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TURBINE DRIVEN SPINNING, DOUBLING, AND TWISTING MACHINE.

APPLICATION FILED AUG. 13, 1906.

930,849.

Patented Aug. 10, 1909.

4 SHEETS—SHEET 1.

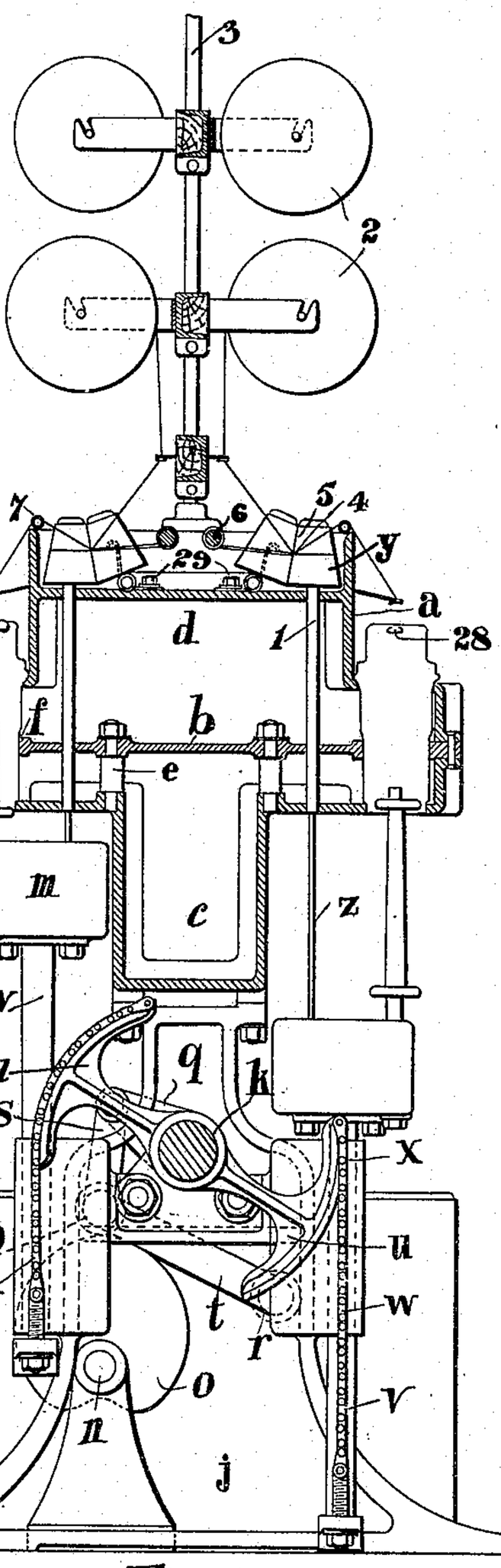

Fig. 1.

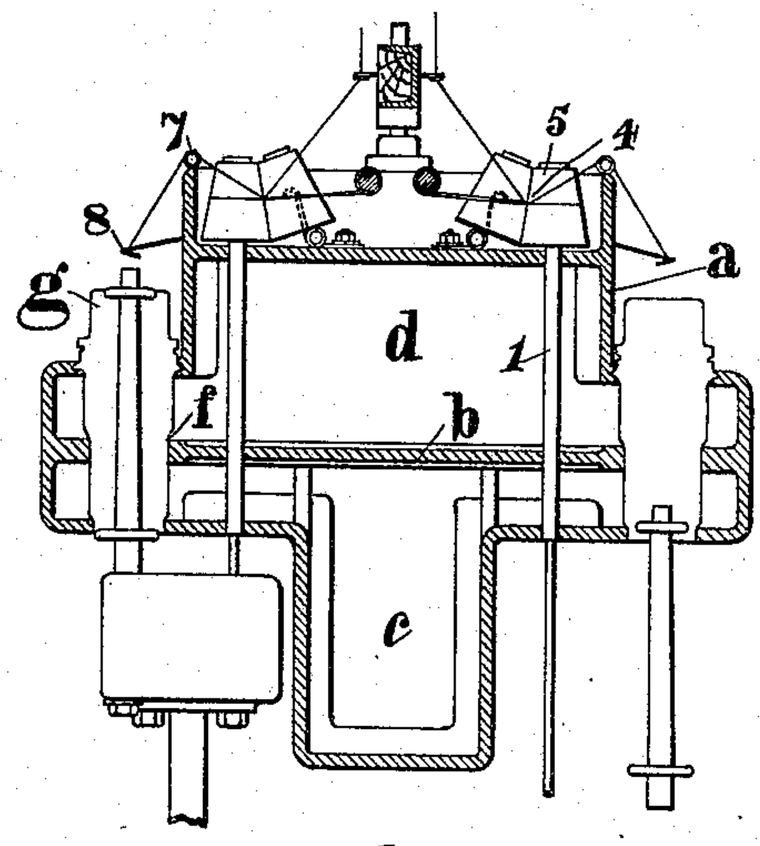

Fig. 4.

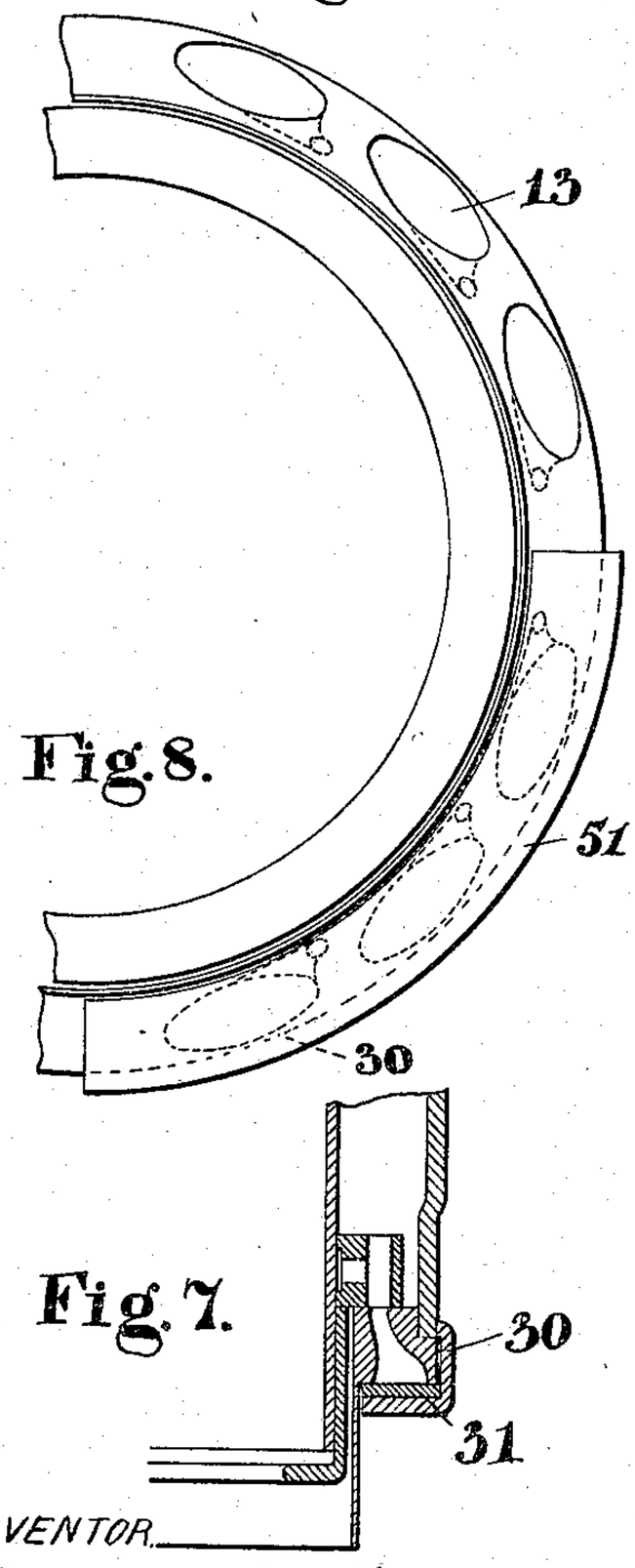

Fig. 8.

Fig. 7.

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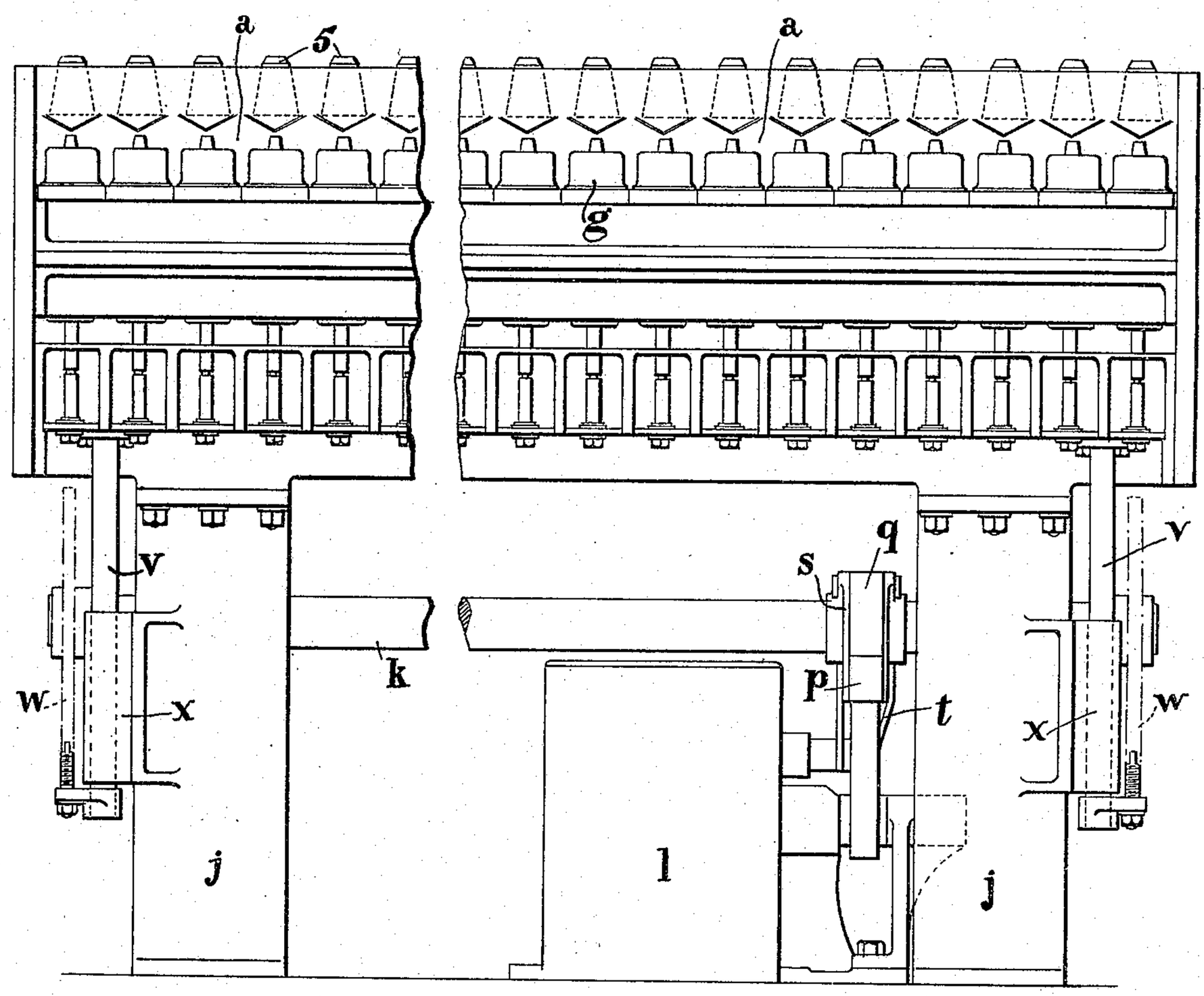

Fig. 2.

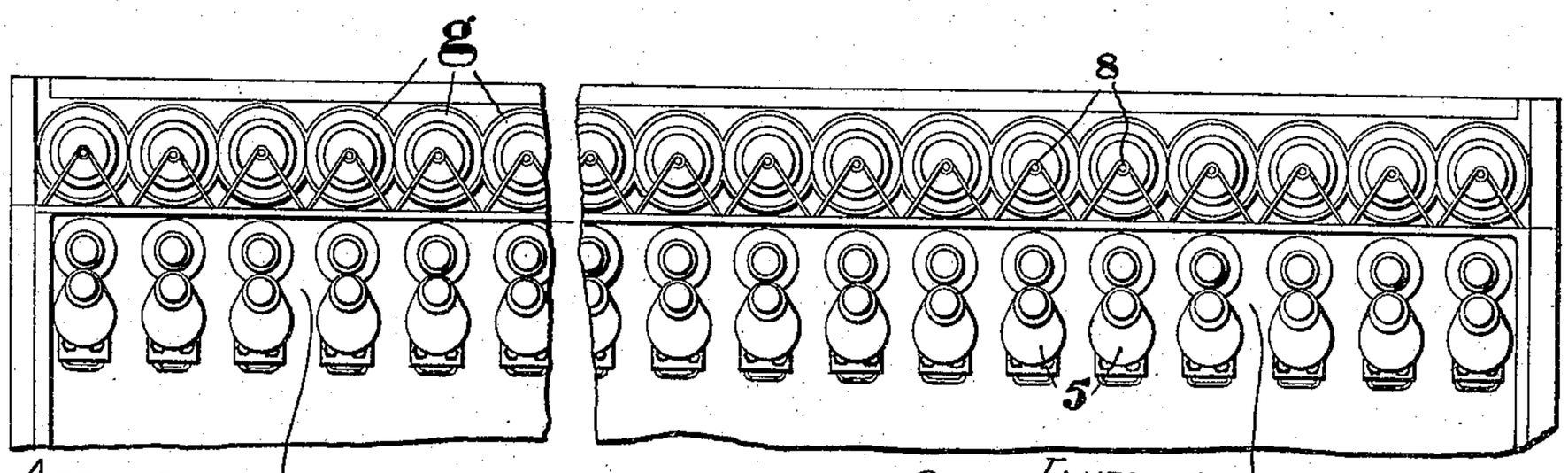

Fig. 3.

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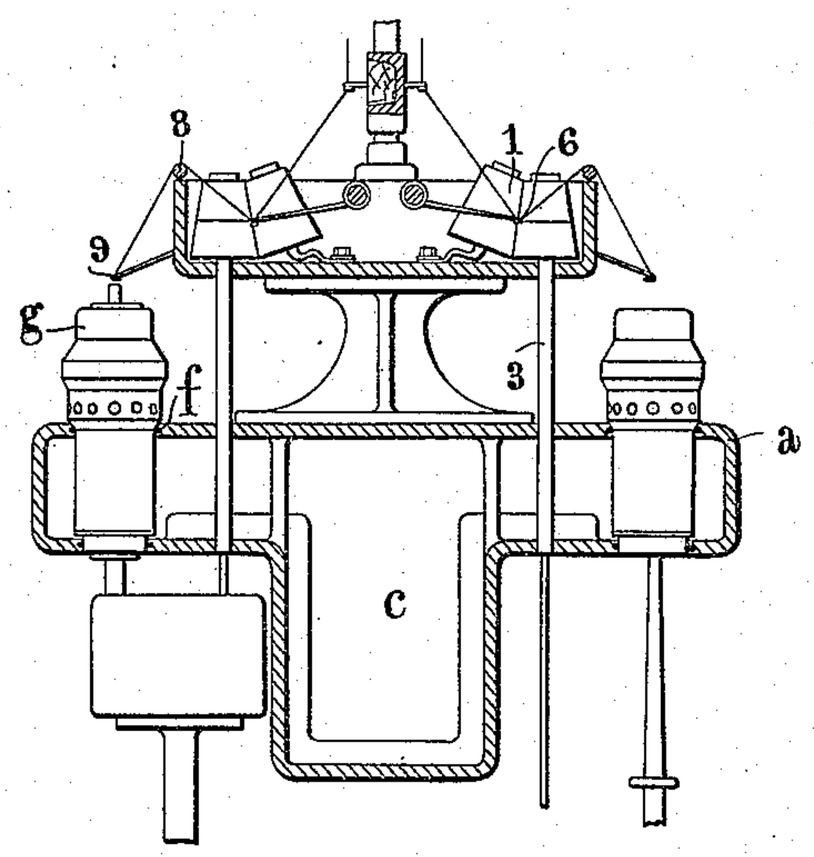

Fig. 4a.

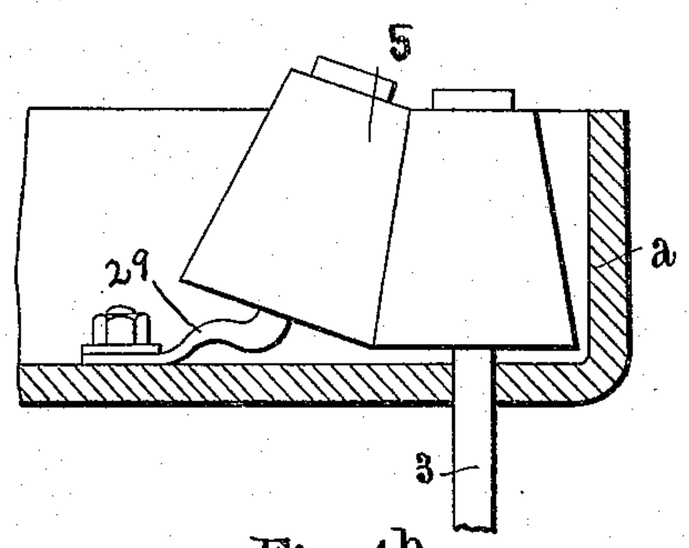

Fig. 4b.

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4 SHEETS—SHEET 4.

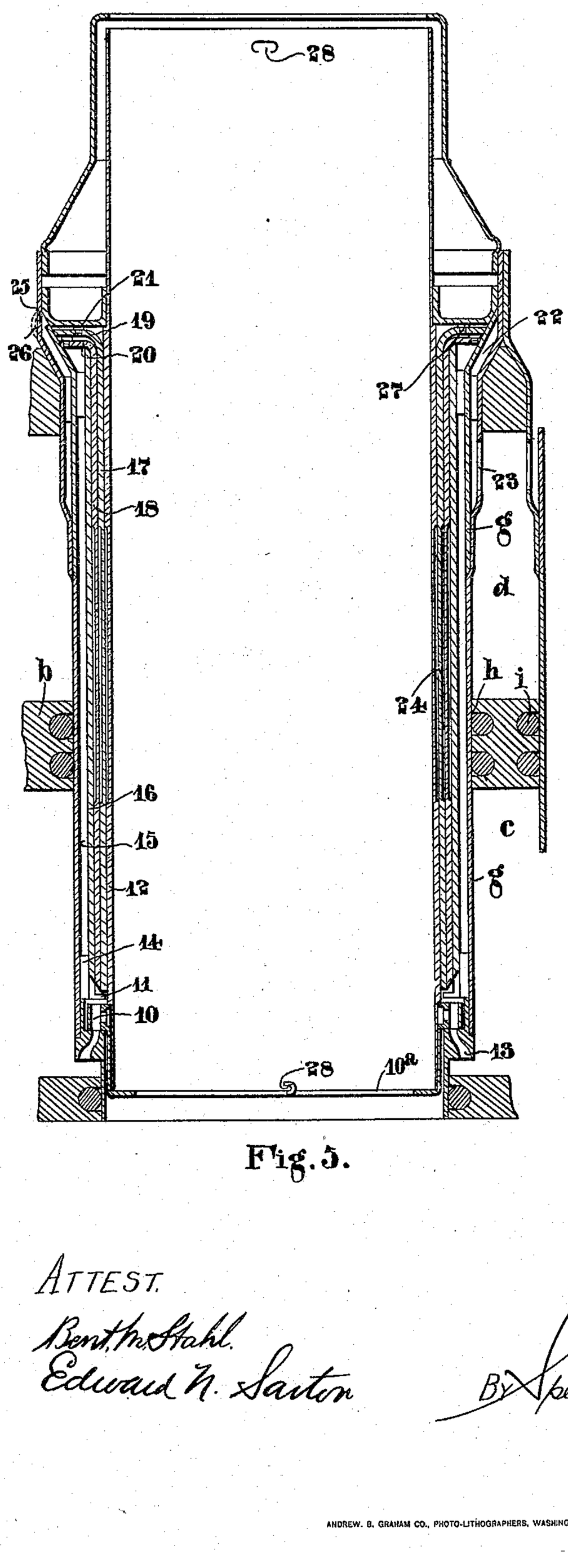

Fig. 5.

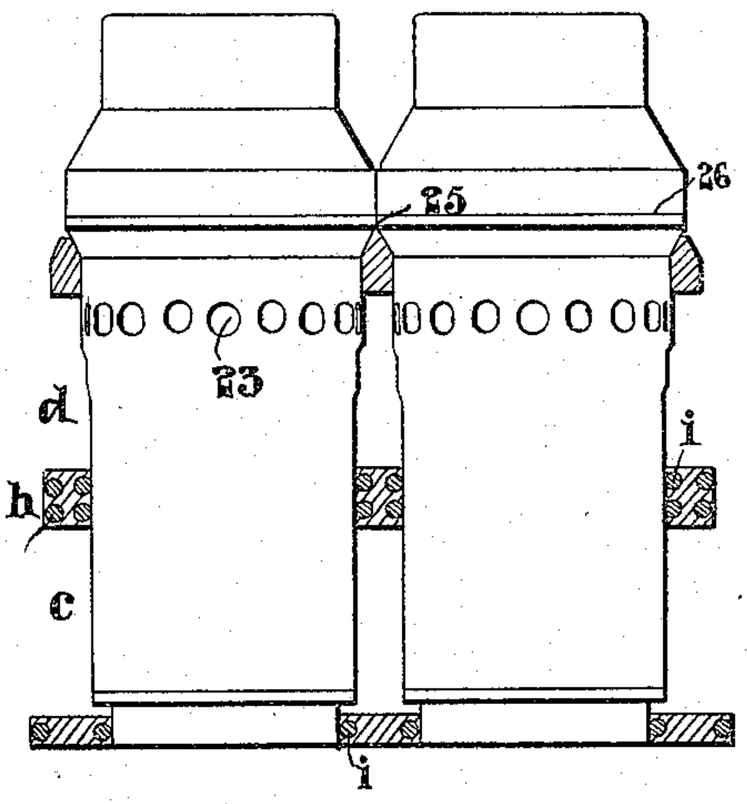

Fig. 6

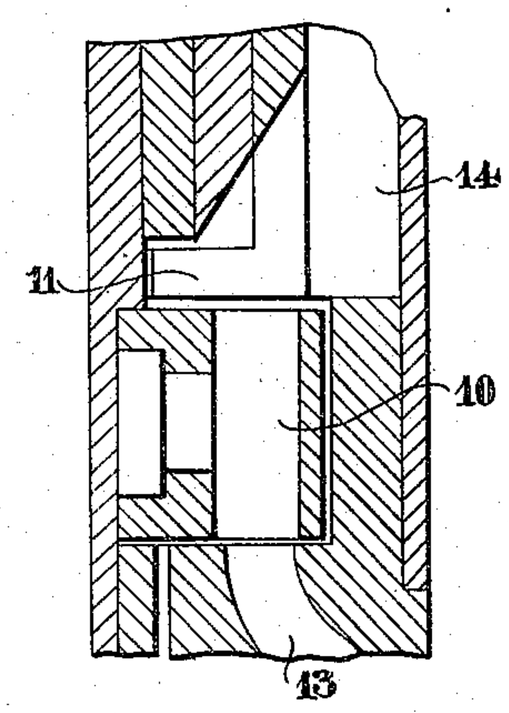

Fig. 9.

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UNITED STATES PATENT OFFICE.

SEBASTIAN ZIANI DE FERRANTI, OF LONDON, ENGLAND.

TURBINE-DRIVEN SPINNING, DOUBLING, AND TWISTING MACHINE.

No. 930,849. Specification of Letters Patent. Patented Aug. 10, 1909.

Application filed August 13, 1906. Serial No. 330,471.

To all whom it may concern:

Be it known that I, SEBASTIAN ZIANI DE FERRANTI, a subject of the King of Great Britain and Ireland, and residing at 31 Lyndhurst road, Hampstead, London, N. W., have invented certain new and useful Improvements Relating to Turbine-Driven Spinning, Doubling, and Twisting Machines, of which the following is a specification.

This invention relates to improvements in turbine driven spinning doubling and twisting machines.

In the specifications of my patent applications, Serial Nos. 221,295, 260,120 and 272,560, I have described certain improvements in textile processes and in the constructions of apparatus having for their main object the obtaining of much higher rates of production than are now common in textile work.

The present invention has for its object to provide an improved construction of machine for obtaining such high rates of production.

My improvements consist in the following elements. In a twisting spinning or doubling machine, the twisting elements of which are turbine driven, considerable expense and complication of parts is entailed if the turbine elements are connected to the pressure main by pipes in the ordinary manner. According to my first improvement, however, not only is the expense materially reduced, but connecting pipes are entirely dispensed with by inserting the turbine elements into the longitudinal supply trunk; and in those circumstances in which the turbines do not exhaust directly into the atmosphere by so disposing the exhaust trunk that the turbine exhaust is discharged directly thereto while the arrangement of parts may preferably be such that the trunk or trunks form one of the main structural elements of the machine.

In the operation of high speed turbine driven twisting elements an important factor in the efficiency and the economy of the machine is the efficiency of the turbine, and any means by which the losses in the turbine can be reduced has an important bearing on the economy of the plant. I have found by experiment that the losses incurred by skin friction and the fanning action of the blades have a material bearing on the efficiency of the turbine, and according to the second part of my invention I am able to effect a substantial reduction in such losses by constructing the nozzles and casings so that the blades are as completely shielded as possible, thereby preventing absorption of power by setting air in motion.

Referring now to the accompanying drawings which illustrate my invention and form part of my specification; Figure 1 shows a cross sectional elevation of a machine constructed according to my invention, Fig. 2 shows an elevation and Fig. 3 a plan of the machine illustrated in Fig. 1. Fig. 4 shows a detail of a modified form of working fluid trunk to that shown in Fig. 1. Fig. 4[a] shows a cross sectional elevation of a form of machine in which the exhaust from the twisting elements takes place directly to the atmosphere. Fig. 4[b] shows a detail view of the feed rolls shown in Fig. 1. Fig. 5 is a sectional elevation of one form of ring flier suitable for the twisting machines illustrated in Figs. 1, 2, 3. Fig. 6 shows outside elevation to a reduced scale of the ring fliers as shown in Fig. 5. Fig. 7 is a cross sectional elevation and Fig. 8 is an inverted plan illustrating one method of reversing the ring flier shown in Fig. 5. Fig. 9 is a detail view of a turbine bladed member provided with a shielding ring.

In carrying my invention into effect according to one modification as applied to the construction of a spinning twisting or doubling machine having leading and lagging parts, I provide a central trunk, *a*, Figs. 1, 2, and 3, which is divided longitudinally by a partition, *b*, so as to form two distinct chambers one of which, *c*, supplies the working fluid to the turbines of the twisting elements, while the other *d*, leads away the exhaust therefrom. The partition, *b*, may be formed integrally with the trunk, *a*, as illustrated in Fig. 4, or may be assembled therewith in the manner illustrated in Figs. 1, 2 and 3. In the latter case the supply chamber, *c*, and exhaust chambers, *d*, are formed separately from the partition plate, *b*, the three parts being assembled in the manner indicated, studs, *e*, being inserted at intervals along the chamber, *c*, so as to form supports for the plate, *b*. On each side of the trunks, holes, *f*, are formed into which the cylindrical casings, *g*, of the twisting elements are inserted. The twisting element in this case may preferably be an air borne turbine driven ring flier such as I have illustrated in Figs. 5 and 6 and will be hereinafter described.

In order to prevent any leakage of the working fluid around the parts adjacent to the ring flier casing, *g*, I cause grooves, *h*, Figs. 5 and 6, to be formed at such places into which grooves one or more rings, *i*, of elastic packing are inserted. This arrangement not only provides an exceedingly effective joint but also forms a flexible support for the twisting element and at the same time permits of the ready withdrawal of the element for inspection or other purposes. In some cases, however, Fig. 4ª I may arrange for only one chamber in the trunk *a* for supplying the working fluid and allow the exhaust from the turbines to take place directly to the atmosphere.

In the above machines I find it preferable to construct a trunk in sections provided with connecting flanges so that a machine of any required number of spindles can be expeditiously and conveniently assembled by connecting together a suitable number of sections. Standards, *j*, for supporting the trunk are provided at intervals along the length thereof, one or more of which may conveniently be used for conducting the working fluid to the supply and two of them preferably situated at the ends of the frame, may be used for leading the air away from the exhaust chamber. The standard which is used for supplying the air is fitted with a valve for controlling the operation of the machine. A shaft, *k*, is rotatably mounted on the standards *j*, and driven independently of the twisting elements, by a motor, *l*, in an oscillatory manner so as to give the required reciprocating motion to the bobbin rail, *m*. This motion is obtained by mounting on the motor shaft, *n*, a heart shaped cam, *o*, which actuates a roller, *p*, attached to an arm, *q*, and to a fixed center, *r*, by the links, *s* and *t*, respectively. The arm, *q*, is rigidly fixed to the shaft, *k*, so that the rotation of the heart shaped cam gives an oscillatory or rocking motion of the shaft, *k*. Quadrants, *u*, are mounted on each end of the shaft and are attached by flexible chains, *w*, to the rods, *v*, fixed to the bobbin rails, *m*, the motion of the bobbin rails being guided by sockets, *x*, in which the rods, *v*, slide.

Feed rolls, 5 one of which is resiliently mounted in the spring, 29 Fig. 4ᵇ, are disposed in a trough, *y*, formed integrally with the exhaust chamber and are driven from the lagging part in the manner described in my patent applications 260120 and 272560 by means of telescopic spindles, *z*, which pass through tubes, 1, inserted in the working fluid trunk in an air tight manner. The material to be twisted is disposed in holders, 2, attached to standards, 3, and is led to the feed rolls, 5, through guide eyes, 4, which are attached to a rotatably mounted shaft, 6, extending the whole length of the machine so that the feed may be varied in all the individual units simultaneously in a manner which I have described in the specifications above referred to. After leaving the feed rolls the material passes over a guide rod, 7, through the guide eye, 8, to the winding hooks, 28, on the ring flier by which it is wound on the bobbin, 9, mounted on a lagging tube preferably of the air-borne type. It will be evident that this construction produces a machine of exceedingly compact form while the working fluid trunk forms one the main structural elements of the machine.

I will now describe a form of air-borne turbine driven ring flier suitable for insertion in the working fluid trunks and which is provided with running bearing parts and means for reversing the direction of rotation, which ring flier however forms no part of the invention claimed herein.

Referring to Figs. 5 and 6, the ring flier, 12, carries turbine blades, 10, of the Laval or other suitable type at its lower extremity the working fluid being led to the blades from the fluid supply trunk, *c*, by nozzles, 13, sets of which may be provided for either directions of rotation. The length of the nozzles, as shown is considerably shortened owing to the manner in which they are cut by the sectional plane. The ring of blades 10 is retained in position by a ring, 10ª, which is provided with winding hooks and is attached to the flier, 12, by means of a bayonet joint or other suitable means. The turbine blades, 10, are shielded by a ring or casing, 11, which, however, has a sufficient number of openings formed therein in adjacent positions to discharge from the nozzles so as to allow a free path for the exhaust. The ring, 11, is formed integrally with the part, 16, and incloses the turbine blades, 10, as much as possible in order to reduce the losses due to the fanning action of the blades. The casing, *g*, is formed in two parts as shown and has projections, 14, attached to its inner surface so as to form an annular chamber, 15, between the casing, *g*, and the stationary part, 16. Between the stationary part, 16, and the highest speed rotating part, 12, which constitutes the ring flier, running bearing parts, 17 and 18 are disposed having flanges, 19 and 20, which rest on an angled seat formed on the casing, *g*. The part, 12, is also provided with a flange, 21, which is arranged above the flanges, 19 and 20. The exhaust from the turbine passes through the chamber, 15, lifts and supports the flanges, 19 and 20, and is thereby introduced below the flange, 21, upon which it acts in a similar manner and finally escapes to the exhaust chamber, *d*, by the ducts, 22, and the holes, 23. It will thus be seen that the dead weight of the rotating parts is supported on a cushion of elastic fluid. Enlarged clearance spaces, 24, are provided in the running parts

and the bottom of the parts, 16, 17 and 18, as well as the shielding ring, 11, are cut away as shown so as to allow a free path for the exhaust. The ring flier, 12, is provided with winding hooks, 28, at both ends in order to prevent fouling of the material.

In order to economize space as much as possible the outside of the casing is flattened at the point, 25, where it adjoins the adjacent casings, the section at other points being as indicated by the dotted lines at 26. Between the flanges, 19, 20 and 21, cushions, 27, of rubber or other suitable material are inserted which act as buffers and allow the flanges, 19, 20 and 21 to be lifted silently and together.

In the above construction of ring flier I effect reversing by removing the ring flier from its casing, inverting the bladed ring and then returning the flier to its casing. Sets of opposite handed nozzles, 13, Figs. 7 and 8, are required in this case and a blanking valve or washer, 30, having a rubber face, 31, is disposed at the entrance of the nozzles which washer is arranged to be rotated so as to cover the set of nozzles which it is desired to render inoperative.

It will be obvious that the above device is of exceedingly simple construction and one in which the fanning losses occurring in the case where opposite sets of blades are provided for each direction of rotation are eliminated.

The amount of diametrical clearance between the various running bearing parts should be of the order for air bearings which I have stated in my patent applications Nos. 260120 and 272560, in which specifications will also be found certain precautions which ought to be taken with regard to the condition of the air in order to obtain the best results.

It will be obvious that my invention is not limited to a machine of the leading and lagging part type as with slight modification it could be applied to other types for example a cup or cylinder spinner and the example illustrated shows one typical method of carrying my invention into effect.

In turbine driven spinning twisting or doubling machines using an elastic working fluid for actuating the twisting elements of the machines, the turbines may be of any of the well known types, according to the second part of my invention however I construct the nozzles and casings so that I have the blades of the turbines as completely shielded as possible thus preventing them setting air in motion and so absorbing power. For this purpose the turbine blades, 10, Fig. 9 rotate inside a smooth and closely fitting casing, 11, which has only sufficient openings therein to efficiently discharge the exhaust. I prefer also to form the nozzles closely adjoining each other so that the exhaust may be all discharged as nearly as possible in a solid jet, and also arrange the speed of the blades to that of the jet so that the velocity thereof is as fully utilized as possible. This I am enabled to do by using low pressure air with nozzles which converge to the throat and either contract or do not substantially expand from the throat to their discharge orifices. The range of fall of pressure is only small.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed I declare that what I claim is:—

1. In a spinning, twisting or doubling machine, the combination of a plurality of turbine driven twisting elements, an elastic fluid conduit in which said elements are removably mounted, said elastic fluid conduit forming a structural element of the machine as set forth.

2. In a spinning twisting or doubling machine, the combination of a plurality of turbine driven twisting elements, an elastic fluid conduit including supply and exhaust ducts in which said elements are removably mounted together with resilient packing means inserted between said twisting elements and said elastic fluid conduits, as set forth.

3. In a spinning, twisting or doubling machine the combination of a plurality of turbine driven twisting units; an elastic fluid conduit in which said twisting units are removably mounted, means for feeding material to said twisting units together with means for receiving spun material from said twisting units, as set forth.

4. In a spinning doubling and twisting machine, the combination of a plurality of turbine driven twisting units, an elastic fluid conduit in which said twisting units are removably mounted, means co-acting with each twisting unit for feeding material to said unit, a plurality of bobbins internally disposed to said twisting units together with means for reciprocating said bobbins, as set forth.

5. In a spinning, twisting or doubling machine, the combination of a fluid conduit; a turbine driven twisting element and a bearing member therefor; a member incasing said twisting element and said bearing member, said twisting element, bearing member and incasing member forming a unit removably mounted in said conduit.

6. In a spinning, twisting and doubling machine the combination of a plurality of turbine-driven twisting units, an elastic fluid conduit in which said twisting units are removably mounted together with a converging nozzle through which the elastic fluid is led to said turbine.

7. In a spinning, twisting or doubling machine, the combination of a fluid conduit

having oppositely disposed walls; a turbine driven twisting element and a member incasing said twisting element, said incasing member passing fluid-tight through said oppositely disposed walls.

8. In a spinning, twisting or doubling machine, the combination of a fluid conduit having oppositely disposed walls; a rotatably mounted twisting element having a turbine mounted thereupon; a member incasing said twisting element and turbine, said incasing member passing fluid-tight through said oppositely disposed walls together with ports in said incasing member leading fluid to said turbine.

9. In a spinning, twisting or doubling machine, the combination of a turbine driven twisting element; a member incasing the same together with a fluid conduit having supply and exhaust portions, said incasing member passing fluid-tight through the walls of said supply and exhaust portions.

10. In a spinning, twisting or doubling machine, the combination of a turbine driven twisting element; a member incasing the same together with a fluid conduit having supply and exhaust portions bounded by walls, one of said walls being common to both portions, said incasing member passing fluid-tight through said common wall and also through other of said walls forming part respectively of said supply and said exhaust portions.

11. In a spinning, twisting or doubling machine, the combination of a fluid conduit having an aperture in one of its bounding walls; a turbine driven twisting element; a member with an enlarged portion incasing said twisting element, said member being located in said aperture with said enlarged portion butting against the periphery of said aperture.

12. In a spinning, twisting or doubling machine, the combination of a fluid conduit having oppositely disposed walls each provided with an aperture; a turbine driven twisting element and a member with an enlarged portion incasing said twisting element, said incasing member being inserted fluid-tight through said apertures with said enlarged portion butting against the periphery of one of them.

13. In a spinning, twisting or doubling machine, the combination of a fluid conduit; a plurality of turbine driven twisting elements and an equal number of members incasing the same inserted in said conduit, said incasing members having mutually butting portions.

14. In a spinning, twisting or doubling machine, the combination of a fluid conduit; a turbine driven twisting element, and a member incasing the same, said incasing member being yieldingly mounted in said conduit.

15. In a spinning, twisting or doubling machine, the combination of a plurality of fluid conduits disposed one at the back and one at the front of the machine; turbine driven ring fliers and members incasing the same, a set of said incasing members and incased ring fliers being mounted in each of said conduits; a rotatably mounted spindle axially movable in each of said ring fliers together with means for causing a relative reciprocating motion between said sets of ring fliers and sets of said spindles corresponding thereto.

16. In a spinning, twisting or doubling machine, the combination of a plurality of fluid conduits disposed one at the back and one at the front of the machine; turbine driven ring fliers and members incasing the same, a set of said incasing members and incased ring fliers being mounted in each of said conduits; a rotatably mounted spindle axially movable in each of said ring fliers together with means for interconnecting sets of said spindles corresponding to said sets of ring fliers and reciprocating said sets of spindles simultaneously in opposite directions.

17. In a spinning, twisting or doubling machine, the combination of a plurality of fluid conduits disposed one at the back and one at the front of the machine; turbine driven ring fliers and members incasing the same, a set of said incasing members and incased ring fliers being mounted in each of said conduits; a rotatably mounted spindle axially movable in each of said ring fliers together with means for causing a relative reciprocating motion simultaneously in opposite directions between said sets of ring fliers and sets of said spindles corresponding thereto.

Dated this 4th day of August 1906.

In testimony whereof I affix my signature in presence of two witnesses.

SEBASTIAN ZIANI DE FERRANTI.

Witnesses:

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LUTHER J. PARR.