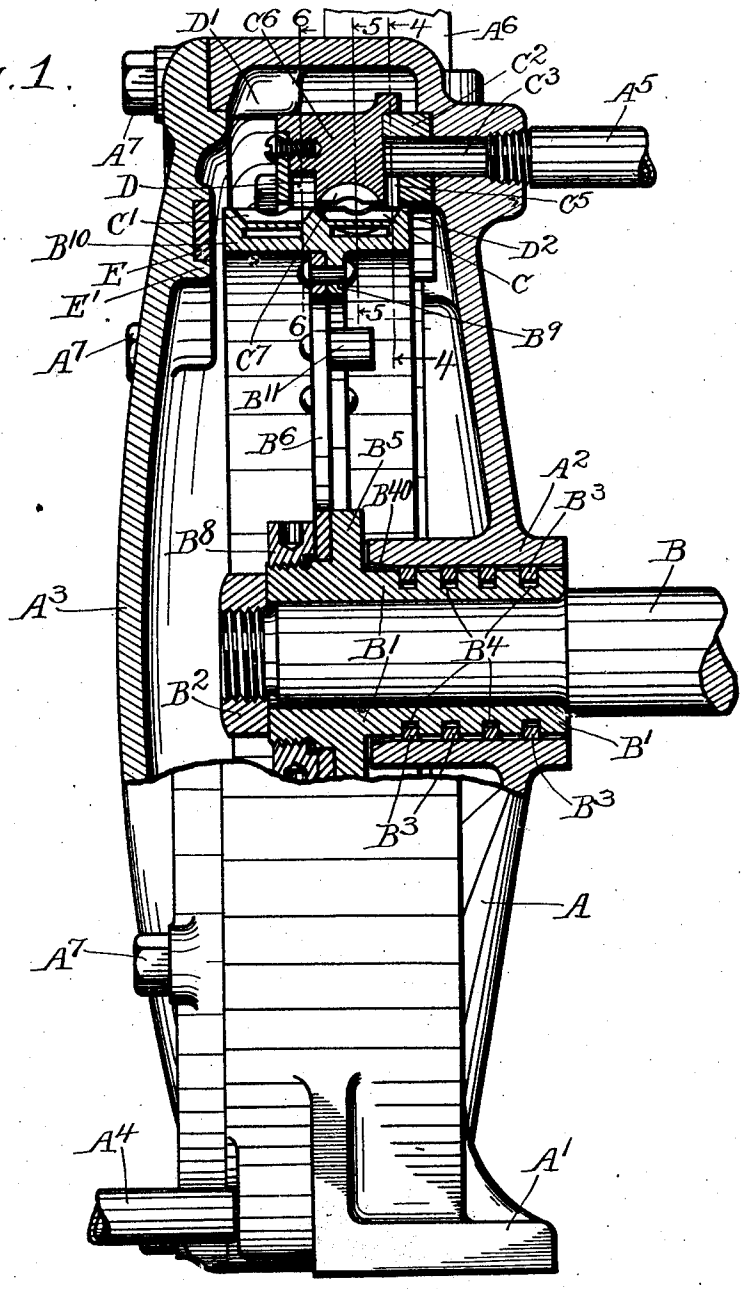
Nov. 30, 1926. 1,609,158

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TURBINE

Filed June 5, 1924 5 Sheets-Sheet 1

Fig. 1.



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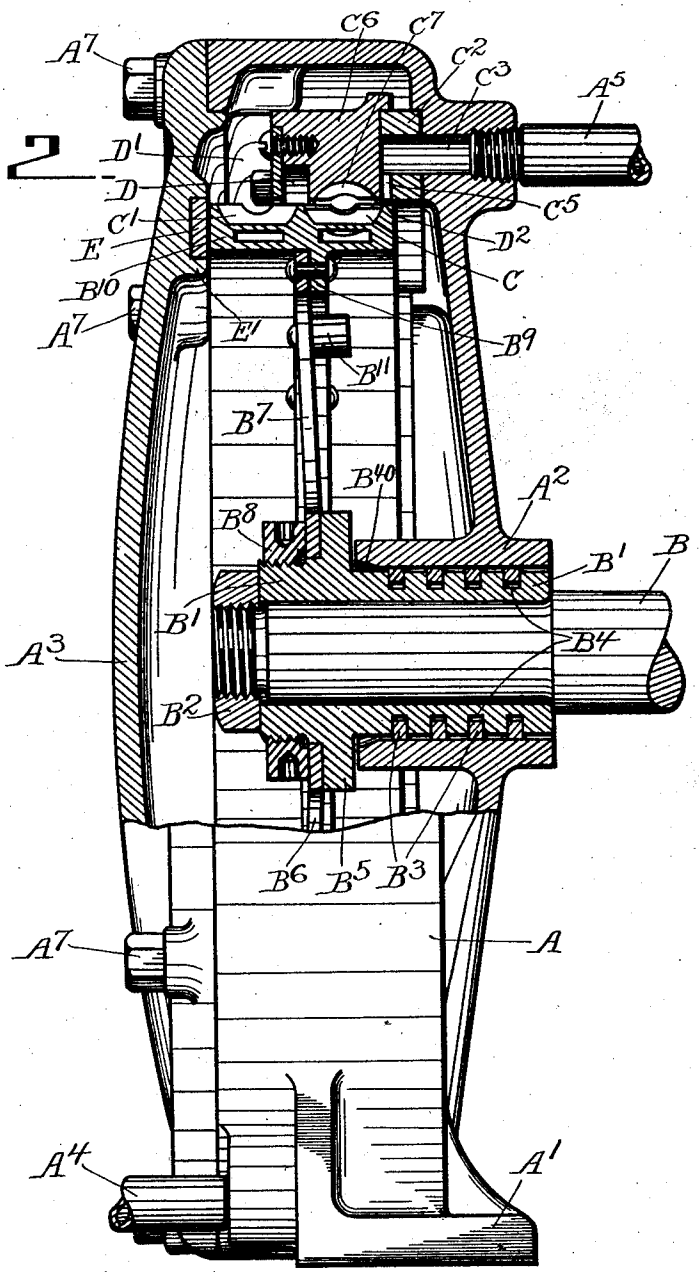
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Filed June 5, 1924 5 Sheets-Sheet 2

FIG. 2



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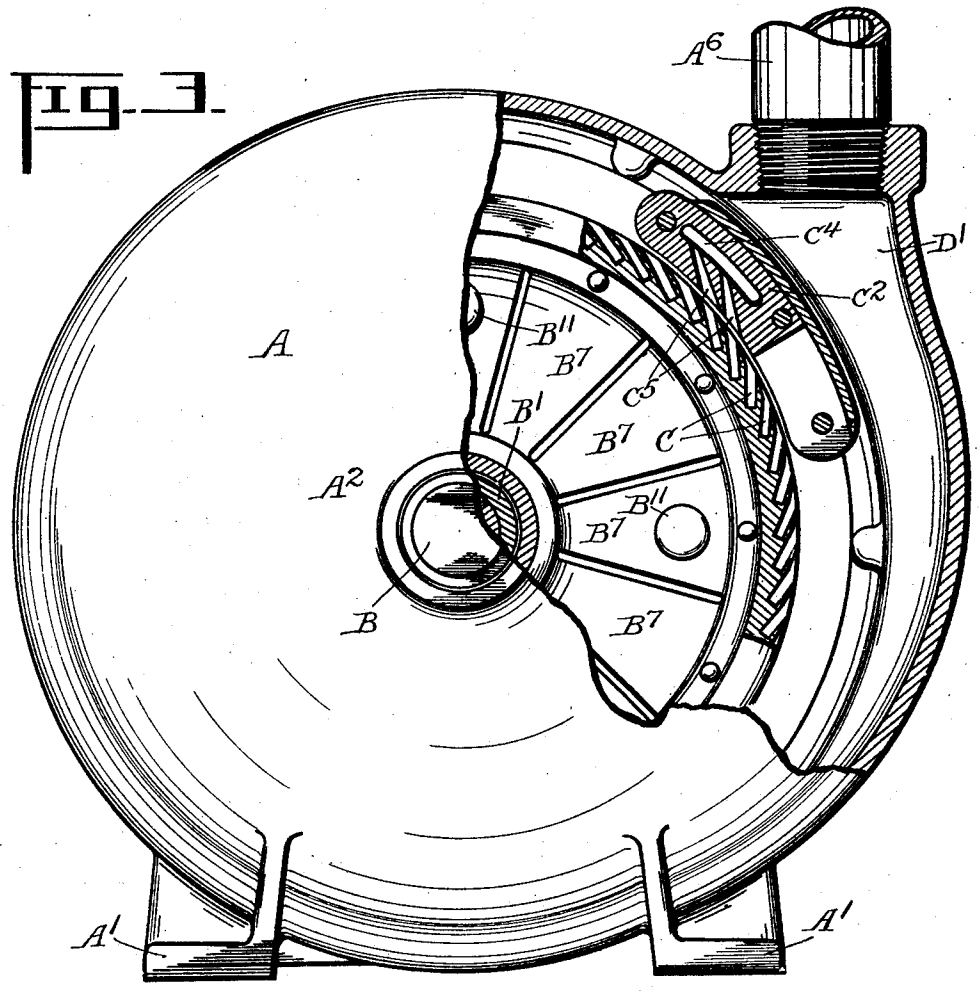
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Fig. 3.



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Fig. 4.

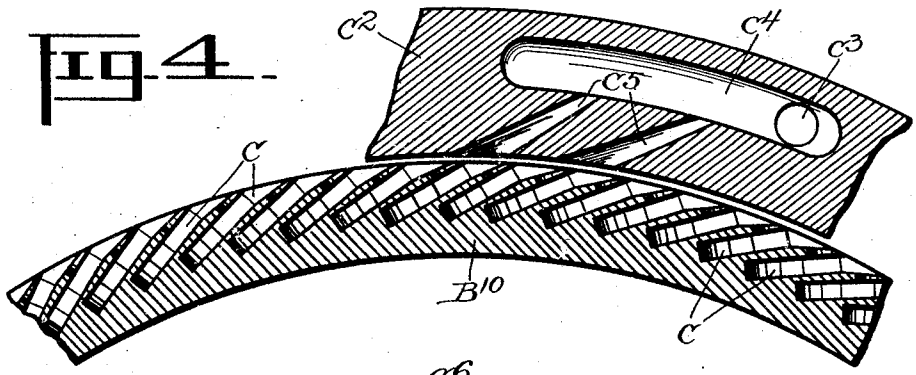


Fig. 5.

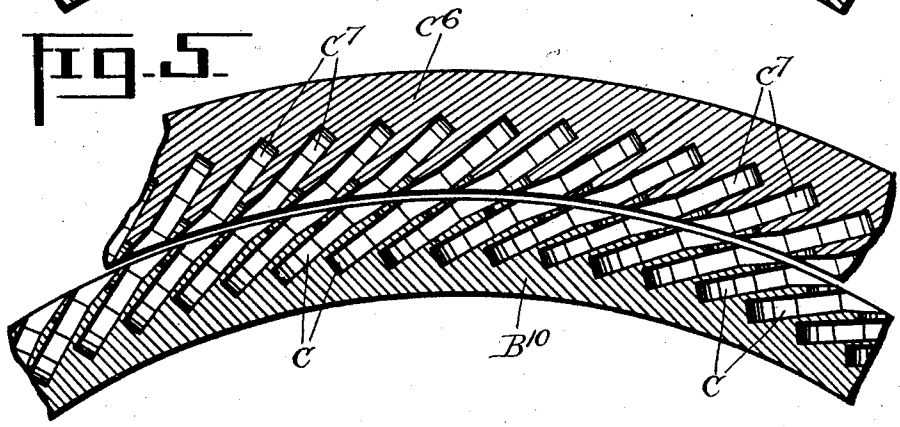
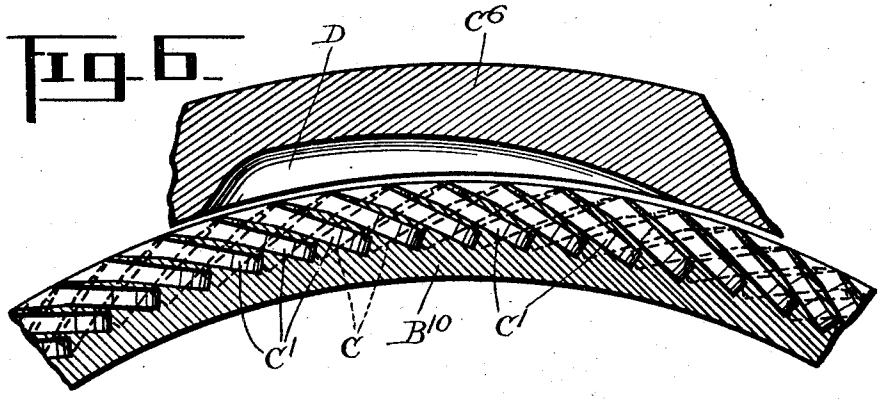


Fig. 6.



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Fig. 7.

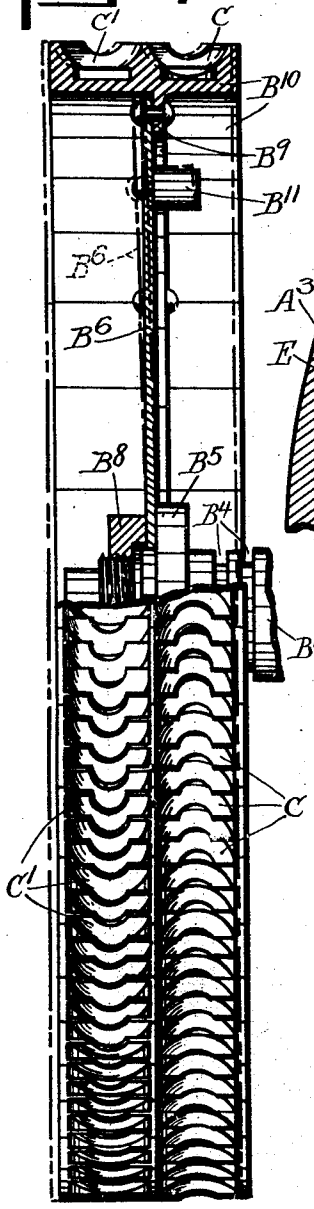
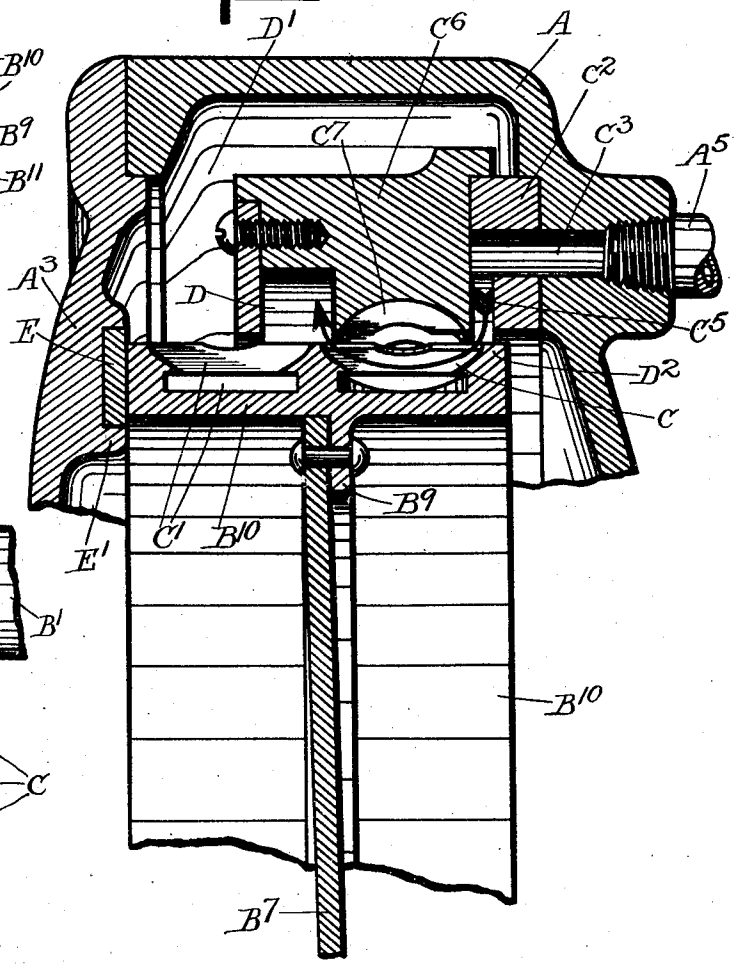


Fig. 8.



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UNITED STATES PATENT OFFICE.

CHARLES W. DAKE, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE PYLE-NATIONAL COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF NEW JERSEY.

TURBINE.

Application filed June 5, 1924. Serial No. 717,917.

My invention relates to improvements in turbines, primarily intended for use in connection with steam or other elastic fluid. It has for one object to provide a new and improved type of self-governing turbine. Another object is to provide a turbine whereby the speed of the turbine is positively checked by an automatic arrangement when the speed exceeds a predetermined point, thus not only limiting excess speeds but positively tending to reduce the speeds back to the normal when the normal has been exceeded. Other objects will appear from time to time throughout the specification and claims.

My invention is illustrated more or less diagrammatically in the accompanyng drawings, wherein:

Figure 1 is a side elevation in part section along the axial line;

Figure 2 is a similar view showing the parts in position to check the speed;

Figure 3 is a front elevation in part section along the line 4—4 of Figure 1;

Figure 4 is a section along the line 4—4 of Figure 1 through the nozzle and bucket;

Figure 5 is a section along the line 5—5 of Figure 1 through the buckets and return passages;

Figure 6 is a section along the line 6—6 of Figure 1 through the reversing buckets and nozzle;

Figure 7 is a side elevation of the wheel in part section;

Figure 8 is a detail section of the wheel showing the parts in the same position as in Figure 2.

Like parts are indicated by like characters throughout the specification and drawings.

A is a generally cylindrical turbine housing having feet A^1 by which the housing may be attached to any suitable support. A^2 is a packing gland centrally disposed in the slightly coned web of the housing. A^3 is a cover closing the housing, A^4 a drain pipe for discharging condensation from the housing, A^5 is the steam or motive fluid supply pipe and A^6 is the exhaust pipe. The cover is held in position on the housing by means of the holding bolts A^7.

B is the turbine shaft. It is preferably supported in bearings not here shown so as to be substantially concentric with the packing sleeve A^2. B^1 is the turbine hub mounted on the shaft B and held in place thereon by the nut B^2. B^3 B^3 are packing rings carried in slots B^4 in the outer face of the hub B^1 engaging the inner wall of the packing sleeve A^2 which sleeve is chamfered at B^{40} to permit the insertion of the hub from the left as shown in Figure 1. The hub B^1 is flanged as at B^5 and carries a wheel web B^6 made up of a series of separate segments B^7 preferably stamped or otherwise made from thin spring steel. These segments may be separate at their inner or outer peripheries or may be joined together or may be separated intermediate their peripheries. At their inner periphery they engage the flange B^5 being held thereagainst by the ring B^8 threaded on the hub B^1 and clamped thereby rigidly in position. At their outer peripheries they are bolted to an inwardly extending flange B^9 on the turbine wheel rim B^{10}. Some or all of these segments B^7 have projecting from one side rigidly mounted weights B^{11} which overhang beyond the point of support of the inner periphery of the wheel.

The wheel rim has on its outer periphery, two parallel series of buckets, the buckets C being normally driving buckets, the buckets C^1 being reverse buckets adapted to work in the opposite direction. These buckets are all of them inclined to the face of the wheel and to a radius of the wheel and have curved bottoms whereby the steam flowing into the bucket at one side of the wheel comes out of the other side in the opposite direction having reversed its flow in the usual manner. C^2 is a nozzle block supplied with steam from the pipe A^5 through the passage C^3. This passage C^3 discharges into a tangential passage C^4 from which lead exhausts C^5 C^5 discharging the steam against the buckets C. C^6 is a return passage block containing return passages C^7 C^7 adapted to receive the steam from the bucket C and return it again to those buckets so that the steam in its passage from the nozzle through the working buckets and return passages makes a number of complete revolutions on a spiral path gradually giving up its power to the buckets.

This will continue as long as the parts are in the position shown in Figure 1. The steam rushing in on one side of the bucket and flowing out on the other side through the return passage and so on. If, however, the bucket wheel be moved laterally into the position shown in Figure 8, some

of the steam instead of being discharged from the bucket into the return passage will be discharged into the reversing passage D which is formed in the return passage block C^6. This steam will have its direction reversed in that passage and will be discharged against the reverse buckets C^1 being thence discharged into the exhaust chamber D^1 in the housing. Thus this steam tending to work against the normal driving of the wheel will check its velocity and tend to reduce its speed. If lateral movement of the wheel continues as far as the position shown in Figure 2, the edge of the wheel D^2 will finally come into line with the nozzles C^5 and cut off the flow altogether.

Any suitable means may be used for shifting the wheels laterally first to throw the reversing or retarding buckets into operation and then to altogether cut off the flow of motive fluid responsive to speed variations or when the speed reaches or exceeds a predetermined point. One method which I have shown takes the form of the laterally projecting weights B^{11}. At normal speeds the spring segments making up the central web of the wheel hold the wheel in line with the nozzle and forward buckets. As the speed exceeds a predetermined rate, the unbalance of these weights tends to bend the web from the position shown in Figure 1 toward the position shown in Figure 2. This bending of the web or of the segments making it up moves the wheel laterally and accomplishes the desired regulating result. As soon as the speed drops down the spring of the wheel tends to resist the tilting action of the weights and returns the wheel and buckets to the normal running position.

The filler ring E is set into an annular rib E^1 on the inner face of the cover A^3 to limit the lateral movement of the wheel and provide a renewable friction surface which may be engaged by the edge of the wheel if the action of the weights becomes sufficient to throw the wheel that far. Under normal conditions, this friction ring will seldom come into action but it has a double function, namely, to limit the lateral movement of the wheel and to add a friction load calculated to retard the wheel and bring it back to a normal rotational speed.

It will be evident that while I have shown in my drawings an operative device, still many changes might be made in the size, shape and disposition of parts without departing materially from the spirit of my invention and I wish, therefore, that my showing be taken as in a large sense diagrammatic.

I claim:—

1. In a turbine, an elastic fluid rotor, means for supplying an elastic motive fluid thereto to rotate it in a forward direction and means operative after a predetermined speed has been reached for causing the motive fluid to exert a retarding action on the rotor, and means for shutting off the entire supply of motive fluid when a predetermined greater speed has been reached.

2. In a turbine, an elastic fluid rotor, means for supplying an elastic motive fluid thereto to rotate it in a forward direction and means operative after a predetermined speed has been reached for causing a part of the motive fluid to exert a retarding action on the rotor, and means for shutting off the entire supply of motive fluid when a predetermined greater speed has been reached.

3. In a turbine, a rotor, means for supplying motive fluid thereto to rotate it in a forward direction and automatic means operative after a predetermined speed has been reached for causing the motive fluid to exert a retarding action on the rotor, and means for frictionally retarding the speed of the rotor when a greater speed has been reached.

4. In a turbine, a rotor, means for supplying motive fluid thereto to rotate it in a forward direction and automatic means operative after a predetermined speed has been reached for causing a part of the motive fluid to exert a retarding action on the rotor, and means for frictionally retarding the speed of the rotor when a greater speed has been reached.

5. In a turbine, an elastic fluid rotor, forward and reverse buckets thereon, means for supplying elastic motive fluid to the forward buckets for normal operation and automatic means operative when a predetermined speed has been reached for directing a compact stream of motive fluid to the reverse buckets.

6. In a turbine, an elastic fluid rotor, forward and reverse buckets thereon, means for supplying elastic motive fluid to the forward buckets for normal operation and automatic means operative when a predetermined speed has been reached for directing a compact stream of motive fluid to the reverse buckets, as well as to the forward buckets.

7. In a turbine, an elastic fluid rotor, forward and reverse buckets thereon, means for supplying elastic motive fluid to the forward buckets for normal operation and automatic means operative when a predetermined speed has been reached for directing a compact stream of motive fluid from the forward to the reverse buckets.

8. In a turbine, a rotor, forward and reverse buckets thereon, means for supplying motive fluid to the forward buckets for normal operation and automatic means operative when a predetermined speed has been

reached for supplying motive fluid to the reverse buckets, and automatic means operative when a higher speed has been reached for shutting off the supply of motive fluid from the forward buckets.

9. In a turbine, a rotor, forward and reverse buckets thereon, means for supplying motive fluid to the forward buckets for normal operation and automatic means operative when a predetermined speed has been reached for supplying motive fluid to the reverse buckets, as well as to the forward buckets, and automatic means operative when a higher speed has been reached for shutting off the supply of motive fluid from the forward buckets.

10. In a turbine, a rotor, forward and reverse buckets thereon, means for supplying motive fluid to the forward buckets for normal operation and automatic means operative when a predetermined speed has been reached for guiding motive fluid from the forward to the reverse buckets, and automatic means operative when a higher speed has been reached for shutting off the supply of motive fluid from the forward buckets.

11. In a turbine, a rotor, forward and reverse buckets thereon, means for supplying motive fluid to the forward buckets for normal operation and automatic governing means operative when a predetermined speed has been reached including means for supplying motive fluid to the reverse buckets, and means for exerting a frictional retarding action on the rotor when a higher predetermined speed has been reached.

12. In a turbine, a rotor, forward and reverse buckets thereon, means for supplying motive fluid to the forward buckets for normal operation and automatic governing means operative when a predetermined speed has been reached including means for supplying motive fluid to the reverse buckets, as well as to the forward buckets, and means for exerting a frictional retarding action on the rotor when a higher predetermined speed has been reached.

13. In a turbine, a rotor, forward and reverse buckets thereon, means for supplying motive fluid to the forward buckets for normal operation and automatic governing means operative when a predetermined speed has been reached including means for guiding motive fluid from the forward to the reverse buckets, and means for exerting a frictional retarding action on the rotor when a higher predetermined speed has been reached.

14. In a turbine, a rotor, forward and reverse buckets thereon, a nozzle adapted normally to supply motive fluid to the forward buckets, return passages associated with said buckets and adapted to receive motive fluid from and return it to them, a reverse pocket adapted to direct motive fluid to the reverse buckets and means for displacing the wheel laterally to cause some of the motive fluid from the forward buckets to be discharged into the reverse pocket when a predetermined speed has been reached.

15. In a turbine, a rotor, forward and reverse buckets thereon, a nozzle adapted normally to supply motive fluid to the forward buckets, return passages associated with said buckets and adapted to receive motive fluid from and return it to them, a reverse pocket adapted to direct motive fluid to the reverse buckets and means for displacing the wheel laterally to cause some of the motive fluid from the forward buckets to be discharged into the reverse pocket when a predetermined speed has been reached and to shut off the supply of motive fluid when a higher speed has been reached.

16. In a turbine, a rotor, forward and reverse buckets thereon, a nozzle adapted normally to supply motive fluid to the forward buckets, return passages associated with said buckets and adapted to receive motive fluid from and return it to them, a reverse pocket adapted to direct motive fluid to the reverse buckets and means for displacing the wheel laterally to cause some of the motive fluid from the forward buckets to be discharged into the reverse pocket when a predetermined speed has been reached and to exert a frictional braking action against the edge of the wheel when a predetermined higher speed has been reached.

17. In a turbine, a rotor, forward and reverse buckets thereon, a nozzle adapted normally to supply motive fluid to the forward buckets, return passages associated with said buckets and adapted to receive motive fluid from and return it to them, a reverse pocket adapted to direct motive fluid to the reverse buckets and means for directing some of the motive fluid discharged from the forward buckets into the reverse pocket when a predetermined speed has been reached.

18. In a turbine, a rotor, forward and reverse buckets thereon, a nozzle adapted normally to supply motive fluid to the forward buckets, return passages associated with said buckets and adapted to receive motive fluid from and return it to them, a reverse pocket adapted to direct motive fluid to the reverse buckets and means for directing some of the motive fluid discharged from the forward buckets into the reverse pocket when a predetermined speed has been reached and for shutting off all the motive fluid when a predetermined higher speed has been reached.

19. In a turbine, a rotor, forward and reverse buckets thereon, a nozzle adapted normally to supply motive fluid to the forward buckets, return passages associated with said buckets and adapted to receive motive fluid from and return it to them, a reverse pocket adapted to direct motive fluid to the reverse

buckets and means for directing some of the motive fluid discharged from the forward buckets into the reverse pocket when a predetermined speed has been reached and for exerting a frictional resistance to retard the wheel when a predetermined higher speed has been reached.

20. In a turbine, a rotor, forward and reverse buckets, a nozzle adapted to supply motive fluid to the forward bucket, a reverse pocket adapted to direct motive fluid to the reverse buckets and means operative when the speed of the rotor exceeds a predetermined point for directing the discharge of some of the motive fluid from the forward buckets to the reverse pocket.

21. In a turbine, a rotor, forward and reverse buckets, a nozzle adapted to supply motive fluid to the forward bucket, a reverse pocket adapted to direct motive fluid to the reverse bucket and means operative when the speed of the rotor exceeds a predetermined point for displacing the rotor to cause it to discharge some of the motive fluid from the forward buckets to the reverse pocket.

22. In a turbine, a rotor, forward and reverse buckets, a nozzle adapted to supply motive fluid to the forward bucket, a reverse pocket adapted to direct motive fluid to the reverse bucket and means operative when the speed of the rotor exceeds a predetermined point for displacing the rotor to cause it to discharge some of the motive fluid from the forward buckets to the reverse pocket, said means being adapted to further displace the rotor and to shut off the supply of motive fluid when a predetermined point has been reached.

23. In a turbine, a rotor, forward and reverse buckets, a nozzle adapted to supply motive fluid to the forward bucket, a reverse pocket adapted to direct motive fluid to the reverse bucket and means operative when the speed of the rotor exceeds a predetermined point for displacing the rotor to cause it to discharge some of the motive fluid from the forward buckets to the reverse pocket, a friction element adjacent the rotor, said means being adapted when a further increased speed is reached to further displace the rotor and bring it into engagement with the friction element to check its speed.

24. In a turbine, a nozzle block, a rotor, buckets thereon, means for supplying motive fluid through the nozzle block to the buckets, return passages adapted to receive motive fluid from the rotor buckets and to return them again thereto, a reverse pocket in the nozzle block and a plurality of reverse buckets associated with the main rotor buckets adapted to receive motive fluid from the reverse pocket, means for displacing the wheel laterally responsive to speed variations to permit the main buckets to discharge some of the motive fluid into the reverse pocket.

25. In a turbine, a nozzle block, a rotor, buckets thereon, means for supplying motive fluid through the nozzle block to the buckets, return passages adapted to receive motive fluid from the rotor buckets and to return them again thereto, a reverse pocket in the nozzle block and a plurality of reverse buckets associated with the main rotor buckets adapted to receive motive fluid from the reverse pocket, means for displacing the wheel laterally responsive to speed variations to permit the main buckets to discharge some of the motive fluid into the reverse pocket, said displacing means being adapted to move an unbucketed part of the rotor into line with the nozzle and cut off the flow of motive fluid when a predetermined speed has been reached.

Signed at Chicago county of Cook and State of Illinois, this 3rd day of June 1924.

CHARLES W. DAKE.