

No. 748,689.

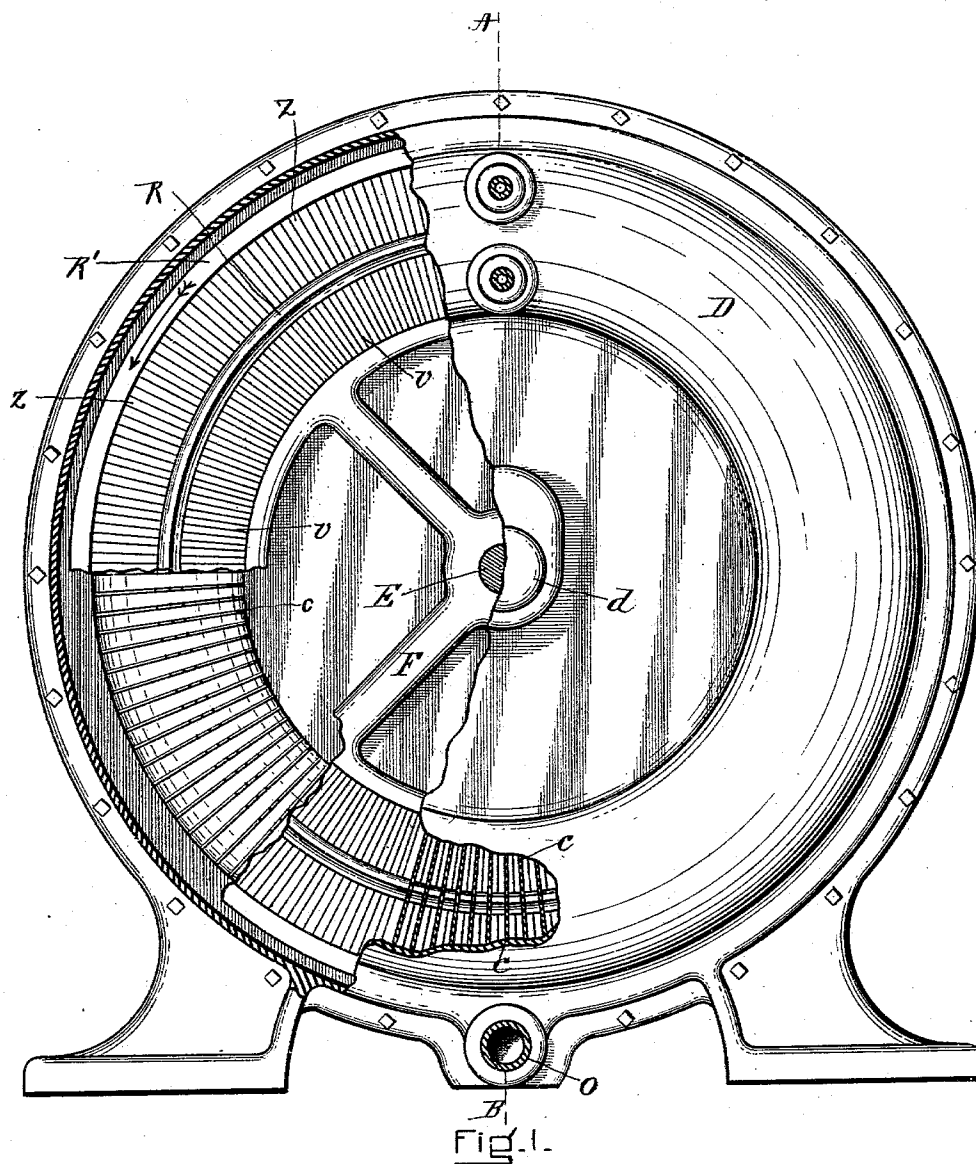
PATENTED JAN. 5, 1904.

J. M. BENJAMIN.
ROTARY MOTOR.

APPLICATION FILED JUNE 5, 1902.

NO MODEL.

3 SHEETS—SHEET 1.



WITNESSES=
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John Buckler

INVENTOR=
John M. Benjamin

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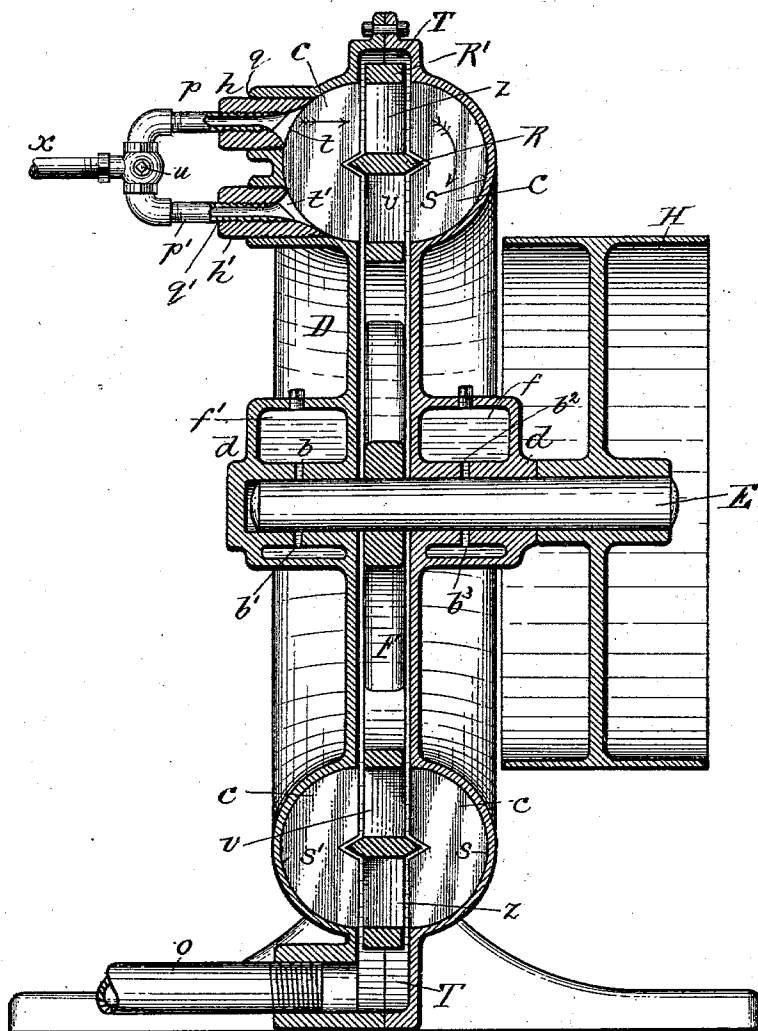


Fig. 2.

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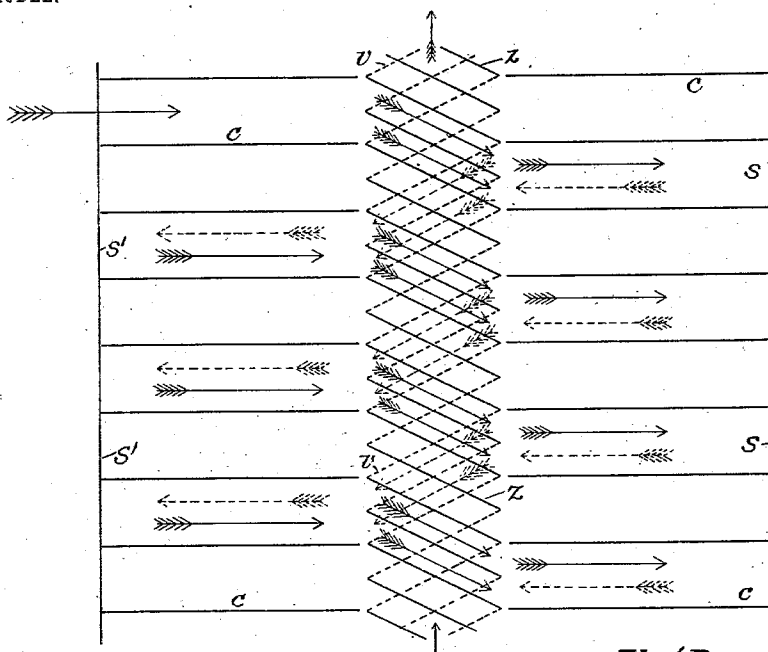


FIG. 3.

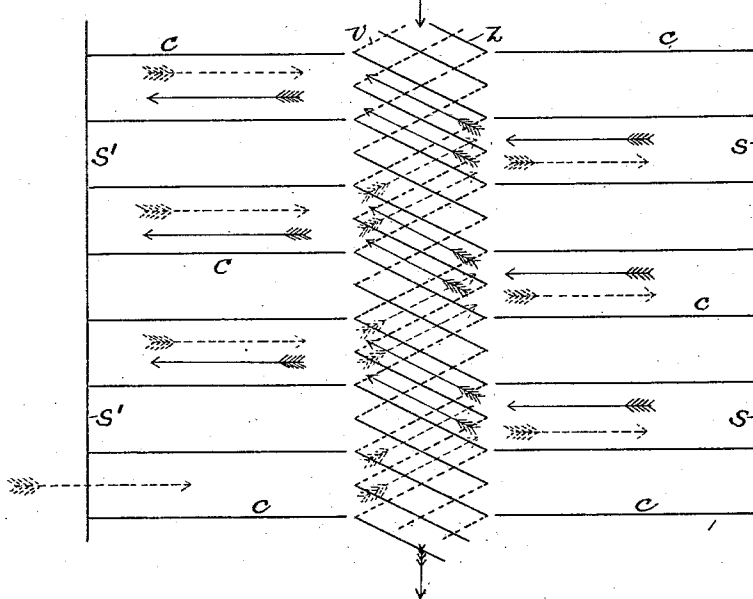


FIG. 4.

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UNITED STATES PATENT OFFICE.

JOHN M. BENJAMIN, OF BOSTON, MASSACHUSETTS, ASSIGNOR OF ONE-HALF
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ROTARY MOTOR.

SPECIFICATION forming part of Letters Patent No. 748,689, dated January 5, 1904.

Application filed June 5, 1902. Serial No. 110,386. (No model.)

To all whom it may concern:

Be it known that I, JOHN M. BENJAMIN, of Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in Rotary Motors, of which the following, taken in connection with the accompanying drawings, is a specification.

This invention relates to improvements in rotary motors in the class of impact-wheels in which the vanes or buckets receive the impact of a jet of fluid at high velocity, which imparts momentum thereto; and the invention consists in a wheel which has two or more series of vanes arranged in radially concentric rings around its shaft, with the vanes in one ring set at an angle to the plane of rotation of the wheel opposite to the angle of those in the next adjoining ring, and annular series of deflecting-chambers in the wheel-casing upon each side thereof to receive the fluid from the vanes of one series and direct it against the vanes of the next series and from the last series employed to the initial series again.

Heretofore in motors of the impact class the progress of the molecules of moving fluid has been in a sinuous path radially or otherwise of the motor-wheel. In the improved construction herein disclosed the progress of the molecules of moving fluid is circumferentially of the motor-wheel, in what may be termed a "helical ring," and in a direction opposite to that in which the wheel is rotating.

The objects of these improvements are, first, to cause the rapidly-moving fluid, after leaving the inlet-passage, to strike a large number of vanes in circumferential succession of the series in the concentric rings in order that there may be imparted to the motor the greatest possible percentage of the kinetic energy of the moving molecules, and, second, to enable the motor to be reversed in its direction of rotation readily and quickly. These objects may be attained by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is an end elevation of the motor with portions of the casing and motor-wheel broken away to show the interior. Fig. 2 is a vertical section of the entire motor on the line A B, Fig. 1. Fig. 3 is a diagrammatical

development on a horizontal plane of the moving vanes and the interior of the case surrounding them and the path of the fluid when the vanes are moving in one direction. Fig. 4 is a diagrammatical development of the vanes and case, showing the path of fluid when vanes are moving in the direction opposite to that shown in Fig. 3.

The case D, in which are incorporated the journal-boxes d and d' and the radial partitions $c c$, the inlet-pipes x and p and p' , and exhaust-pipe o , constitutes the framework of the motor. In the journal-boxes d and d' turns a shaft E, carrying a spider-wheel F within the case D and a pulley H without. The spider F carries two sets of radial vanes—an inner set $v v$ and an outer set $z z$ —which are oppositely inclined to the plane of rotation of spider F and to the planes of the partitions $c c$. The two sets of vanes $v v$ and $z z$ are separated from each other and held in place by a ring R, and the vanes $z z$ are surrounded and held in place by a ring R'. The fluid-inlet pipes p and p' , which are connected to a pipe x through a two-way cock u , enter bushings h and h' in holes q and q' in case D, said bushings having flaring inner openings t and t' . Surrounding said spider and vanes is an exhaust-passage T, which has a multiplicity of openings to the chamber in which the vanes revolve and is in substantially continuous communication therewith. This passage T is entered by exhaust-pipe O, which may be connected at its other end to a condenser. (Not shown.) Surrounding journal-boxes d and d' are oil-receptacles f and f' , from which oil is admitted to shaft E through openings b , b' , b^2 , and b^3 . In Figs. 3 and 4 the full-line horizontal arrows denote the direction of fluid passing through the outer set of vanes $z z$, and the dotted arrows denote the direction of the fluid when passing through the inner set of vanes $v v$, while the vertical arrows denote the direction of motion of the vanes.

The operation of the motor is as follows: When it is desired to drive the motor in the direction shown by the arrows in Figs. 1 and 3, the fluid under pressure is admitted from the pipe x through the pipe p . When using a fluid—such as steam, for instance—under

high pressure, it will expand in the flaring outlet t or t' and its initial pressure be greatly reduced, thereby converting its potential energy into kinetic energy, and it will then be driven with great velocity across the space between the partitions c c and strike one or more of the vanes z , thereby imparting a portion of its kinetic energy thereto, which will set the wheel F in motion. The molecules of fluid after passing between the vanes z will be projected into the chambers between the opposite partitions c and be deflected by the outer curved surfaces s of those chambers and turned in the opposite direction, as indicated by the arrow, Fig. 2, against the vanes v , imparting thereto still more of the kinetic energy of the molecules and giving the wheel F an additional impetus. Passing between the vanes v the fluid will be deflected upward by the curved outer surfaces s' of the chambers between the partitions c upon that side and be directed against other vanes z , and so on the fluid molecules will be directed first in one direction and then the other, so as to strike successively vanes in the series z and then vanes in the series v , and as the vanes in these two series are set at opposite angles to the planes of the partitions c the molecules will be thrown off from the respective vanes at an angle opposite to the direction in which the vanes are revolving, and consequently will be directed into chambers between the partitions c retrogressively around the circumference of the motor-casing, thus causing the fluid molecules to follow a substantially helical path, as delineated in Figs. 3 and 4, from deflecting-chambers upon one side of the casing D through one series of vanes to deflecting-chambers upon the other side of the casing and then back through the other series of vanes, and so on around the series of vanes, and at each impact upon the vanes imparting thereto a portion of the kinetic energy remaining in the fluid molecules until such energy is finally exhausted. By this operation approximately the maximum amount of inherent effective force of the moving fluid is utilized. When it is desired to drive the motor in the opposite direction from that shown by the arrow in Fig. 1, the fluid is admitted under pressure through the pipe p' , from which it will first strike the vanes v , thence will pass to curved surfaces S and be deflected in the opposite direction, so as to strike the vanes z , and so on throughout the series of vanes in a helical path around the shaft E in a direction opposite to that which the fluid takes when admitted through pipe p . An excess of pressure of the motive fluid in any part of the chamber wherein it follows its helical path will tend to impede the progress of the fluid, and by surrounding such chamber with the exhaust-space T and connecting it therewith throughout the circumference of the wheel such excess of pressure is immediately relieved by the passage of fluid from the chamber to the space T at any point where it may

occur and while the motive fluid is still doing work, and thus an equilibrium will immediately be established. In prior structures no such relief of pressure can occur, and the motive fluid cannot and does not enter the exhaust-passages until it has passed entirely through the wheel and has finished its work.

The distinguishing features of these improvements over prior structures are in an impact-wheel of such construction that after the motive fluid is projected against the vanes of an initial series it will be reflected back and forth in a substantially helical path through vanes of all the series and then returned to vanes of the initial series, and this operation will be continually repeated around the axis of the wheel until all of the kinetic energy in the moving molecules of fluid is exhausted by repeated impact upon the motor-vanes; also, that while the motive fluid is still imparting its kinetic energy to the motor any excess of pressure at any point in its helical path is immediately relieved by the passage of fluid at that point into the circumferential exhaust-passage and only such amount as will be sufficient to establish an equilibrium throughout the system.

In Figs. 1 and 2 a wheel with only two concentric series of vanes is shown; but a greater number of series of such vanes may be employed and operate in the same manner and accomplish the beneficial result by connecting the last series of vanes in the wheel with the initial series by independent passages of the same general form as those produced by the partitions c c , but placed outside of those chambers. If only one ring of vanes is employed, one of the inlets, as t' , with its connecting-pipe p' , should be placed upon the opposite side of the case—that is, directly opposite to the inlet t —so that when the fluid is admitted at t it will strike the angular vanes z upon one side and turn the wheel in one direction, and when admitted at t' it will strike the vanes z upon the other side and turn the wheel in the other direction. With such construction also the chambers similar to those between the partitions c c which conduct the fluid around from one side to the other of the single series of vanes would be formed in the casing outside of the periphery of the wheel.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A rotary motor, consisting of a wheel provided with two or more series of vanes arranged around the shaft concentrically with its axis, with the vanes of alternate series placed at opposite angles to the plane of rotation of the wheel, an inlet for motive fluid, radially-arranged segmental chambers at each side of the series of vanes to receive the motive fluid deflected from each vane and reflect it upon other vanes in a continuous substantially helical path around the axis of the wheel, and in a direction opposite to that of its rotation.

2. A rotary motor, consisting of a wheel

provided with two or more series of vanes arranged radially in circles concentric with its shaft, with the vanes of each series placed at an angle to the plane of rotation of the wheel, 5 opposite to the angle at which the adjoining series is placed thereto; an inlet for motive fluid, and a series of fixed chambers at the sides of the series of vanes to receive the motive fluid which is projected between the successive vanes of one series and reflect it 10 against vanes of the next series, and from the final series to the initial series, in a continuous substantially helical path around the axis of the wheel.

15 3. A rotary motor, consisting of a wheel provided with two or more series of radial vanes arranged in circles concentric to its shaft, and with the vanes of alternate series placed at opposite angles to the plane of rotation of the wheel; an inlet adapted to deliver 20 fluid at high velocity against the surface of vanes set at one angle and an inlet to deliver such fluid against the surface of vanes set at another angle, and fixed chambers upon

each side of the circles of vanes, to receive 25 the fluid which is deflected by each series and reflect it against the vanes of the next series, and an annular series of passages to conduct the moving fluid from the series of vanes of final impact to the series of initial impact. 30

4. A rotary motor consisting of a wheel provided with vanes arranged concentrically around its shaft, an inlet to admit fluid under pressure against the vanes, a series of 35 fixed chambers to receive the motive fluid deflected from each vane and reflect it upon other vanes, in a helical path around the wheel, and an exhaust-chamber connected with such helical path throughout its circumference, for the purpose set forth. 40

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 23d day of May, A. D. 1902.

JOHN M. BENJAMIN.

Witnesses:

FRANK G. PARKER,
JOHN BUCKLER.