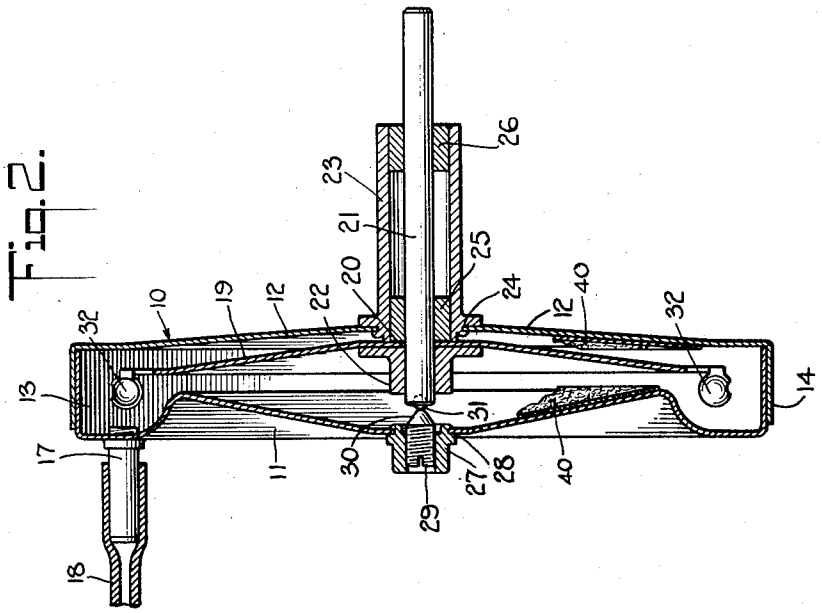
Sept. 12, 1933. E. S. CORNELL, JR 1,926,528

AIR MOTOR

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Fig. 2.



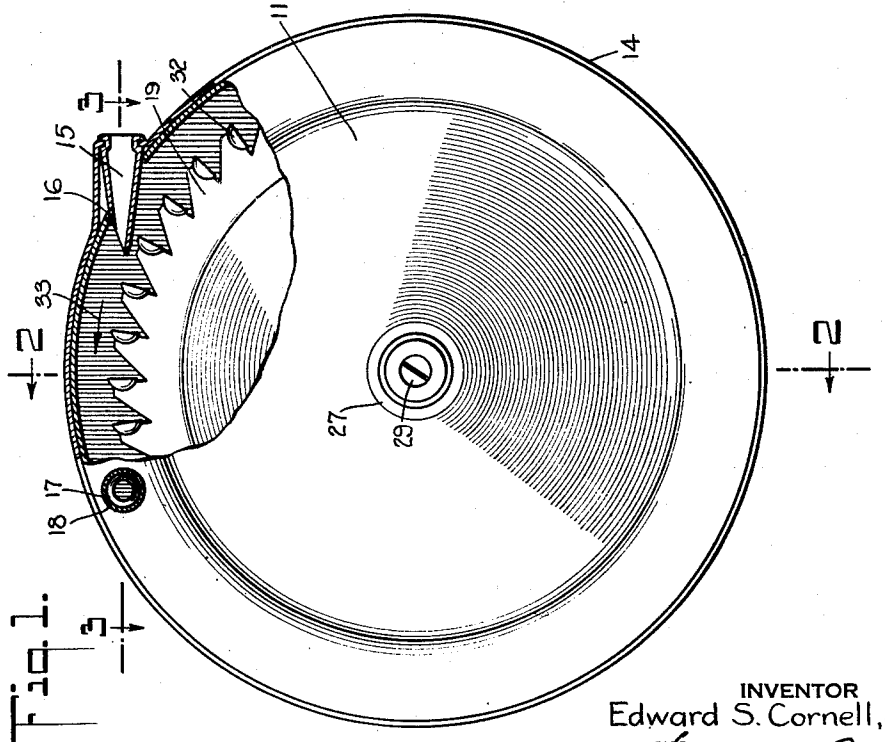


Fig. 1.

INVENTOR
Edward S. Cornell, Jr.
BY
Henry J. Lucke
HIS ATTORNEY

Sept. 12, 1933. E. S. CORNELL, JR 1,926,528

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Fig. 3.

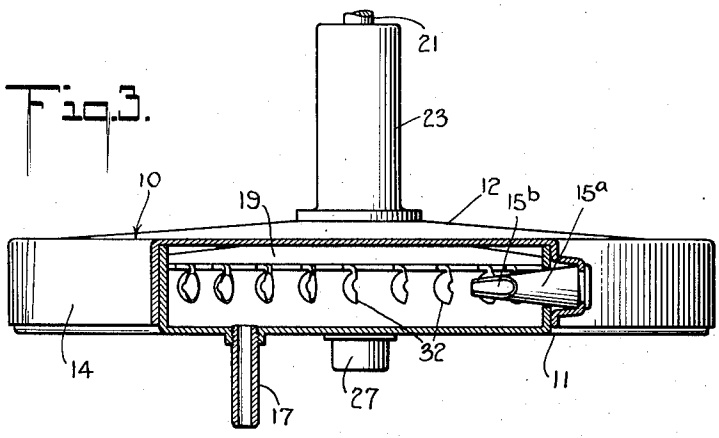
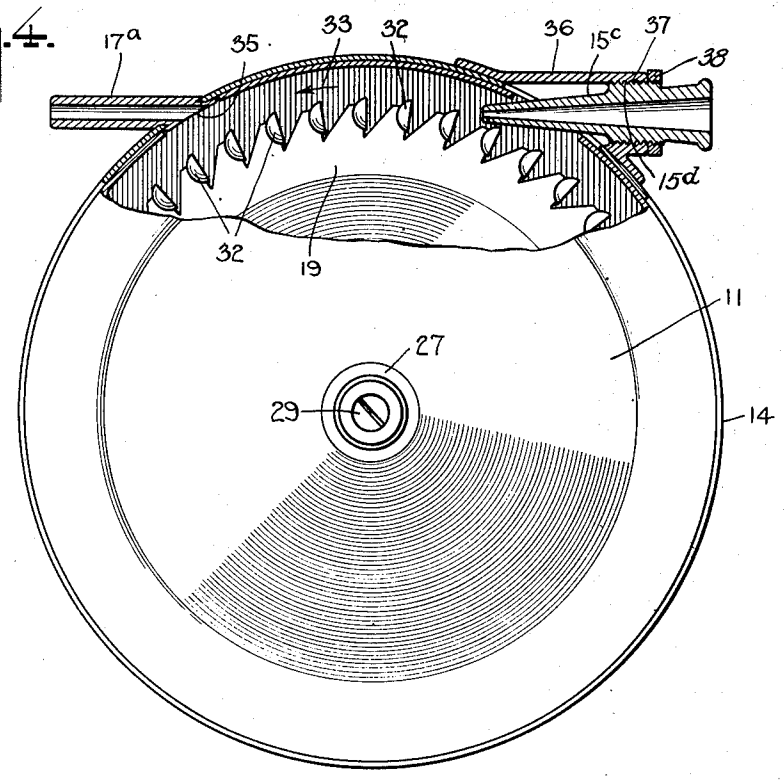


Fig. 4.



INVENTOR
Edward S. Cornell, Jr.
By Henry J. Lucke,
HIS ATTORNEY

Patented Sept. 12, 1933 1,926,528

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AIR MOTOR

Edward S. Cornell, Jr., Larchmont, N. Y., assignor to American Radiator Company, New York, N. Y., a corporation of New Jersey

Application July 21, 1932. Serial No. 623,697

5 Claims. (Cl. 253—50)

The invention relates to improved air motors.

The present invention is an improvement on my invention set forth in my co-pending application entitled Suction-driven prime mover, Serial No. 555,030, filed August 4th, 1931.

A feature of the invention is an assembly of a rotor provided with a plurality of air-actuated elements, preferably uniformly spaced from one another, a rotor casing in which the rotor is rotatably mounted and enclosed, the casing being provided with intake and discharge orifices respectively communicating with the substantially cylindrical interior of the rotor casing, the intake and discharge orifices being spaced from one another and respectively positioned relative to the path of travel of the air-actuated rotor elements whereby the rotor is efficiently operated at relatively low range of sub-atmospheric pressure differentials.

The spacing between the intake and discharge orifices is less than one hundred and eighty angular degrees, and preferably less than ninety angular degrees, but greater than the spacing between any two succeeding air-actuated elements of the rotor.

Preferably, each air-actuated element has a concave trailing face, to be more effectually actuated by the flow of air in the zone within the substantially cylindrical interior of the rotor casing between the inlet and the discharge orifices. Also, preferably, each air-actuated element is provided with a convex leading face to thereby minimize the resistance of such face in its forward travel in the rotor casing, and to minimize the creation of disturbing or retarding eddy currents.

Preferably, the air-actuated elements of the rotor are mounted at the circular periphery of the body per se of the rotor, the extent of radial projection of each air-actuated element being less than the radial extent of the body per se of the rotor.

Also, preferably, the trailing and leading faces of each air-actuated element are substantially normal to a plane passing substantially through the body per se of the rotor, which plane is also substantially normal to the axis of rotation of the rotor.

Preferably, also, the axis of the intake orifice is substantially tangential or parallel to a tangent to the cylindrical periphery of the body per se of the rotor, and also substantially normal to the trailing face of each air-actuated element at a stage in its path of rotation in the zone between the intake orifice and the discharge orifice.

To increase the efficiency of the rotor, particularly for ranges of sub-atmospheric pressure differential operation, each air-actuated element is cut away at a peripheral portion intersecting a line passing through the axis of the intake orifice at a stage when the element enters an effective portion of the zone between the intake and the discharge orifices.

Further features and objects of the invention will be more fully understood from the following detail description and the accompanying drawings, in which

Fig. 1 is a side elevation, partly broken away at a side face of the rotor casing; and

Fig. 2 is a sectional elevational view taken on line 2—2 of Fig. 1;

Fig. 3 is a top plan view of Fig. 1, partly broken away in horizontal section, adjacent the zone of greatest influence; and

Fig. 4 is a side elevation, partly broken away at the top in vertical section, illustrating another embodiment of the invention.

Referring to the drawings, showing one preferred form of my pressure differential motor, the casing 10 may be of any suitable form. As illustrated, the casing comprises a front member 11 and a rear member 12, the front and rear members being generally cylindrical in shape, the cylindrical flange 13 of the front member 11 making a tight fit within the cylindrical flange 14 of the rear member 12, and when assembled provide a motor casing having a substantially cylindrical interior. The material of the casing is substantially imperforate, excepting for the intake and discharge means.

Any suitable form of intake orifice may be used. As illustrated, the intake orifice 15 is a single orifice and of tube or nozzle, that is, convergingly tapering formation, a portion 16 of the cylindrical flange 13 being cut away as indicated, and perforated to permit the intake nozzle 15 to be inserted therethrough and to have its outer end firmly secured to the outer edges of the cut-away portion 16. The axis of the intake nozzle 15 is preferably substantially perpendicular to a diameter of the rotor casing 10, and is operatively related to the air-actuated elements of the rotor, as appears more fully hereinafter.

The discharge orifice 17 may be of any suitable formation to provide communication with the interior of the rotor casing 10 at a location at or adjacent the periphery of its cylindrical contour. As illustrated, the discharge orifice is in the form of a tube or nozzle, which is suitably secured in the discharge orifice of the rotor casing.

A pipe 18 or equivalent serves to connect the discharge orifice 17 with any suitable means for effecting differential pressure.

As is more fully disclosed in my co-pending application Serial No. 555,030, filed August 4th, 1931, and entitled Suction-driven prime mover, and, also, in my co-pending application Serial No. 606,878, filed April 22, 1932, and entitled Auto heating system, I contemplate the actuation of my sub-atmospheric motor by connection of the discharge orifice either directly or indirectly with the intake manifold of an internal combustion motor, which motor may serve as the driving power for a self-propelled vehicle.

In lieu of operation of my air-actuated motor by pressure differential induced by an internal combustion motor, I may employ any other suitable means for effecting pressure differential, such as a vacuum system, exhausting pump or equivalent.

My motor is particularly applicable for sub-atmospheric pressure differential, that is, for ranges of pressure below the pressure of the atmospheric air.

My air-actuated motor may be employed in combination with a heating unit supplied with heat from an internal combustion motor of a self-propelled vehicle, the air-actuated motor serving to drive a fan or equivalent means for forcing air relative to the heating unit.

My air-actuated motor is also applicable for use with heating units such as radiators of a central heating system, the assembly of an air-actuated motor and fan being individual for each radiator unit of such system; or my invention may be applied with a fan or equivalent to a single radiator in a single unit heating arrangement.

The rotor of my air-actuated motor may be of any suitable form. As illustrated, the rotor comprises a body member 19 shown in the form of a disc, which, if desired, may be dished at its center. The body member 19 is provided with an aperture 20 for receiving the rotor shaft 21, the inner end of the shaft 21 being suitably secured to the rotor body 19, as by means of a flange hub 22, or equivalent.

The rotor shaft 21 is rotatably mounted in any suitable manner. As illustrated, the shaft 21 is mounted in oilless bearing comprising the bearing tube 23, supported by and secured in a central opening 24 of the rear casing member 12, the bearings 25, 26 being of self-lubricating material.

Also, as illustrated, a thrust bearing may be provided for the rotor shaft 21, namely, by the boss 27 supported by and secured in the central opening 28 in the front casing member 11, the boss being interiorly threaded to receive a screw 29, the pointed end 30 of which bears against a ball bearing 31 positioned within a suitable recess in the front end of the rotor shaft 21. The bearing provided by the set screw 29 has its axis arranged substantially in alignment with the axis of the rotor shaft 21.

The rotor has any suitable form of air-actuated elements, which are preferably uniformly spaced from one another. As illustrated, the air-actuated elements are disposed successively in co-extensive relation radially, at the periphery of the rotor body 19. Preferably, each air-actuated element 32 is of cup formation, the concavity of the cup serving as its trailing face and its convexity serving as its leading face, the rotor being driven by the pressure differential in the direction of the indicated arrow 33, see Fig. 1, as appears more fully hereinafter.

The elements 32 may be individually secured to the rotor body 19, or formed by blanking and forming operations integrally with the material of the rotor body.

To enhance the drive of the rotor, it is desirable, as illustrated, to cut away, see 34 Fig. 2, the upper edge of each element 32, to thereby reduce the resistance by the fluid flow from the inlet upon the elements 32 as they are successively brought into the region of greatest influence and to increase the torque exerted upon the elements 32 upon attaining the region of greatest influence.

The location of the discharge orifice 17 may be selected as desired, either through the opening in a lateral side of the casing, as illustrated in Figs. 1 and 2, and also in Fig. 3, or in the circumferential side of the casing as illustrated in Fig. 4, or otherwise.

The construction illustrated in Fig. 3, conforms generally to that of Figs. 1 and 2, and like parts are designated by like reference characters. A particular feature of the construction illustrated in Fig. 3 is the provision of an inlet constructed to preclude the creation of whistling or like sound or noise, arising from the inflow of the air or other fluid through the inlet. As one means of minimizing and precluding whistling or other disturbing vibration, the nozzle 15*a*, see Fig. 3, is cut away adjacent its inner orifice, as is indicated at 15*b*, that is to say, cut away at the portion of the inlet in the region of proximity of the buckets or other elements 32 as the same approach the region of greatest influence, and preferably, as illustrated in Figs. 1 and 3, on the side of the nozzle which is remote from the path of the buckets.

Whistling and other sound or noise is also minimized by providing a clearance between the inner orifice of the inlet and the periphery of the buckets or other elements 32 brought into adjacent relation with the inner orifice of the inlet. Such clearance is advantageously effected by the provision of the cut-away portions of the radially outward edges of the rotor elements, referred to more particularly herein. Also, as appears, the cut-away portions of the radially outward edges of the rotor elements enable the rotor to be mounted to locate the rotor elements in substantially immediate adjacency relative to the inlet as the rotor elements successively approach the inlet in their transit toward and through the zone of greatest influence.

In the embodiment shown in Fig. 4, the general relationship of the parts is largely similar to that appearing in the above described figures and like parts are designated by like reference characters. In this construction, the discharge orifice 17*a* is disposed to communicate with the interior of the rotor housing through an opening 35 in the peripheral members, i. e., cylindrical members 13, 14 of the housing, whereby the path of flow of air or other fluid ensues substantially rectilinearly relative to the path of the fluid through the inlet and in transit over the path of greatest influence.

Fig. 4 also illustrates the nozzle 15*c* as adjustably mounted relative to the rotor housing, as by means of the cylindrical housing 36 which is provided with threading 37, and the threading 15*d* for the nozzle 15*c*, whereby as appears, the clearance between the inner end of the nozzle relative to the path of travel of the buckets is regulated. The washer 38 serves to lock the nozzle 15*c* in its adjusted position.

It is desirable, under certain circumstances to

preclude "drumming" or other audible vibration of the housing walls, which is effected by lining the inner faces of the housing walls with felt, paper, or equivalent material, 40, as indicated in Fig. 2, in whole or in part; audible vibration of the housing walls may also be precluded by forming ribbing or other bends of the material of the wall, either alone or in conjunction with the vibration damping material 40.

From the above, it appears that my invention provides for a differential pressure motor having a housing which is otherwise substantially imperforate excepting for its inlet and discharge, the inlet and discharge being related to one another less than one hundred and eighty arcuate degrees and greater than the spacing between any two consecutive fluid actuated elements.

My invention also provides for fluid actuated elements, preferably having concave trailing faces, the center of each trailing face being substantially in alignment with the axis of the inlet when the element passes through the zone of greatest influence.

Pursuant to my invention, each cup-like element is preferably provided with a convex leading face, to thereby minimize the resistance of each face in its actuated movement.

In certain preferred forms of my invention, the fluid actuated elements are disposed adjacent the periphery and at one side of a substantially disk rotor member. Under certain conditions, it is advantageous to also dispose the discharge to communicate with the interior of the housing on the side of the rotor at which the fluid actuated elements are disposed.

It is advantageous to form the housing to provide for a substantially annular casing portion through which the fluid actuated elements pass. The mounting of the discharge to communicate with the casing within such annular interior portion thereof, effects an increased efficiency.

From the results attained in the commercial uses of my invention, I am of the belief that the cutting-away of the inlet at the side of the inlet remote from the path of travel of the rotor elements, particularly of the convergingly tapered type, the zone of greatest influence of the actuating air flow between the inlet and the discharge, is enlarged in cross-sectional area and the tendency of creation of eddy currents within the zone of greatest influence is minimized. Based upon the results attained in commercial uses of my invention, I am also of the belief that the tendency of creation of eddy currents within the interior of the casing other than the zone of greatest influence is also minimized by cutting-away the inlet at its side remote from the path of the travel of the rotor elements.

Whereas I have described my invention by specific reference to various forms thereof, it will be understood that many changes and modifications may be made without departing from the spirit of the invention.

I claim:

1. A differential pressure motor comprising a housing provided with an inlet and a discharge, the walls of the housing being otherwise substantially imperforate, a substantially flat cylindrical rotor rotatively mounted within the housing, a series of rotor elements mounted substantially uniformly adjacent the periphery of the rotor, said series of rotor elements extending about a complete periphery, each rotor element having a convex leading face and a concave trailing face, the mean effective area of its trailing face being disposed substantially normal to the plane of the rotor, the inlet and discharge being spaced from one another relative to the periphery of the rotor less than one hundred and eighty angular degrees, the inlet and the discharge being related to one another and to the periphery of the rotor so that the plane passing through the axis of the inlet and the axis of the discharge and also tangent to the rotor is substantially normal to the mean effective area of the trailing face of each rotor element as it passes through the zone between the inlet and the discharge, means for rotatively mounting the rotor within the casing, and means for minimizing the tendency of creation of eddy currents, said minimizing means comprising a cut-away portion of the inlet on its side opposite to the path of travel of the rotor elements.

2. A differential pressure motor comprising a housing provided with an inlet and a discharge, the walls of the housing being otherwise substantially imperforate, a substantially flat cylindrical rotor rotatively mounted within the housing, a series of rotor elements mounted substantially uniformly adjacent the periphery of the rotor, said series of rotor elements extending about a complete periphery, each rotor element having a convex leading face and a concave trailing face, the mean effective area of its trailing face being disposed substantially normal to the plane of the rotor, the inlet and discharge being spaced from one another relative to the periphery of the rotor less than one hundred and eighty angular degrees, the inlet and the discharge being related to one another and to the periphery of the rotor so that the plane passing through the axis of the inlet and the axis of the discharge and also tangent to the rotor is substantially normal to the mean effective area of the trailing face of each rotor element as it passes through the zone between the inlet and the discharge, means for rotatively mounting said rotor to position the radially outward edges of the rotor elements in immediate adjacency to the inlet as the rotor elements successively approach the inlet, said rotative mounting means including cut-away portions at the radially outward edges of the rotor elements, and means for minimizing the tendency of creation of eddy currents, said minimizing means comprising a cut-away portion of the inlet on its side opposite to the path of travel of the rotor elements.

3. A differential pressure motor comprising a housing provided with an inlet and discharge, the walls of the housing being otherwise substantially imperforate, a substantially flat cylindrical rotor rotatively mounted within the housing, a series of rotor elements mounted substantially uniformly adjacent the periphery of the rotor, said series of rotor elements extending about a complete periphery, each rotor element having a convex leading face and a concave trailing face, the mean effective area of its trailing face being disposed substantially normal to the plane of the rotor, the inlet and discharge being spaced from one another relative to the periphery of the rotor less than one hundred and eighty angular degrees, the inlet and the discharge being related to one another and to the periphery of the rotor so that the plane passing through the axis of the inlet and the axis of the discharge and also tangent to the rotor is substantially normal to the mean effective area of the trailing face of each rotor element as it passes through the zone between the inlet and the discharge,

means for rotatively mounting the rotor within the casing, and means for minimizing whistling effect in the operation of the movable parts of the motor, said minimizing means including clearances between the inlet and the radially outward edges of the rotor elements and a cut-away portion of the inlet at its side opposite to the path of travel of the rotor elements.

4. A differential pressure motor comprising a housing provided with an inlet and a discharge, the walls of the housing being otherwise substantially imperforate, a substantially cylindrical rotor rotatively mounted within the housing, a series of rotor elements mounted substantially uniformly adjacent the periphery of the rotor, said series of rotor elements extending about a complete periphery, each rotor element having a convex leading face and a concave trailing face, the mean effective area of its trailing face being disposed substantially normal to the plane of the rotor, the inlet and discharge being spaced from one another relative to the periphery of the rotor less than one hundred and eighty angular degrees, the inlet being convergently tapering, the inlet and the discharge being related to one another and to the periphery of the rotor so that the plane passing through the axis of the inlet and the axis of the discharge and also tangent to the rotor is substantially normal to the mean effective area of the trailing face of each rotor element as it passes through the zone between the inlet and the discharge, means for rotatively mounting the rotor within the casing, and means for minimizing whistling effect in the operation of the movable parts of the motor, said minimizing means including cut-away portion of the convergently tapered inlet on its side opposite the path of travel of the rotor elements.

5. A differential pressure motor comprising a housing provided with an inlet and a discharge, the walls of the housing being otherwise substantially imperforate, a substantially cylindrical rotor rotatively mounted within the housing, a series of rotor elements mounted substantially uniformly adjacent the periphery of the rotor, said series of rotor elements extending about a complete periphery, each rotor element having a convex leading face and a concave trailing face, the mean effective area of its trailing face being disposed substantially normal to the plane of the rotor, the inlet and discharge being spaced from one another relative to the periphery of the rotor less than one hundred and eighty angular degrees, the inlet being convergingly tapering, the inlet and the discharge being related to one another and to the periphery of the rotor so that the plane passing through the axis of the inlet and the axis of the discharge and also tangent to the rotor is substantially normal to the mean effective area of the trailing face of each rotor element as it passes through the zone between the inlet and the discharge, means for rotatively mounting the rotor within the casing, and means for minimizing whistling effect in the operation of the movable parts of the motor, said minimizing means including cut-away portion of the convergingly tapered inlet on its side opposite the path of travel of the rotor elements and further including cut-away portions at the radially outward edges of the rotor elements.

EDWARD S. CORNELL, JR.