush and said hub, said housing being provided with relief ports behind said partition means to permit escape to the atmosphere of steam leaking from said outer casing between said contact surfaces, said housing extending over said transmission mechanism to its point of engagement with said valve, the latter part of said housing including a portion closely fitting said transmission mechanism, a relief port to the atmosphere being provided in said housing between said close fitting portion and said valve to prevent leakage steam from said valve from passing said close fitting portion.

13. In a machine of the class described, a casing defining an exhaust steam chamber, an impulse wheel mounted in said chamber, a rotary shaft driven thereby, a nozzle for directing steam onto said impulse wheel, a valve for controlling the supply of steam to said nozzle, an outlet in said chamber for exhaust steam, a governor mechanism mounted within said chamber; transmission means for controlling said valve extending between said valve and governor mechanism, a portion of said means traversing a space under atmospheric pressure, and a housing within said steam chamber enclosing said governor mechanism to exclude the exhaust steam therefrom.

14. In a machine of the class described, a casing defining an exhaust steam chamber, an impulse wheel mounted in said chamber, a rotary shaft driven thereby, a nozzle for directing steam onto said impulse wheel, a valve for controlling the supply of steam to said nozzle, an outlet in said chamber for exhaust steam, a governor mechanism within said chamber actuated by said impulse wheel comprising a rotary member and an axially shiftable member, transmission means for controlling said valve extending between said valve and said axially shiftable member, a housing within said steam chamber enclosing said governor mechanism and rotatable therewith, and means for maintaining the space at the juncture of said rotary housing and axially shiftable member at atmospheric pressure.

15. In a machine of the class described, a casing defining an exhaust steam chamber, an impulse wheel mounted in said chamber, a rotary shaft driven thereby, a nozzle for directing steam onto said impulse wheel, a valve for controlling the supply of steam to said nozzle, an outlet in said chamber for exhaust steam, a centrifugally operated governor mechanism within said chamber comprising a tensioned sleeve, a housing enclosing said governor mechanism and rotatable therewith having an opening outside of said steam chamber for the end of said tensioned sleeve, said opening being maintained at atmospheric pressure, and transmission means for controlling said valve extending between said valve and governor mechanism.

16. In a machine of the class described, a casing defining an exhaust steam chamber, an impulse wheel mounted in said chamber, a rotary shaft driven thereby, a nozzle for directing steam onto said impulse wheel, a valve for controlling the supply of steam to said nozzle, an outlet in said chamber for exhaust steam, a centrifugally operated governor mechanism within said chamber

comprising a tensioned sleeve, a housing enclosing said governor mechanism and rotatable therewith having an opening outside of said steam chamber for the end of said tensioned sleeve, said opening being maintained at atmospheric pressure, a removable head for said casing for bounding a portion of said steam chamber, an actuating shaft mounted in said head, an auxiliary casing formed in said head adjacent each end of said actuating shaft, a lever in one of said auxiliary casings connected to said actuating shaft and abutting against said sleeve, a second lever in the other auxiliary casing connected to another part of said actuating shaft adapted to control said valve, and a port open to the atmosphere adjacent said actuating shaft between said two auxiliary casings.

17. In a machine of the class described, a casing defining an exhaust steam chamber, an impulse wheel mounted in said chamber, a rotary shaft driven thereby, a nozzle for directing steam onto said impulse wheel, a valve for controlling the supply of steam to said nozzle, an outlet in said chamber for exhaust steam, a centrifugally operated governor mechanism within said chamber comprising an adjustably tensioned sleeve, a housing enclosing said governor mechanism and rotatable therewith having an opening outside of said steam chamber for the end of said tensioned sleeve, said opening being maintained at atmospheric pressure, a removable head for said casing for bounding a portion of said steam chamber, a rock shaft pivotally mounted in said head, an auxiliary casing formed in said head adjacent each end of said rock shaft, a lever in one of said auxiliary casings connected to said rock shaft and abutting against said sleeve, a readily detachable cover for said one auxiliary casing for rendering said tensioned sleeve readily accessible for adjustment, a second lever in the other auxiliary casing connected to another part of said rock shaft adapted to control said valve, and a port open to the atmosphere adjacent said rock shaft between said two auxiliary casings.

18. In a machine of the class described, a casing defining an exhaust steam chamber, an impulse wheel mounted in said chamber, a rotary shaft driven thereby, a nozzle for directing steam onto said impulse wheel, a valve for controlling the supply of steam to said nozzle, an outlet in said chamber for exhaust steam, a governor mechanism mounted within said chamber; a housing within said steam chamber enclosing said governor mechanism to exclude the exhaust steam therefrom, a detachable cover for said casing for bounding a portion of said steam chamber with said housing therein, and a mechanical transmission system for controlling said valve extending between said valve and governor mechanism mounted on said cover, said transmission mechanism terminating in abutting relation only without attachment to said valve and governor mechanism, whereby the removal of said cover permits immediate access to said housing and governor mechanism.

19. In a machine of the class described, a casing defining a steam chamber, an impulse wheel mounted in said chamber, a rotary shaft driven thereby, a valve unit comprising an external jacket extending beyond the ends of said casing, an inlet in said jacket, a nozzle mounted in said jacket adjacent said impulse wheel, a valve assembly mounted within said jacket for controlling the flow of steam from said inlet to said nozzle, readily detachable means connecting said valve unit consisting of said jacket with the valve assembly therein to one end of said casing, a governor mechanism within said steam chamber operable with said impulse wheel, a mechanical transmission system for controlling said valve assembly adjacent and outside the end of the casing opposite the detachable connecting means, and an auxiliary casing for the portion of the transmission mechanism cooperating with the valve assembly in the jacket extending beyond the steam chamber casing, an auxiliary casing for the portion of the transmission mechanism cooperating with the governor mechanism, and a cover for said steam chamber casing having said two last-mentioned casings formed therein.

20. In a machine of the class described, a casing defining a steam chamber, an impulse wheel mounted in said chamber, a rotary shaft driven thereby, a valve unit comprising an external jacket extending beyond the ends of said casing, an inlet in said jacket, a nozzle mounted in said jacket adjacent said impulse wheel, a valve assembly mounted within said jacket for controlling the flow of steam from said inlet to said nozzle, readily detachable means connecting said valve unit consisting of said jacket with the valve assembly therein to one end of said casing, a governor mechanism within said steam chamber operable with said impulse wheel, a mechanical transmission system for controlling said valve assembly adjacent and outside the end of the casing opposite the detachable connecting means, and an auxiliary casing for the portion of the transmission mechanism cooperating with the valve assembly in the jacket extending beyond the steam chamber casing, and readily detachable closure means for said auxiliary casing for permitting an adjustment of said mechanical transmission system relative to said valve.

21. In a machine of the class described, a casing defining an exhaust steam chamber, an impulse wheel mounted in said chamber, a rotary shaft driven thereby, a valve unit mounted in said casing comprising a jacket containing a steam chest, a valve assembly and a nozzle, said valve assembly controlling the flow of steam from said steam chest to said nozzle, readily detachable means for mounting said complete valve unit in said casing, a governor mechanism controlled by said impulse wheel and, in turn, controlling said valve assembly, and readily detachable closure means in said valve unit for conveniently withdrawing said valve assembly only.

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