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TURBINE

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FIG. 1.

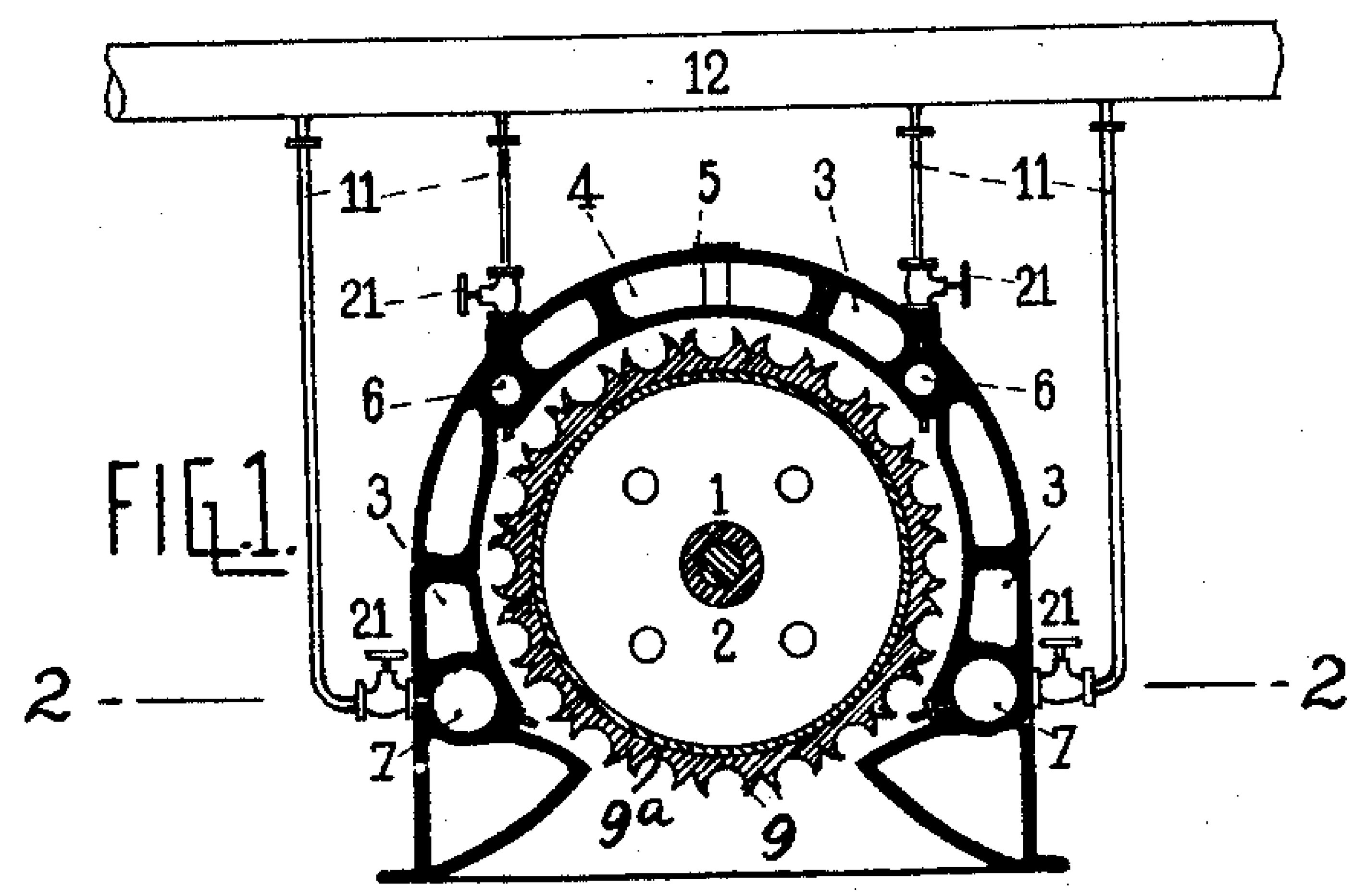

FIG. 2.

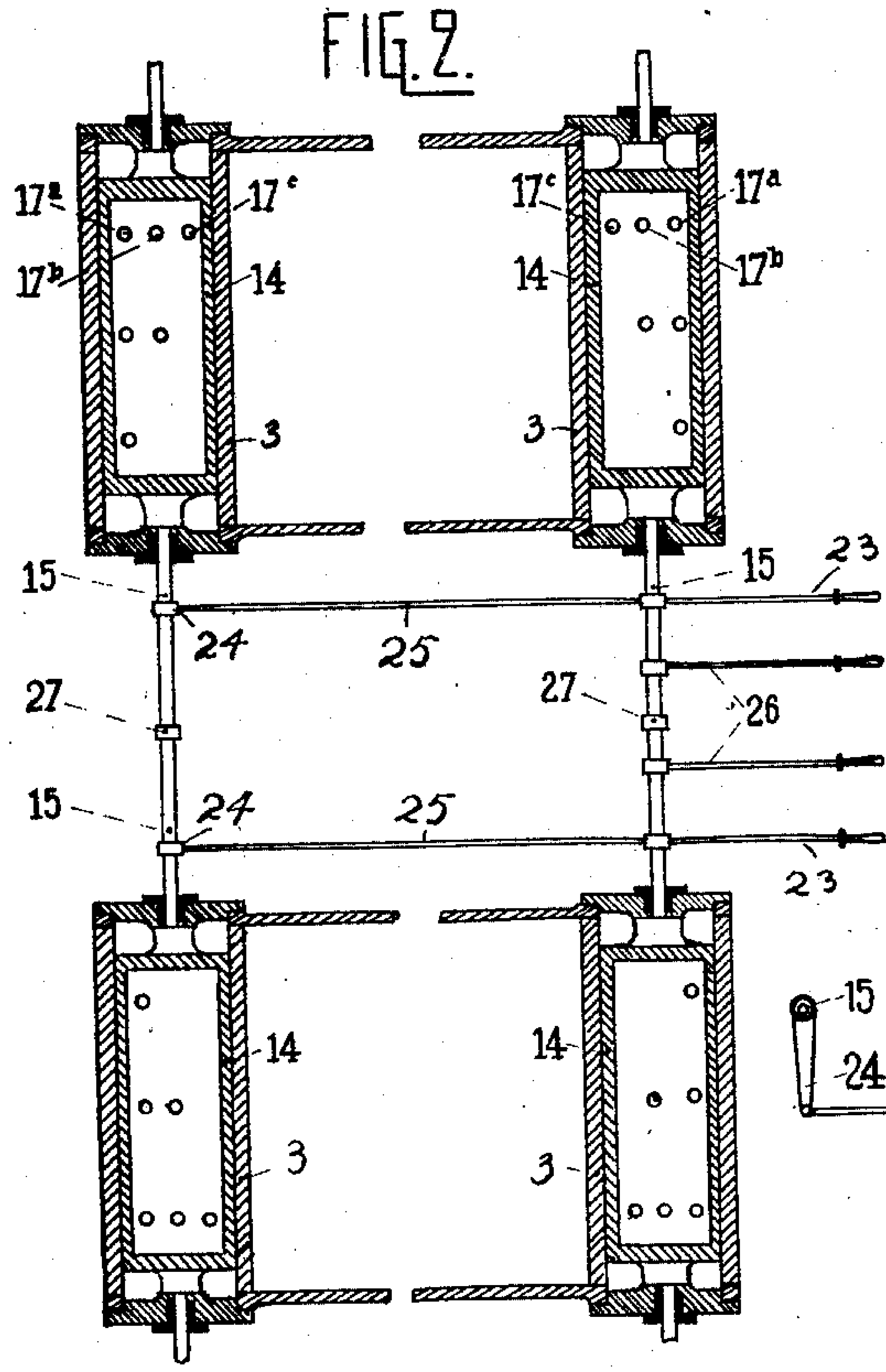

FIG. 3.

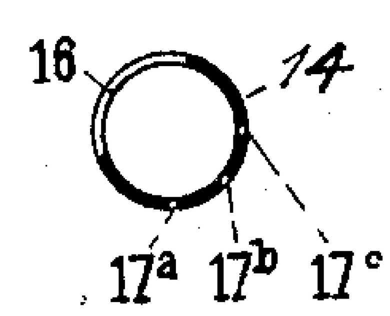

FIG. 4.

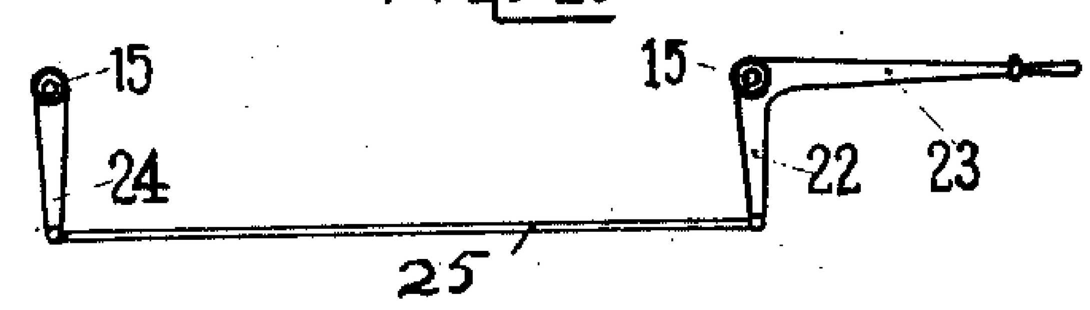

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FIG.5.

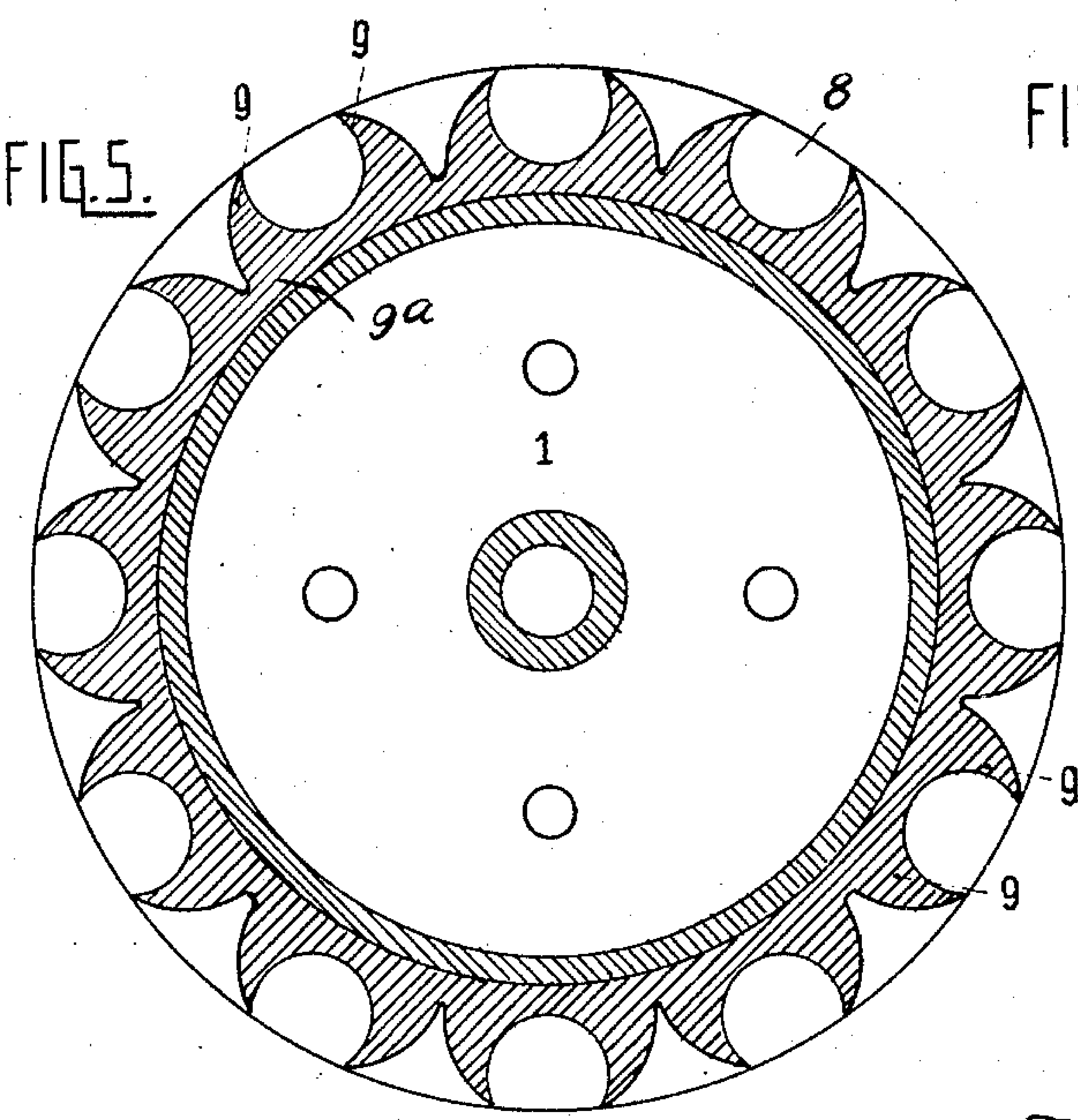


FIG.6.

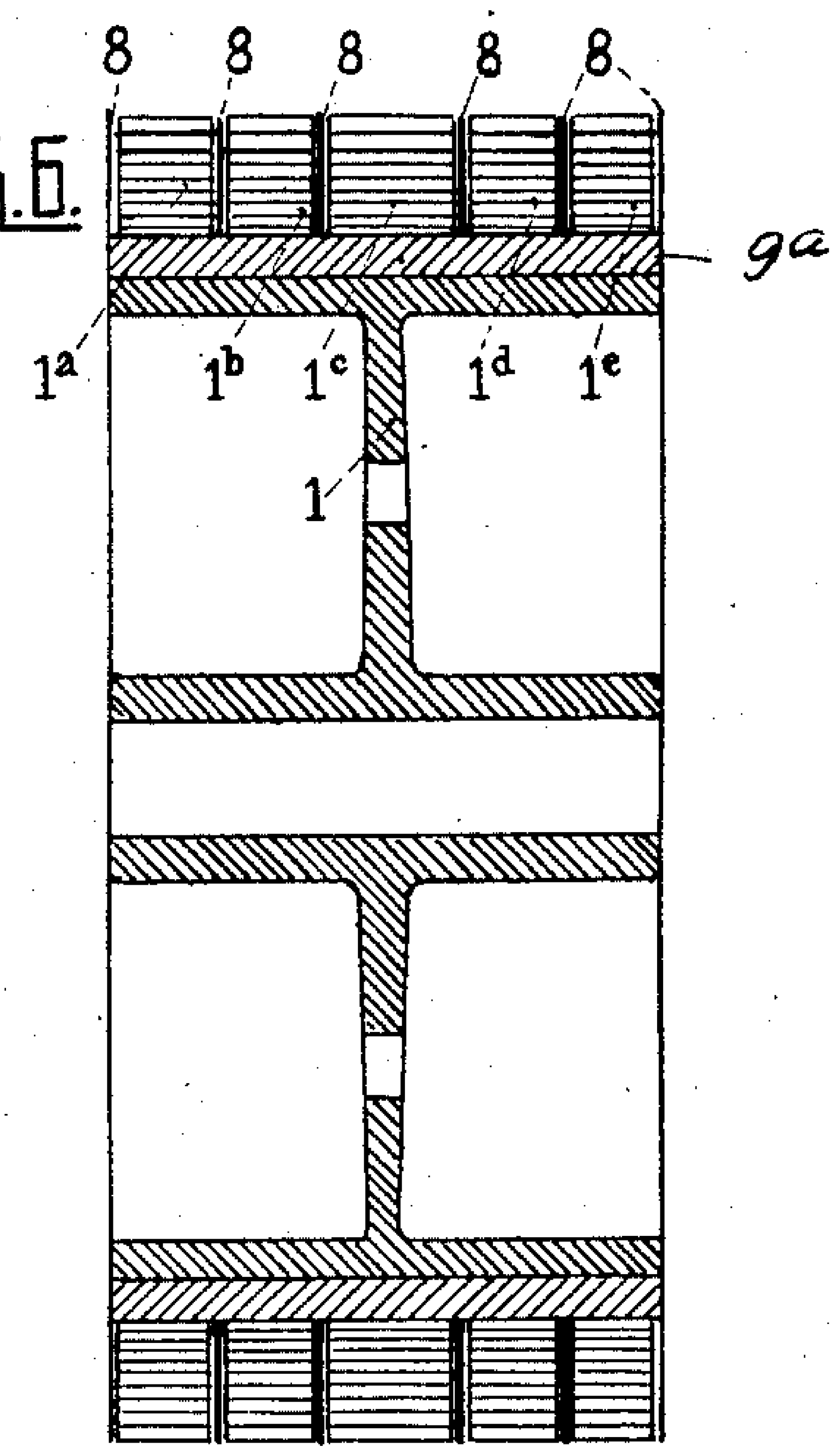
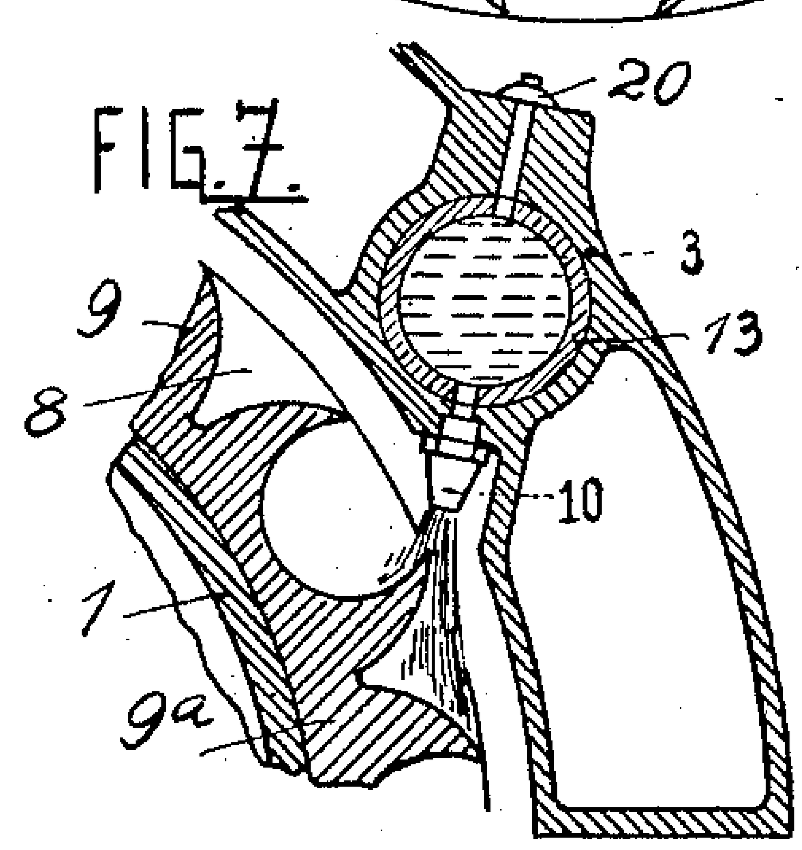


FIG.7.



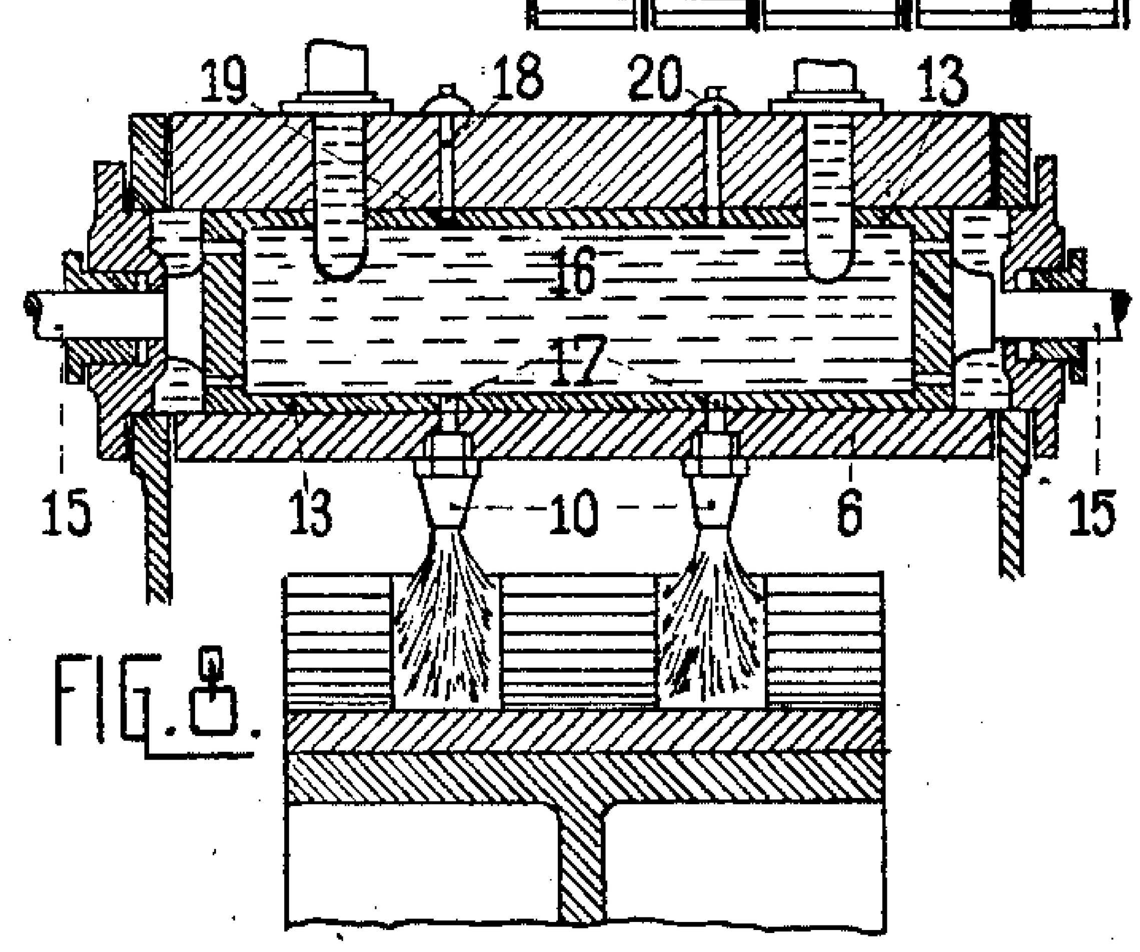
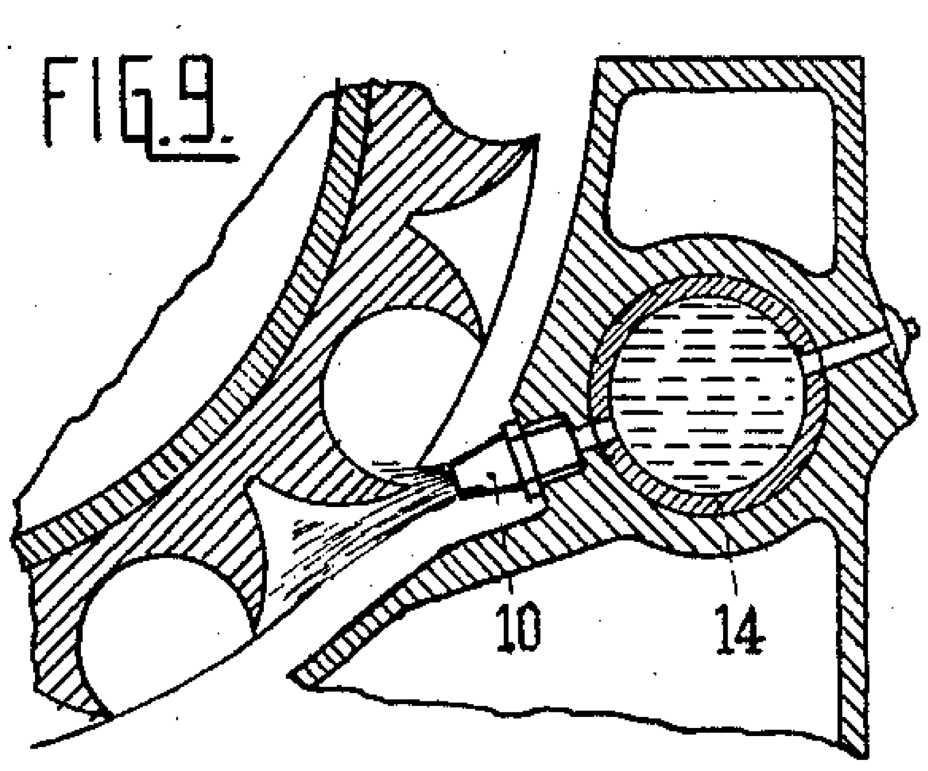


FIG.8.

FIG.9.



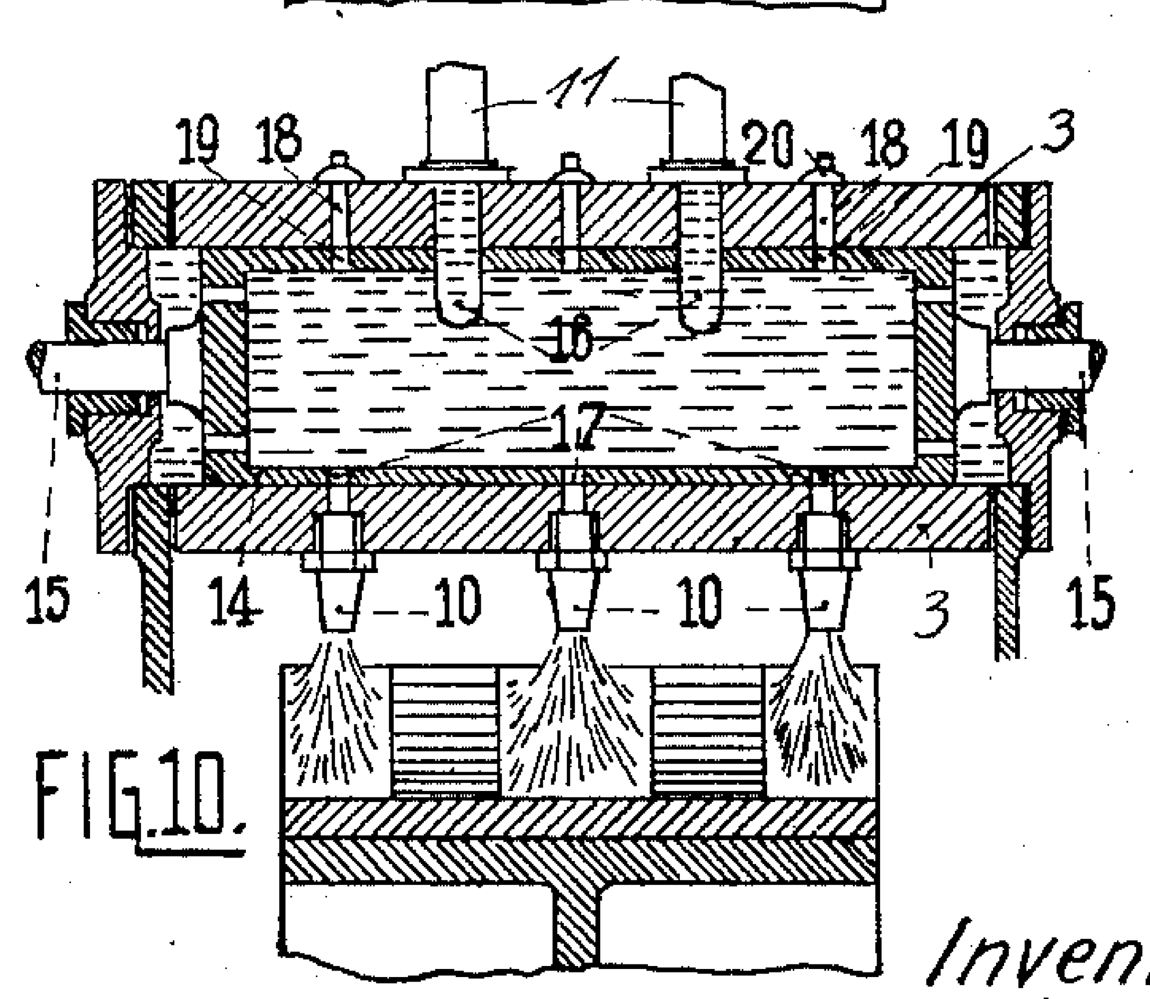


FIG.10.

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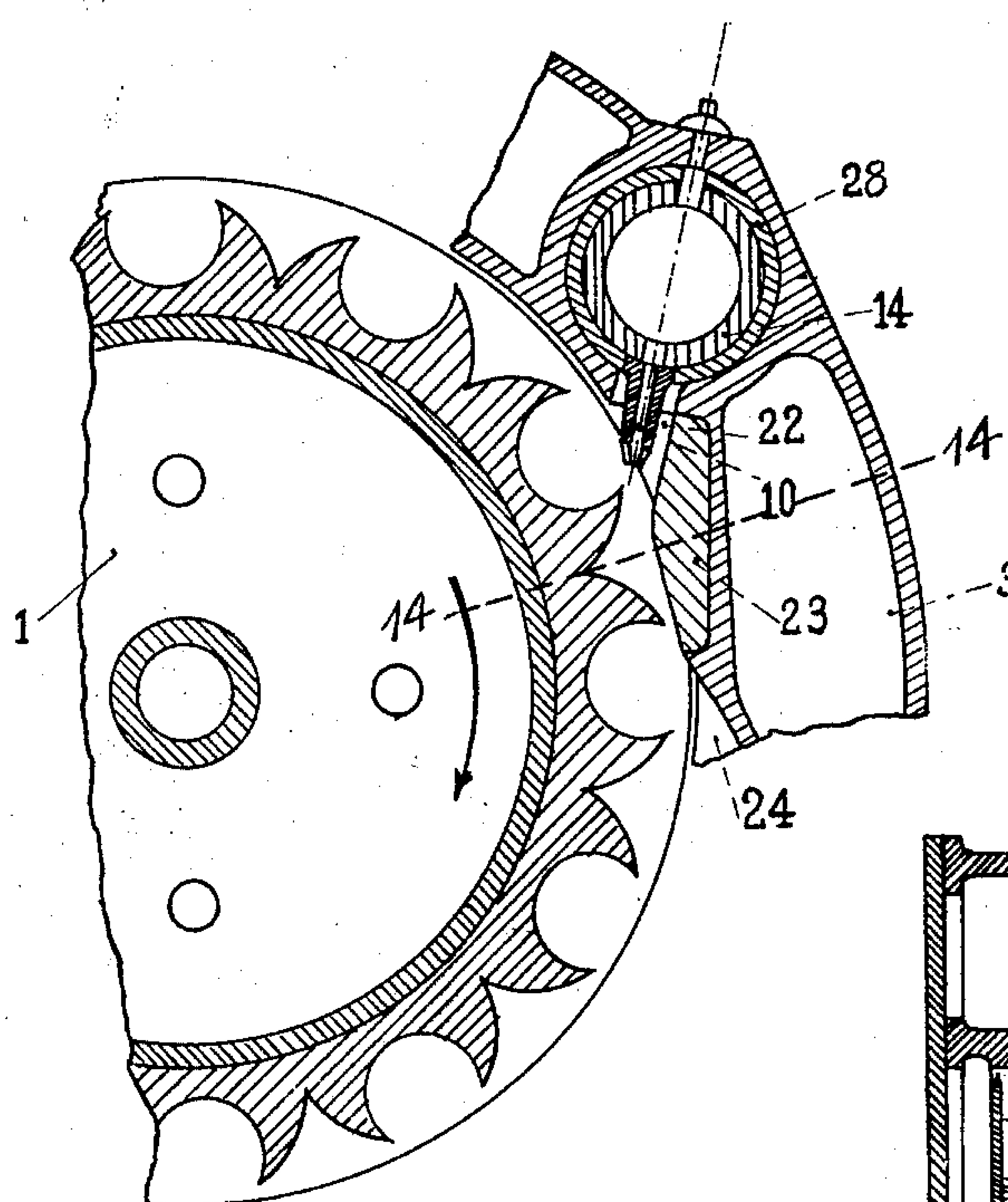


FIG.11.

FIG.14.

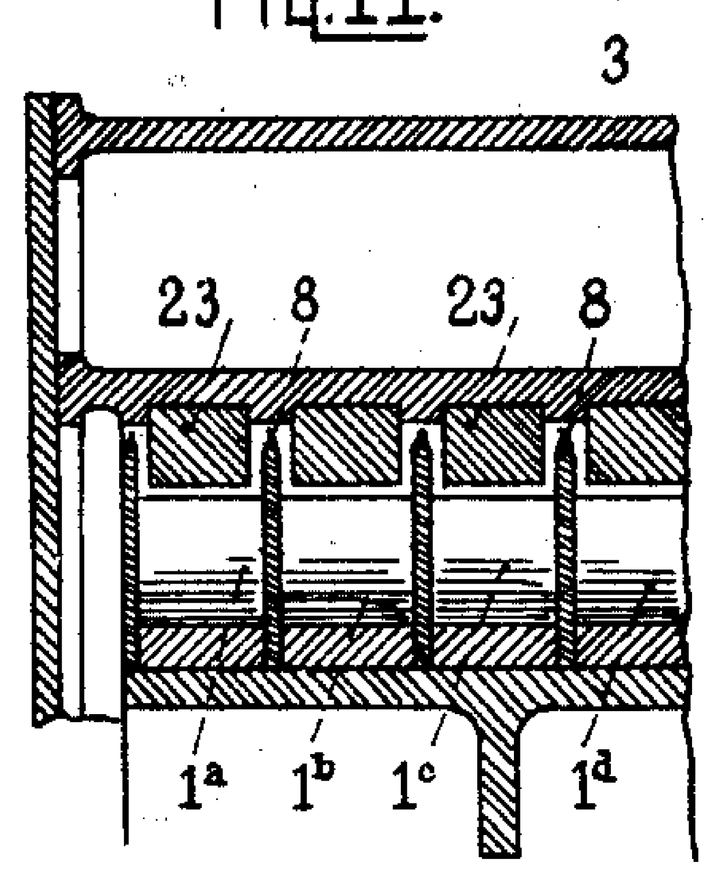
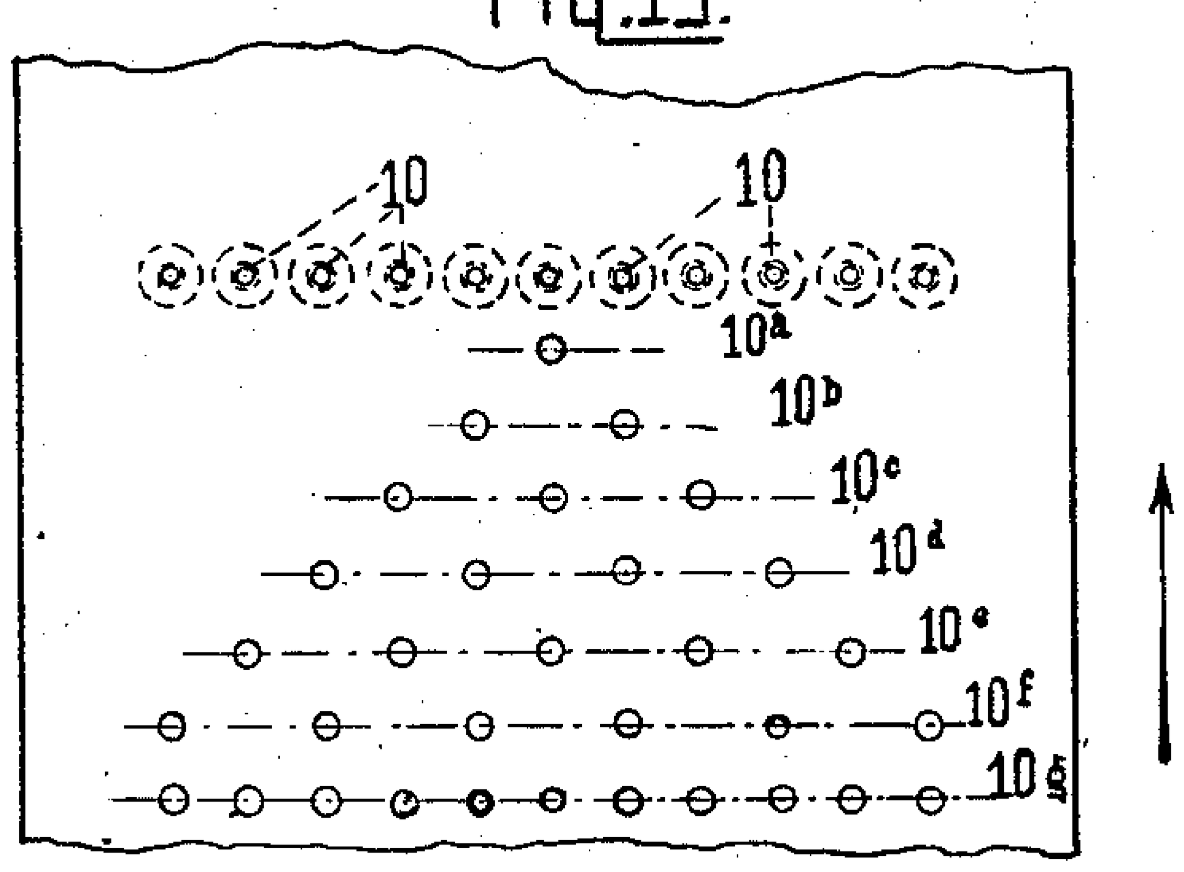


FIG.13.



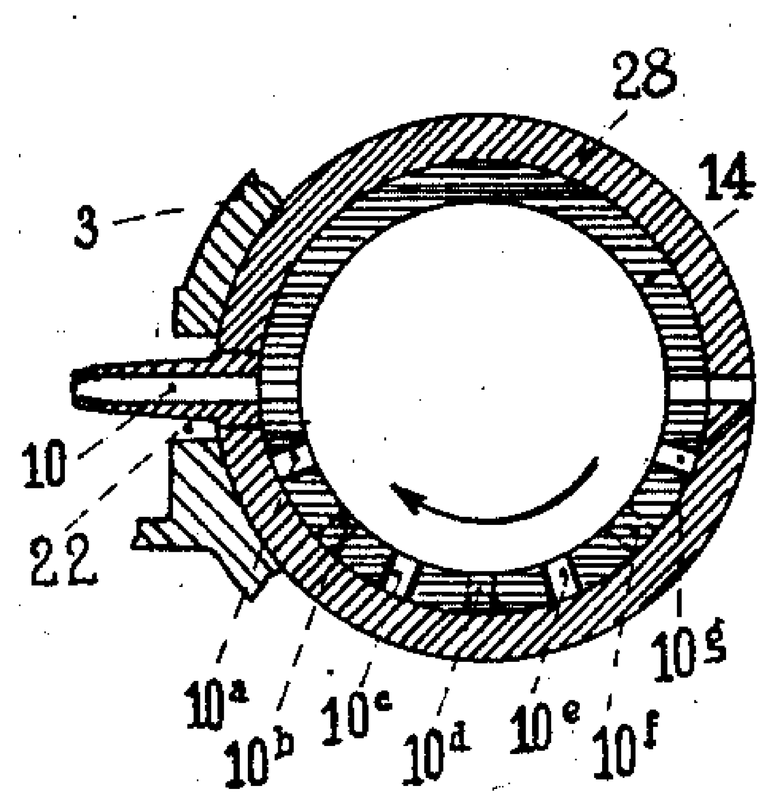


FIG.19.

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UNITED STATES PATENT OFFICE

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TURBINE

Application filed June 10, 1926, Serial No. 115,105, and in Germany June 15, 1925.

This invention relates to a turbine for use with steam or water and consists essentially in the provision of a blade wheel having a rim which presents, when viewed in axial direction, alternate circular and substantially V-shaped recesses forming blades of corni-form cross-section turned alternately in opposite directions.

This arrangement enables the wheel, which works with tangentially admitted fluid, to be rotated with equal effect in both directions; the pressure is taken up gradually by the blades, and the fluid is enabled to clear the blades readily after its energy has been spent on the same.

The turbine is controlled by means of hollow cylindrical valves by the rotary adjustment of which a plurality of nozzles can be put in varying numbers into and out of operation.

Fig. 1 of the accompanying drawings represents a vertical section of the turbine,

Fig. 2, a section on the line 2—2 of Fig. 1 and on an enlarged scale of the casing of a twin turbine,

Fig. 3, a cross-section of one of the valves,

Fig. 4, a side view of one of the control levers,

Fig. 5, a sectional side view of the blade wheel,

Fig. 6, an axial section of the wheel,

Figs. 7 and 8 are sectional views at right angles of one of the nozzle arrangements.

Figs. 9 and 10, similar views of another nozzle arrangement,

Fig. 11, a view of the first nozzle arrangement showing a modified structure,

Fig. 12, a cross-section of a valve cylinder of modified construction,

Fig. 13, a development of this valve cylinder, and

Fig. 14, a section on the line 14—14 of Fig. 11.

The turbine has a U-shaped, double-walled casing 3 in the end walls of which the turbine shaft 2 is rotatably mounted. The casing is divided horizontally on a level with the turbine shaft into two parts. The upper, segmental part has at the top a segmental slot through which minor repairs of the blade wheel may be executed. This slot is normally closed by a correspondingly shaped lid 4 which fits the slot and which is held in position by gravity without fastenings. There is an aperture 5 in the lid through which the interior of the turbine can be observed. The chambers formed between the double walls of the casing and of the lid 4 are utilized for the storage of oil and the like. At each side of the shaft 2, the casing is formed with two cylindrical chambers 6 and 7 arranged parallel with the shaft, one in the upper and one in the lower part of the casing. These chambers contain and form a tight fit with hollow cylindrical valves 13 and 14 respectively which receive driving fluid through the medium of pipes 11 from a distributing pipe 12 and delivers such fluid through nozzles 10 tangentially to the blade wheel. The latter consists of a wheel body 1 on to which a blade rim 9^a is forced. This rim presents, when viewed axially as in Fig. 5, alternate circular and substantially V-shaped recesses forming between them blades 9 of corni-form cross-section turned alternately in opposite directions. The V-shaped recesses are of the same depth as the circular ones, the distance between the tips of adjacent blades is substantially uniform and the convex sides of the blades are therefore extensive enough for reacting effectively with the driving fluid. In the construction shown, the rim 9^a is divided axially into five sections 1^a–1^e which are situated between flanges 8, the blades of alternate sections being in a staggered position. Two of these sections, whose blades are in alignment are fed from the upper valve chambers 6 and the other three, whose blades are also in alignment, are fed from the lower valve chambers 7. The nozzles 10 direct the fluid tangentially on to the blade wheel, the fluid acting on the convex side of one blade and on the concave side of the next, as shown in Figs. 7 and 9. In the circular blade recesses about two thirds of the surface reacts with the fluid so as to impart rotation to the wheel, the other third of the surface serving to guide the spent fluid back into the discharge passage between the wheel and the casing. The nozzles at one side of the turbine are set so as to drive the blade wheel in one direction and those at the other side, in the opposite direction. Valves 21 in the pipes 11 allow the fluid to be supplied as desired to either side.

The power outpt is normally controlled by means of the valves 13 and 14 which are adjusted rotatively for putting one or more nozzles into operation. For this purpose the nozzles for each valve are arranged in alignment, and the valve is formed with feed apertures arranged in rows each of which supplies a different number of nozzles. In Fig. 2, for instance, wherein three nozzles are to be dealt with, the valve 14 has three rows of apertures 17^a, 17^b and 17^c each of which can be turned into register with the nozzles, one row supplying three, the next two, and the third only one nozzle. Segmental slots 16 in the valve cylinders remain in communication with the supply pipes 11 in all three adjustments. Diametrically opposite the feed apertures 17, the valve cylinders have apertures 19, and diametrically opposite the nozzes 10, the casing 3 has apertures 18. These apertures, when in register, allow a tool to be inserted for cleaning the apertures themselves as well as the nozzles. Normally the apertures 18 in the casing are closed by plugs 20 so as to prevent escape of fluid.

The valve cylinders are fitted with shafts 15 whereby the adjustment is made. All the control levers are at the same side of the turbine. The near-side valve is adjusted by means of a lever 26 which is secured direct to the shaft 15. The far-side valve is adjusted by means of a bell-crank 22, 23 loosely arranged on the near-side shaft and connected by a link 25 to a lever 24 which is rigidly secured to the far-side shaft. In Fig. 2, where two turbines are arranged in juxtaposition so as to act on the same driving shaft 2, the control shafts 15 of the two turbines are in alignment and coupled by clutches 27 so that both turbines can be controlled by a single lever if desired.

Further regulation of the power output can be obtained by a throttling of the individual nozzles.

The number of nozzles and blade rim sections may be varied according to requirements, the valves being modified to correspond. Figs. 12 and 13 show an arrangement of eleven nozzles. The valve cylinder 14 is formed with seven rows of feed apertures 10^a–10^g, the first six of which increase their number of apertures progressively from one to six, apertures of adjacent rows being arranged in a staggered position. The last row has eleven apertures and is put into operation when for some reason, for instance in the case of a sudden reversal of the turbine, full power is required.

For regulating the position of the nozzles relative to the blades, the nozzles are preferably connected to a bushing 28 which allows of rotary adjustment within the valve chamber, the turbine casing being provided with a slot 22 which admits the nozzle and which is widened to allow its adjustment.

In order to allow the discharge passage between the blades and the adjacent casing wall to be varied according to requirements, the casing is preferably recessed for the reception of an exchangeable guide fillet 23 the thickness of which is chosen according to the required depth of the passage. This arrangement also allows an easy compensation for wear. Behind the fillet 23 which prevents the fluid from slipping off the convex sides of the blades too easily, the casing has a recess 24 through which the fluid can readily escape so as to clear the blades after its force has been spent on the latter.

I claim:

1. A turbine comprising a casing, a blade wheel in said casing, rows of nozzles fitted at the inside of said casing for supplying driving fluid to the wheel and rotatable hollow valve cylinders fitted in the casing for feeding fluid to different rows of nozzles, each valve cylinder being provided with feeding apertures arranged in parallel rows all having different numbers of apertures, the number of apertures in one of the rows being equal to the number of nozzles.

2. In a turbine, a blade wheel having a rim which presents, when viewed in an axial direction, alternate circular and substantially V-shaped recesses forming blades of corniform cross-section turned alternately in opposite directions, the V-shaped recesses being of the same depth as the circular ones, a casing enclosing the blade wheel, rows of nozzles fitted at the inside of the casing for supplying driving fluid to the wheel, and a rotatable hollow valve cylinder fitted in the casing for feeding fluid to each row of nozzles, each valve cylinder being provided with feeding apertures arranged in parallel rows, all having different numbers of apertures, two of said rows of apertures being longer than the others and of equal length but provided with different numbers of apertures, the number of apertures in one of said rows being equal to the number of nozzles.

3. A turbine comprising a blade wheel, a casing enclosing the blade wheel, rows of nozzles fitted at the inside of the casing for supplying driving fluid to the wheel, a rotatable hollow valve cylinder fitted in the casing and provided with apertures for feeding fluid to a row of nozzles, casing and cylinder being also formed with cleaning apertures arranged diametrically opposite the nozzles and the feeding apertures respectively so as to admit a cleaning tool through the nozzles from the outside, and plugs whereby the cleaning apertures of the casing are normally closed.

4. A turbine comprising a blade wheel, a casing enclosing the blade wheel, nozzles fitted at the inside of said casing, for feeding driving fluid to the wheel, and rotatably adjustable bushings arranged parallelly with the turbine axis and holding the nozzles so that the position of the latter relative to the blades can be regulated by a rotary adjustment of said bushings.

5. A turbine comprising a blade wheel, a casing enclosing the blade wheel, nozzles fitted at the inside of the casing for feeding driving fluid to the wheel, rotatably adjustable bushings arranged parallelly with the turbine axis and holding the nozzles so that the position of the latter relative to the blades can be regulated by a rotary adjustment of the bushings, and valves arranged in said bushings for controlling the fluid supply to the latter.

6. A turbine comprising a blade wheel, a casing enclosing the blade wheel, nozzles fitted at the inside of said casing for feeding driving fluid to the wheel, and exchangeable fillets arranged in recesses in the casing so as to determine the depth of the passage between the blades and the casing immediately behind the nozzles.

7. A turbine comprising a blade wheel, a casing enclosing the blade wheel, said casing being formed at the top with a segmental slot giving access to the blade wheel, and a lid fitting said slot and normally held therein by gravity so as to maintain the slot closed, the lid being formed with an aperture through which the interior of the turbine can be observed.

8. In a turbine, a blade wheel having a rim divided into a plurality of annular sections, each section presenting, when viewed in an axial direction, alternate circular and substantially V-shaped recesses forming blades of corniform cross-section turned alternately in opposite directions, the circular recesses comprising each substantially two-thirds of a circle, the V-shaped recesses being of the same depth as the circular ones, flanges separating the different sections, a wheel body to which said sections and flanges are independently secured, alternate sections having their blades in a staggered position, a casing enclosing the blade wheel, and rows of nozzles, having a diameter of substantially one-tenth of the diameter of the circular recesses of the rim, fitted at the inside of the casing for supplying driving fluid to the wheel.

9. In a turbine, a blade wheel having a rim which, when viewed in an axial direction, presents alternate circular and substantially V-shaped recesses forming blades of corniform cross-section turned alternately in opposite directions, the V-shaped recesses being of the same depth as the circular ones, the distance between the tips of adjacent blades being substantially uniform, a casing enclosing the blade wheel and rows of nozzles, having a diameter of substantially one-tenth of the diameter of the circular recesses of the rim, fitted at the inside of the casing for supplying driving fluid to the wheel.

10. In a turbine, a blade wheel having a rim divided into a plurality of annular sections, flanges separating the different sections, rows of nozzles for supplying driving fluid to the wheel, rotatable hollow valve cylinders for feeding fluid to different rows of nozzles, each valve cylinder being provided with feeding apertures arranged in parallel rows all having different numbers of apertures, the apertures of adjacent rows being in a staggered relative position.

11. In a turbine, a blade wheel having a rim divided into a plurality of annular sections, flanges separating the different sections, rows of nozzles for supplying driving fluid to the wheel, rotatable hollow valve cylinders for feeding fluid to different rows of nozzles, each valve cylinder being provided with feeding apertures arranged in parallel rows all having different numbers of apertures, the apertures of adjacent rows being in a staggered relative position, one of said rows having as many apertures as there are nozzles and being adjacent to a row having about half that number of apertures.

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