

Dec. 6, 1960

G. M. MAGARIAN

2,962,748

TURBINE DRIVEN SWEEPER ATTACHMENTS FOR VACUUM CLEANERS

Original Filed Sept. 17, 1956

5 Sheets-Sheet 1

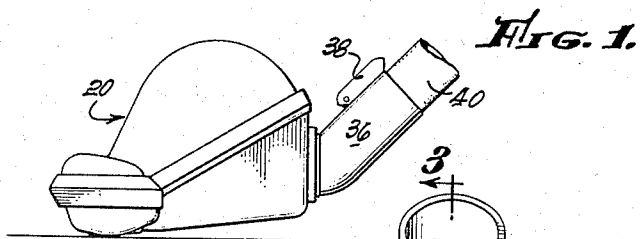


FIG. 1.

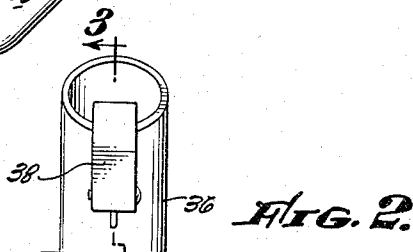


FIG. 2.

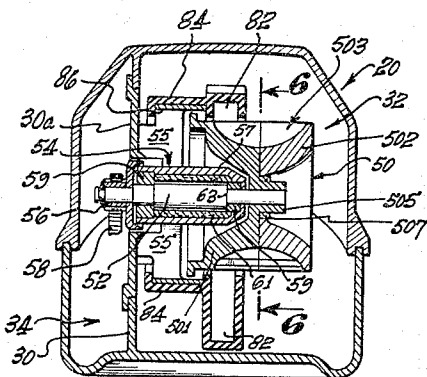
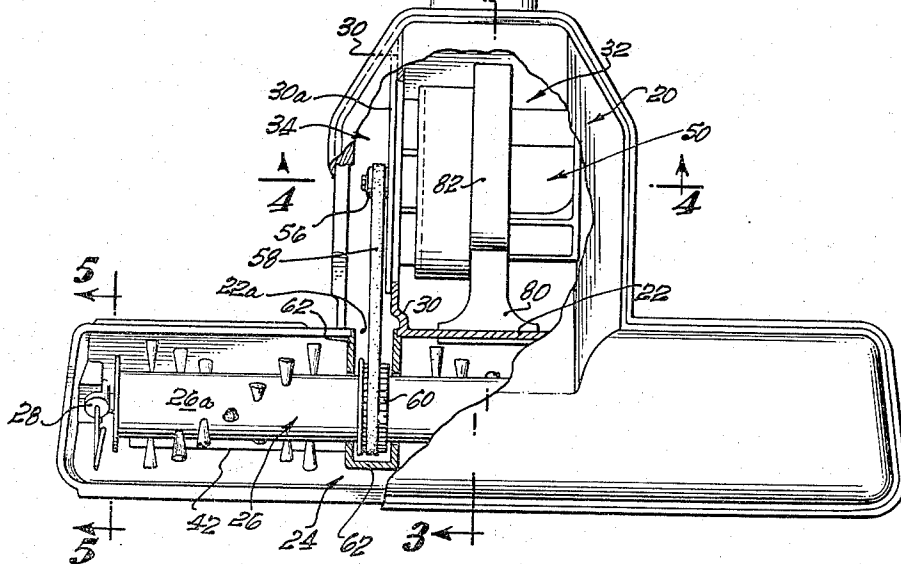


FIG. 4.

GERALD M. MAGARIAN,
INVENTOR.

By *Paul Lewis*

Dec. 6, 1960

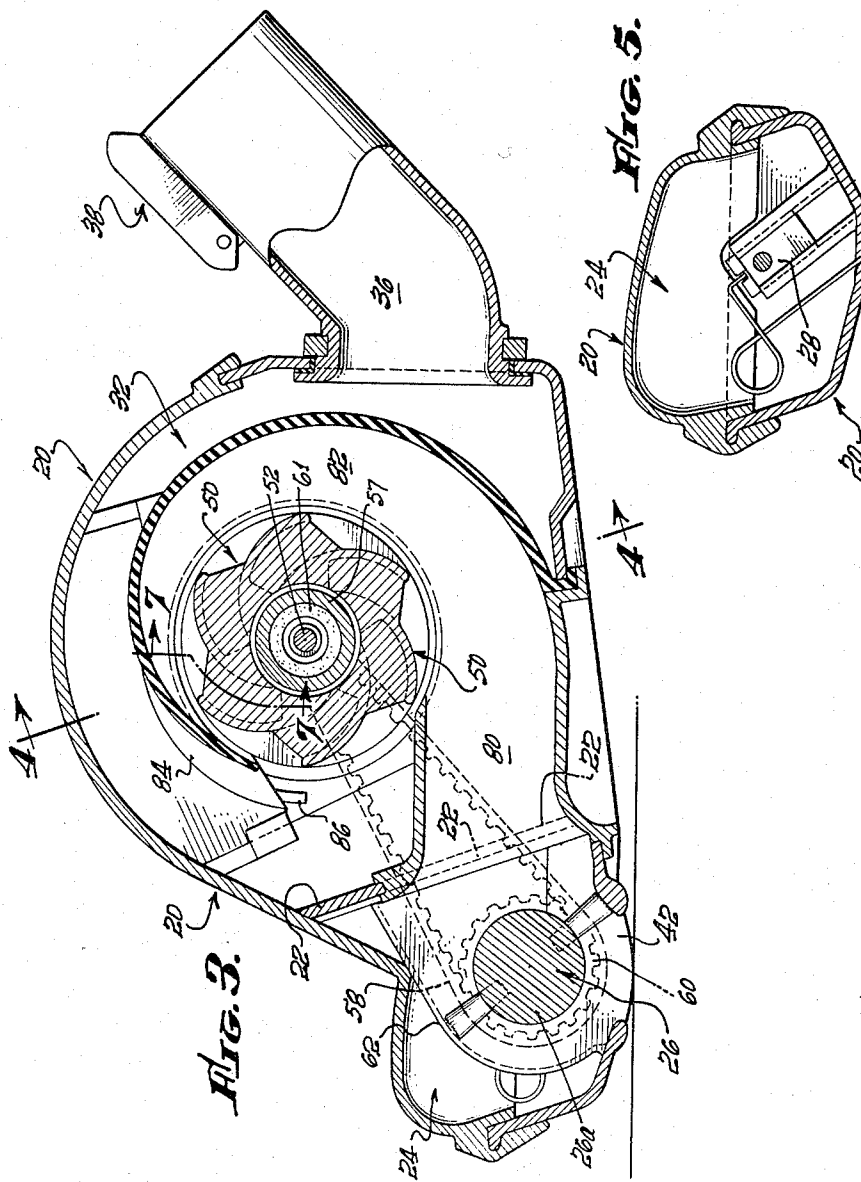
G. M. MAGARIAN

2,962,748

TURBINE DRIVEN SWEEPER ATTACHMENTS FOR VACUUM CLEANERS

Original Filed Sept. 17, 1956

5 Sheets-Sheet 2



GERALD M. MAGARIAN,

INVENTOR.

By *Buckley & Lewis*

Dec. 6, 1960

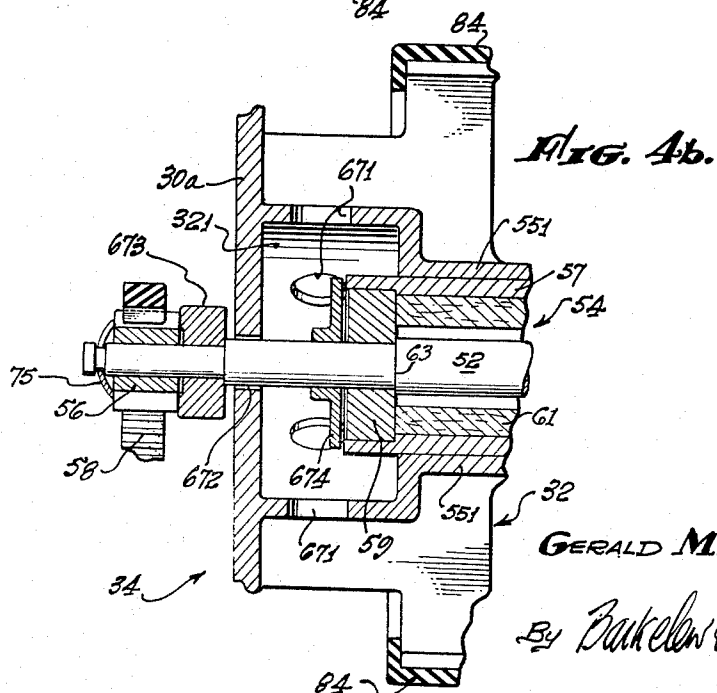
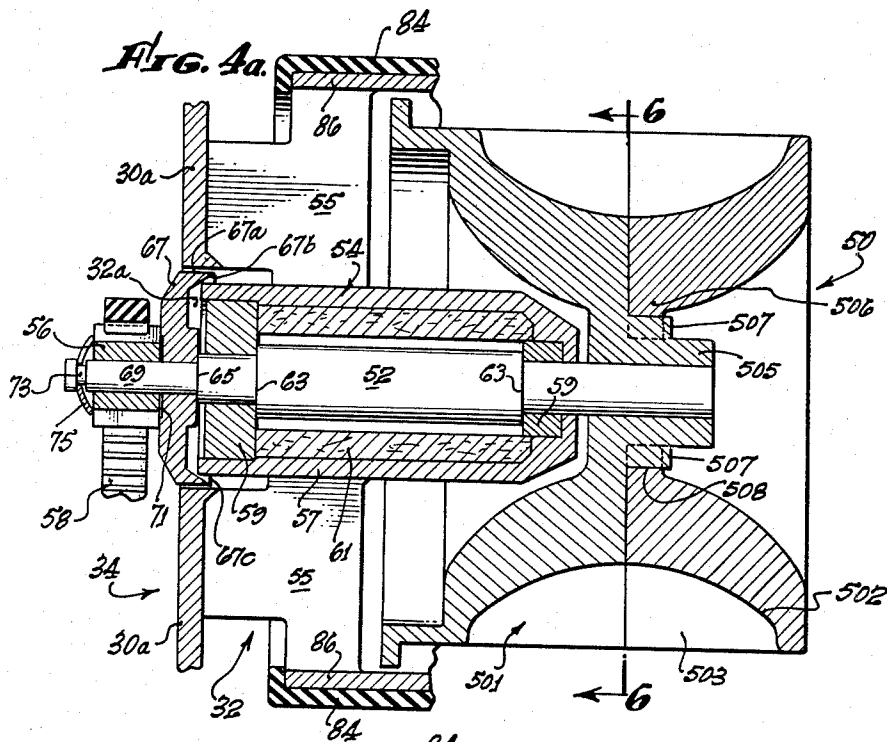
G. M. MAGARIAN

2,962,748

TURBINE DRIVEN SWEEPER ATTACHMENTS FOR VACUUM CLEANERS

Original Filed Sept. 17, 1956

5 Sheets-Sheet 3



GERALD M. MAGARIAN,
INVENTOR.

By *Barkley & Lewis*

Dec. 6, 1960

G. M. MAGARIAN

2,962,748

TURBINE DRIVEN SWEEPER ATTACHMENTS FOR VACUUM CLEANERS

Original Filed Sept. 17, 1956

5 Sheets-Sheet 4

FIG. 6.

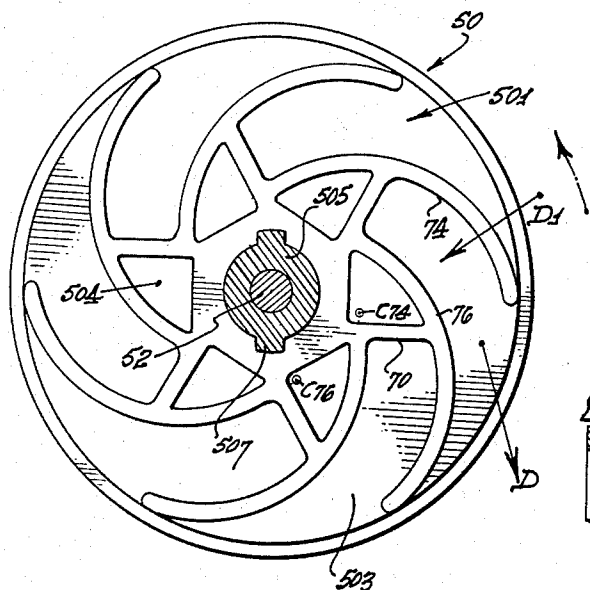


FIG. 7.

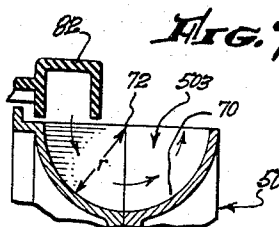
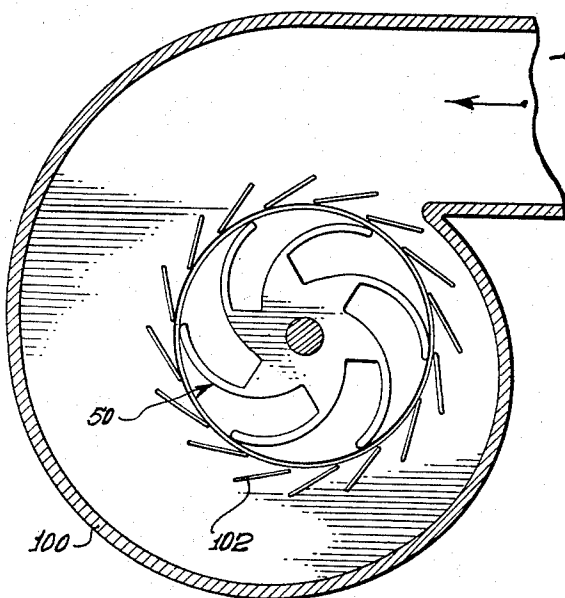


FIG. 8.



GERALD M. MAGARIAN,
INVENTOR.

By *Barkley & Lewis*

Dec. 6, 1960

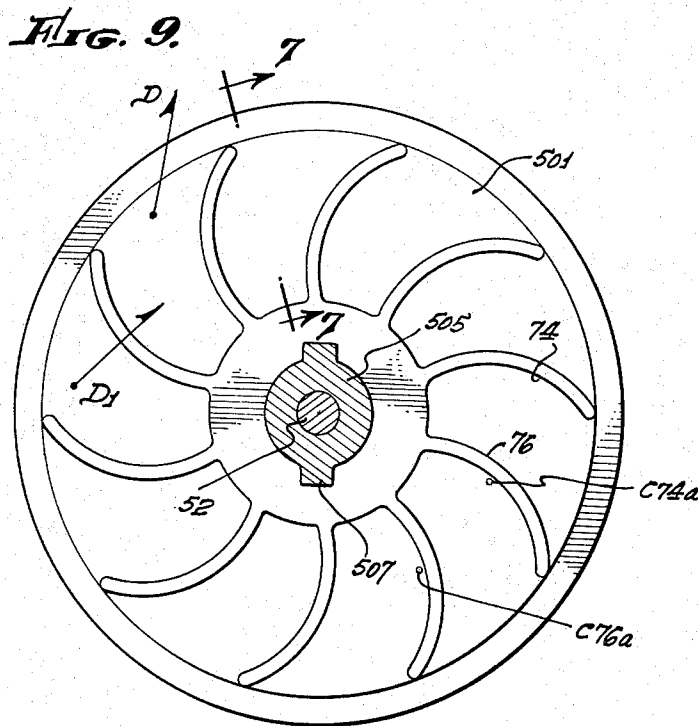
G. M. MAGARIAN

2,962,748

TURBINE DRIVEN SWEEPER ATTACHMENTS FOR VACUUM CLEANERS

Original Filed Sept. 17, 1956

5 Sheets-Sheet 5



GERALD M. MAGARIAN,
INVENTOR.

By *Barkden & Lewis*

1

2,962,748

TURBINE DRIVEN SWEEPER ATTACHMENTS FOR VACUUM CLEANERS

Gerald M. Magarian, Long Beach, Calif., assignor to
Preco Incorporated, Los Angeles, Calif., a corporation
of California

Original application Sept. 17, 1956, Ser. No. 610,285.
Divided and this application July 5, 1957, Ser. No.
670,079

6 Claims. (Cl. 15—387)

This application is a division of my co-pending application Ser. No. 610,285, filed September 17, 1956, entitled Turbine Mechanism, More Particularly for Air Flow Operation For Vacuum Cleaning.

In said application there is set forth, among other things, a turbine mechanism design adapted particularly for high efficiency in producing the mechanical power for operating a rotary brush, the turbine being driven by the vacuum-produced air flow that is drawn in through the cleaner nozzle. As set forth there, it is necessary among other things that the reduction in air flow caused by the turbine be as small as possible, that the turbine be dirt-proof and as efficient as possible, and that the power transmission between the turbine and the brush be initially, and maintained in operation, as free as possible from frictional and other losses. The amount of power available in such a system is so small that to achieve any practical results the over-all efficiency must be high and the power losses reduced to the minimum. The subject matter of this divisional application comprises the novel features involved in the power transmission from turbine to brush to make that transmission as efficient as possible, to reduce its losses to a minimum; and to maintain the transmission system, under the conditions of its use, at high efficiency and minimum losses. And, in that connection, one of the features resides in the protection of journal bearings and other parts from the frictional losses and wear caused by contamination by the dirt and dust necessarily carried on the air current.

The accompanying drawings illustrate a present preferred embodiment of the invention as a vacuum-cleaner nozzle attachment for driving a rug brush of the roller type. In those drawings:

Fig. 1 is a side elevation of the attachment, shown connected to the usual vacuum-cleaner wand that serves as a manipulating handle and as the conduit applying the vacuum to the attachment;

Fig. 2 is a partially broken away plan of the apparatus of Fig. 1;

Fig. 3 is a section on line 3—3 of Fig. 2;

Fig. 4 is a section on lines 4—4 of Figs. 2 and 3;

Fig. 4a is an enlargement of a portion of Fig. 4;

Fig. 4b, similar to Fig. 4a, shows a modification;

Fig. 5 is a detail section on line 5—5 of Fig. 2;

Fig. 6 is a detail section on lines 6—6 of Figs. 4 and 4a;

Fig. 7 is a detail schematic section on lines 7—7 of Figs. 3 and 9 showing the air flow in the turbine bucket;

Fig. 8 shows a variant; and

Fig. 9 is a view similar to Fig. 6 showing another bucket conformation.

As shown in these drawings a casing, generally designated 20, encloses the mechanism of the attachment. The specific details of the casing structure are of no particular moment here, except for the features here mentioned. A wall or partition 22 divides the interior of the casing into two main chambers; an elongate brush chamber 24 which contains the rotary brush 26 journaled

2

at each end in bearings 28, and another chamber which is divided by a partition wall 30 into a relatively large turbine chamber 32 and a smaller belt chamber 34. Outlet fitting 36 communicates with turbine chamber 32 and is provided with a clamping device 38 for snugly clamping it around the end of section wand 40. The casing of brush chamber 24 has an elongate nozzle opening 42 on its lower side; this opening allowing the brush to rotatively contact and brush a rug or other surface and forming the suction nozzle through which the air flow from the rug, or other surface, is drawn into the brush chamber 24. That chamber 24 communicates with turbine chamber 32 in the manner hereinafter explained.

The turbine wheel element 50, preferably formed of two die-cast halves as shown in Figs. 4 and 4a force fitted together, is mounted, preferably also by force fitting, on one end of turbine shaft 52 journaled in a bearing structure 54 which is mounted by brackets 55 on a plate 30a that forms a part of partition wall 30. That end of the shaft, and turbine 50, are in turbine chamber 32. The other end of shaft 52 projects into belt chamber 34 and there carries a belt wheel 56, preferably of the cogged or lugged type. An internally lugged belt 58 drivingly engages that wheel and an annular cogged wheel 60 mounted on the drum 26a of brush 26, the ratio of the belt drive as here shown being about three to one. The belt extends through an opening 22a in division wall 22. A belt guard 62 is mounted on wall 22 around opening 22a and extends around brush drum 26a to protect the belt and wheel 60 from dust and debris in the brush chamber.

Bearing structure 54, as here shown, comprises an outer tubular body 57, supported by brackets 55 on plate 30a, and carrying the bearing bushings 59 and an oil soaked wicking 61. Shaft shoulders at 63 prevent endwise displacement of the shaft. The end of shaft 52 that projects into belt chamber 34 is shouldered at 65 and a disk-shaped member 67 is force-fitted on the reduced end portion 69 against that shoulder. Cog-wheel 56 is freely fitted on 69 and frictionally bears at one end against disk 67. The disk is recessed at 71 to restrict the frictional bearing surface to an annular face at or near the periphery of the wheel, so that the frictional torque under a given longitudinal pressure is reasonably well calculable and will remain substantially uniform as wear occurs.

At the outer end of wheel 56, shaft end 69 is annularly grooved, as shown at 73 (Fig. 4a), and a spring clip 75 is sprung into the groove to resiliently bear against 56 and hold that wheel frictionally between itself and disk 67. The spring clip used here is a well known standard product and needs no particular description.

The described structure forms a very simple, reliable and inexpensive frictional drive for wheel 56, and brush 26, from the turbine. The frictional drive is so calculated and designed as to slip in event the brush jams on the edge of a rug, a hair pin, etc. The slippage then prevents the injury to the belt that sudden stoppage would otherwise cause.

One structure of turbine wheel 50 is shown best in Figs. 4, 4a and 6. As there shown the wheel is composed of two halves 501 and 502 parted on the central plane designated 6—6. Each part contains its half of each of the buckets 503 and, in the form of Fig. 6, is cored out, as indicated at 504 in Fig. 6 to reduce weight and metal cost. Part 501 has a hub sleeve 505 projecting from the face 6—6. That hub sleeve fits tightly on shaft 52, and a central part 506 of part 502 is force fitted over 505. The hub sleeve carries two integral keys 507 which fit in complementary key-ways 508 in 506. Keys 507 project through and beyond the part 506 of the half 502 and are peened over to hold the halves

securely assembled. Keys 507 align the two halves so that their bucket halves are properly aligned.

Illustrative and presently preferred designs of turbine element 50 and its buckets are best shown in Figs. 6, 7 and 9. In the aspect of Fig. 7 the curved bottom wall 70 of each bucket is shown as substantially semi-circular with center located at 72 at the periphery of the turbine wheel. In the aspects of Figs. 6 and 9—that is, in a plane transverse of the axis—each bucket is seen to be curved in shape, both back wall 74 and front wall 76 being curved with their concavities facing in the same direction. In the specific designs here shown these curves are circular, with centers as indicated at C74 and C76 in Fig. 6, and at C74a and C76a in Fig. 9. For matters of definition, let it be stated that each bucket opening at the wheel periphery faces in the tangential direction indicated for one bucket at D in Figs. 6 and 9. The curvature concavity of the bucket—the concavities of its two walls—face in the general tangential direction indicated as D1 in Figs. 6 and 9. To define the relations of the bucket openings and the bucket curvatures it may therefore be said that the bucket openings, and the curvature concavities of the buckets, face in the same direction about the axis of the wheel.

It will be noted that the curvatures of the bucket walls in Fig. 6 are such that the walls are substantially equidistant throughout the depth of the bucket—the bucket does not materially decrease in width toward its bottom. In the form of Fig. 9 the buckets decrease in width toward the bottom, though not enough to interfere with the flow through the buckets. The form of Fig. 9 is particularly resistant to fouling by particularly adherent types of dirt, because its bucket walls are more nearly radial than in the form of Fig. 6.

The distinctive feature of the present turbine design is the curvature of the buckets in a plane normal to the axis. In a turbine wheel of any given diameter, that curvature of the buckets makes it possible to make the buckets much deeper—to make the radius r much larger—than can be had with a straight, uncurved, bucket of the type generally known as the Terry type. In general, and particularly on small sized wheels, that increase in depth (bucket diameter) makes for several distinct advantages; particularly in a vacuum cleaner application.

In the present design, air flow is directed to the turbine wheel by a conduit in the form of a channel-shaped scroll. The large end portion 80 of the conduit communicates through wall 22 with brush chamber 24, as best shown in Fig. 3. The portion 82 of the conduit which surrounds the turbine is channel shaped with the flange edges of the channel formation closely surrounding the wheel periphery as shown in Figs. 3 and 4. The channel portion is of uniform width but tapers in size (in radial depth) as it extends around the wheel from 80, and, as shown here, it preferably surrounds only about three-quarters of the wheel periphery. Although efficiency is increased by completely surrounding the turbine with a conduit, the short unsurrounded portion is preferred in a system handling dirt, etc. as it allows the wheel to throw off matter which might otherwise adhere or accumulate in the conduit.

The conduit scroll is preferably made of such material, and/or so mounted, that its end may spring away from the wheel to allow escape of large objects, such as buttons, etc. As here shown the conduit scroll is preferably formed of a medium-hardness rubber-like material, such as a flexible vinyl, or similar material. As shown in Figs. 4 and 4a it is positioned by being mounted, via an integral flange 84, on a mounting ring 86 which is carried by mounting plate 30a.

Reference to Figs. 4, 4a and 7 shows the width of the conduit relative to the axial length of the turbine wheel and the bucket diameter. In the aspect of Fig. 7, the bottom wall of the bucket is semicircular. Fig. 7 particularly shows the relation of the conduit and its width

to the bucket diameter, showing also the air flow path through the bucket. The turbine wheel is, as the drawings show, located wholly in chamber 32. The air flow from the wheel consequently goes directly into that chamber and from it to the suction outlet fitting 36.

For setting up an efficient flow path through the bucket the width of the inflow conduit must be substantially less than half the bucket diameter, preferably not more than about one-third. Some actual dimensions and other data on an actual mechanism constructed in accordance with the drawings here will demonstrate the outstanding achievements of the invention. The actual size of the successful mechanism may be scaled from the drawings by considering that the diameter of the turbine wheel 50 is two inches.

It has been found from experience that the width of the inflow conduit and of scroll 82 should be as much as three-eighths inch, as shown in Fig. 7, in order freely to pass larger objects picked up in vacuum cleaning. With relation to that width it was desired to have a bucket diameter of about 1½ inches to maintain a good air path through the buckets. By curving the buckets as shown in the drawings it was found practicable to have buckets of that depth and diameter in a wheel two inches in diameter. The general results are a turbine that is small in size, compact, light, cheap and mechanically rugged. The performance efficiency of the turbine installation shown in the drawings and of the size stated, is forty percent as compared with 20% to 30% of other turbines in comparable uses.

In operation, the pressure in turbine chamber 32 is of course lower than that in the brush chamber and that in belt chamber 34 which more or less openly communicates with the brush chamber. To prevent that difference in pressure from drawing dirt laden air through the bearing structure 54 and causing frictional losses and undue bearing wear, that structure is located in chamber 32, and any leakage between chambers takes place around shaft 52 where it passes through wall 30a. In the particular design shown in Fig. 4a, the leakage through wall 30a around shaft 52 occurs at the small clearance 67a around disk 67. That small clearance opens directly into turbine chamber 32. Preferably the diameter of disk 67 is greater than that of bearing housing 57, and a rim 67b overhangs the end of 57; so that the leakage stream is delivered past the bearing end. Clearance at 67c between disk 67 and the bearing allows the pressure in chamber 32 to also be present in space 32a at the left hand end of the bearing, thus applying the same pressure to both bearing ends. Seeing that the clearance at 67a does not communicate with space 32a and there is no air flow through that space, the clearance at 67c can be, and is, quite small so as to exclude dirt from the bearing at that end.

Fig. 4b shows a variation which also protects the bearing by applying the pressure of chamber 32 to both its ends. Here, for instance, the bearing structure 54 is shown as carried in a tubular support 551 that projects from wall 30a into chamber 32. The left hand bearing end is spaced from that wall; and the space 321 at the bearing end is open to chamber 32 through large openings, such as shown at 671, in tubular support 551. The small leakage which passes through the small clearance at 672 where shaft 52 passes through wall 30a then does not materially modify the pressure in 321; space 321 is in full effect a part of chamber 32 as far as pressure is concerned. In Fig. 4b a disk 674 on the shaft close to the bearing end keeps dirt out of the bearing. In this connection it may be noted that, at the other end of the bearing (see Figs. 4 and 4a) the hub of turbine part 501 does the same thing at the right-hand bearing end.

In the modification of Fig. 4b friction disk 673 is shown located beyond wall 30a, shaft 52 itself passing through wall 30a. Fundamentally, the friction disk 67 of Fig. 4a may be regarded as a part of shaft 52, the

leakage taking place around that part. As compared with the showing in Fig. 4b, disk 67 of Fig. 4a has the additional function of locating and directing the leakage around and past the end of the bearing structure, rather than directly opposite the bearing end as in Fig. 4b.

In both forms of Figs. 4a and 4b, the disk 67 or 673 has the function of throwing dirt, hair, lint, etc. off by centrifugal action in the belt chamber. In Fig. 4a the outer (left-hand) face of disk 67 is to the left of dividing wall 30a, and so throws off dirt, etc. in the belt chamber. In Fig. 4b the disk 673 is located completely in the belt chamber and is considerably larger in diameter than the bore 672 where the shaft passes through dividing wall 30a. Consequently it most effectively throws off the dirt, etc. and prevents it from reaching the clearance at 672 and in Fig. 4b the disk 674 similarly throws off the dirt, etc., at a radius larger than the shaft journal, into the turbine chamber.

For use in a flow of clean fluid turbine efficiency may be further increased by directing the fluid input to the turbine around its complete periphery. Fig. 8 is a schematic showing of such an arrangement. There 100 may represent a conduit equipped with directional vanes 102 completely surrounding the turbine (of the same proportionate width and relative location in an axial direction as above discussed), and forming the fluid input.

As stated before, the subject matter of this divisional application has to do with the power transmission from the turbine to the brush.

The cogged belt drive between the turbine shaft and the brush, and the fact that the axes of those two elements are parallel, eliminating any necessity of twist in the belt, have much to do with high efficiency of the drive. The cogged belt requires no tension, in contradistinction to an ordinary belt drive and consequently puts no undue pressures on the bearings. It is also not subject to the slippage losses inherent in friction drives such as V-belt or elastic belt; and is highly immune to wear and efficiency losses due to adhering dirt and dust.

And the protection of the turbine shaft journals from the frictional effects, and wear, due to contamination with dust and dirt, is of major importance in maintaining high efficiency, and small losses, in the power transmission. The passage of shaft 52 through partition wall 30a with free clearance completely eliminates any power absorbing friction at that passage. The air leak which is thus allowed through the clearance is quite small, as compared with the air flow from the brush chamber through the turbine chamber, the passages at 80 and 36 being much larger than the clearance at 67a or 672. The shaft clearances are so small that the leakage is inconsequential.

I claim:

1. In a vacuum cleaning device of the character described, which comprises in combination a casing with an internal division wall dividing the interior of the casing into two chambers, a nozzle opening in the bottom wall of one chamber, a rotative member mounted in said one chamber above the nozzle opening, wall structure including a partition wall dividing the other chamber into a transmission chamber and a motor-wheel chamber, said transmission chamber communicating with the nozzled chamber, a motor-wheel shaft extending through an opening formed in said partition wall with one end projecting into the transmission chamber and the other into the motor-wheel chamber, journal means for the shaft supported on said wall structure, connective driving means in the transmission chamber between the shaft end in the transmission chamber and said rotative member, an air driven motor wheel mounted on the shaft end in the motor wheel chamber, an input conduit having an intake end communicating with the nozzled chamber and

having a portion peripherally surrounding a peripheral portion of the motor wheel, and a suction outlet leading from said motor-wheel chamber; the improvement which comprises the location of the shaft journal means entirely within the motor-wheel chamber, the shaft extending with free clearance through the opening in said partition wall, together with means which diverts around the journal means the fluid stream that leaks through the partition wall around the shaft, said clearance forming an air passage which is small compared with the air passage of said input conduit.

2. The improvement defined in claim 1, and in which the diverting means includes a disk, of diameter larger than the diameter of the journal means, set on the shaft and having a peripheral portion overhanging the journal means.

3. The improvement defined in claim 1, and in which the diverting means comprises the spacing of the journal means from the partition wall, the space between said journal means and partition wall being freely open to the interior of the motor-wheel chamber.

4. The improvement defined in claim 3, and including also a deflective disk set on the shaft in said space close to the journal means.

5. In a vacuum cleaning device of the character described, which comprises in combination a casing with an internal division wall dividing the interior of the casing into two chambers, a nozzle opening in the bottom wall of one chamber, a rotative member mounted in said one chamber above the nozzle opening, wall structure including a partition wall dividing the other chamber into a transmission chamber and a motor-wheel chamber, said transmission chamber communicating with the nozzled chamber, motor-wheel shaft extending through an opening formed in said partition wall with one end projecting into the transmission chamber and the other into the motor-wheel chamber, journal means for the shaft supported on said wall structure, connective driving means between the shaft end in the transmission chamber and said rotative member, an air driven motor wheel mounted on the shaft end in the motor-wheel chamber, an input conduit having an intake end communicating with the nozzled chamber and having a portion peripherally surrounding a peripheral portion of the motor wheel, and a suction outlet leading from said motor-wheel chamber; the improvement which comprises the location of the shaft journal means entirely within the motor-wheel chamber, the shaft extending with free clearance through the opening in said partition wall, together with a disk rotatively set on the shaft within the transmission chamber close to the partition wall, said disk being larger in diameter than the opening in the partition wall through which the shaft passes.

6. The improvement defined in claim 5, and including also a disk rotatively set on the shaft within the motor-wheel chamber close to the adjacent end of the bearing means.

References Cited in the file of this patent

UNITED STATES PATENTS

1,145,516	Schmid-Roost	July 6, 1915
1,309,093	Hoover	July 8, 1919
1,788,992	Ecabert	Jan. 13, 1931
1,999,696	Kitto	Apr. 30, 1935
2,168,899	Dow	Aug. 8, 1939
2,287,922	White	June 30, 1942
2,345,623	Oaks	Apr. 4, 1944
2,730,750	La Briere	Jan. 17, 1956
2,754,161	Bouvat-Martin	July 10, 1956
2,800,759	Emmons	July 30, 1957