April 23, 1957 N. A. KATH 2,789,306

VACUUM CLEANER ATTACHMENT

Filed May 26, 1954

FIG. 1

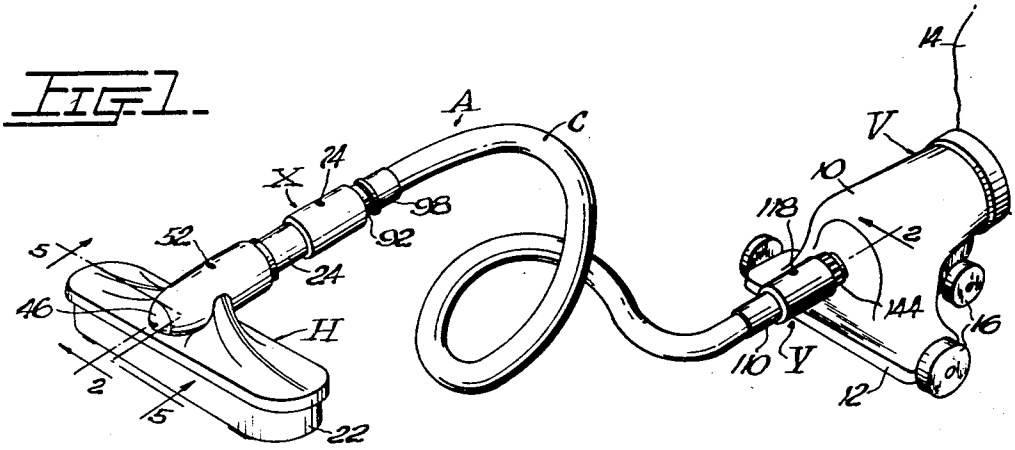
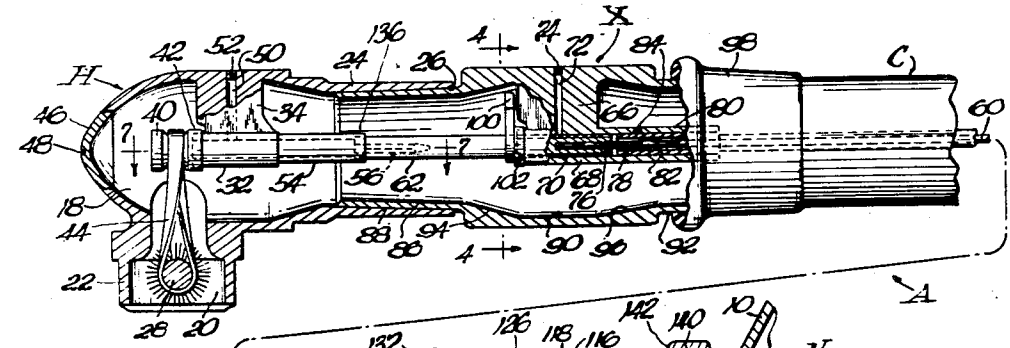


FIG. 2



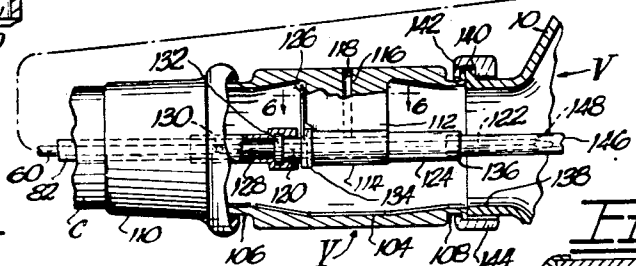


FIG. 5

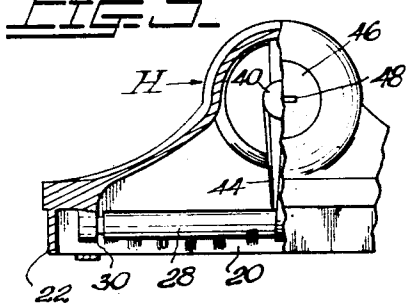


FIG. 6

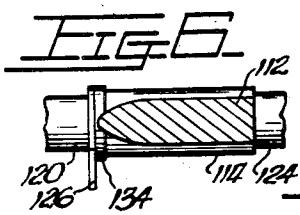
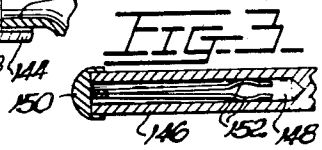


FIG. 3



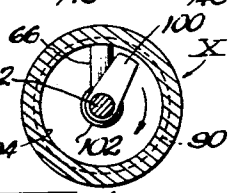
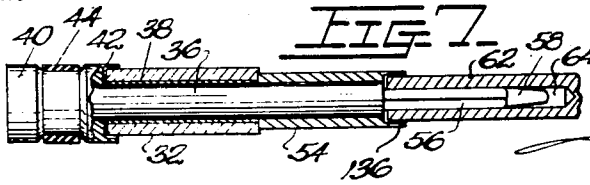


FIG. 4

FIG. 7



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VACUUM CLEANER ATTACHMENT

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4 Claims. (Cl. 15—339)

This invention relates to an attachment for a vacuum cleaner and has for a primary object the provision of an attachment in which a rotary or otherwise drivable cleaning element is power-driven from the motor or power source of the basic vacuum cleaner unit.

As is well known, vacuum cleaners are of a few basic types. One type will include a base unit having an electric motor and a housing provided with a relatively large suction port that is used primarily for cleaning horizontal surfaces, such as rugs, carpets, floors, etc. In the so-called tank type, the bsic unit does not itself include means for cleaning horizontal surfaces but has a suction port to which a floor-cleaning element is connectible as one of many attachments. In both types of cleaners, there are several attachments for various purposes, such as for cleaning walls, Venetian blinds, furniture, etc. The same general characterization exists as to industrial cleaners and even those connected to a central source of vacuum as in hotels, for example. In all of these cleaners, efficiency, such as it is, of the attachment depends solely on vacuum or suction and no successful commercial embodiment of an attachment having a rotary or otherwise drivable cleaning element is known.

Previous attempts have been made to design attachments having power-driven cleaning elements in association with the intake or suction port but these have in the main proven unsuccessful, primarily because of the failure of earlier designers to solve the problem of transmitting drive from the basic vacuum cleaner to the drivable element in the attachment head. According to the present invention, this problem is simply and efficiently solved by the provision of a coaxial flexible drive shaft having telescopic connections at opposite ends respectively to the vacuum cleaner power shaft and to the drivable element in the attachment head. It is an important object of the invention to provide an improved attachment head and conduit therefor including one or more couplings, each of which has a novel bearing support. Another object of the invention is to utilize, in a conduit of the flexible type capable of axial shortening and lengthening, an internal coaxial drive shaft connected between bearings at opposite ends of the conduit in such manner that the conduit itself is retained against axial extension; as a matter of fact, the installation of the shaft is such as to place the conduit in slight axial compression. This eliminates rubbing of the coaxial drive shaft against the inner wall surfaces of the conduit. A further object of the invention is to utilize a flexible drive shaft including a non-rotatable casing or housing. The invention features also the provision of an improved coupling which is enlarged in cross section to compensate for the area used up by the bearing and its support. In this respect, the invention has for a further feature the utilization with the radial support for the bearing of a rotatable arm that operates substantially in shearing relationship to the radial support so as to disintegrate large particles, such as cigaret butts, passing through the conduit. The radial shear member is preferably made yieldable so that it may yield in the event that it encounters an object of substantial resistance, such as a paper clip, bobby pin, etc. The internal characteristics of the coupling and its associated parts involve airfoil principles to eliminate obstructions to the passage of air and air-

entrained dirt through the conduit. Other objects of the invention are the achievement of economy and simplicity; the use of couplings both at the basic cleaner unit and at the attachment head; the utilization as far as possible of conventional components so that the attachment may be readily interchanged with a large variety of cleaners and other attachments; and the achievement of light weight so that the attachment may be readily used by the average housewife as well as by personnel in service stations, hotels, etc.

The foregoing and other important objects and desirable features inherent in and encompassed by the invention will become apparent as a preferred embodiment of the invention is disclosed in detail in the following specification and accompanying sheet of drawings, the several figures of which will be described immediately below.

Fig. 1 is a perspective view showing a preferred embodiment of the attachment in association with one type of basic vacuum cleaner.

Fig. 2 is a sectional view, on an enlarged scale, and with intermediate portions omitted, as seen substantially along the line 2—2 of Fig. 1.

Fig. 3 is an enlarged sectional view showing one means of temporarily closing the driving socket in the vacuum cleaner power shaft when the shaft and attachment are not used.

Fig. 4 is a transverse sectional view on the line 4—4 of Fig. 2.

Fig. 5 is a fragmentary sectional view, drawn to the scale of Fig. 2, as seen along the line 5—5 of Fig. 1.

Fig. 6 is an enlarged fragmentary sectional view as seen along the line 6—6 of Fig. 2.

Fig. 7 is an enlarged fragmentary sectional view as seen along the line 7—7 of Fig. 2.

Fig. 1 best illustrates the over-all arrangement, wherein the letter V designates generally a vacuum cleaner of one conventional type which has a motor housing 10, a floor-cleaning portion 12 and a conventional cleaner bag 14, the unit being supported on small wheels 16, as is customary, to achieve portability.

The attachment is designated generally by the letter A and comprises a hollow cleaning head H, a conduit C and couplings X and Y for coupling opposite first and second ends of the conduit respectively to the head and to the vacuum cleaner V. The conduit C is predominantly flexible but the couplings X and Y are relatively rigid to afford support for internal drive means, as will presently appear.

The head H, being hollow, has an internal chamber 18 to which leads an intake opening 20, which opening is defined by an elongated marginal portion 22 transverse to the longitudinal axis of a tubular part 24 which has an open rear end 26 communicating with the interior chamber 18. The head, as well as the couplings X and Y, may be of any suitable molded or cast construction, and it is immaterial, for patent purposes, whether it is metal or non-metal. Preferably, the marginal intake portion 22 and the tubular part 24 are molded or cast integrally with the body part of the head H.

Associated with the head is a drivable cleaning element, here in the form of an elongated rotary brush 28 journaled at its opposite ends respectively in bearings within the head, only one of which bearings is visible at 30 in Fig. 5, it being understood that the construction at the opposite end is the same. A bearing 32 is mounted within the chamber 18, coaxially with the tubular part 24 and is mounted or positioned by means of a single radial support 34 preferably molded or cast integrally with the structure of the head H. The details of the bearing are shown in Fig. 7. This bearing journals a

longitudinally coaxial driven shaft 36. Journaling may be accomplished in any suitable manner, as by an oil-impregnated bearing 38; although, it will be obvious that roller bearings or even ball bearings may be used if desired. However, the oil-impregnated type lends itself to the construction because of its relatively small size.

The shaft 36 includes a forward or driving portion in the form of a sheave or pulley 40 having formed integrally therewith an annular flange 42 that establishes a dust cap over the forward end of the bearing 36. The sheave 40, as best seen in Fig. 2, is in vertical alinement with but has its axis transverse to the axis of the rotary brush 28. Driving means interconnects the sheave 40 and the brush 28, such driving means here taking the form of a crossed belt 44. The forward portion or nose of the head H has a coaxial removable cap 46 threaded into the head and removable, as by means of a screwdriver slot 48, to provide access to the sheave and belt. The radial support 34 for the bearing 32 may be drilled at 50 to establish an oil hole for lubrication of the bearing, which oil hole is normally closed by a removable threaded plug 52.

The sheave 40 prevents axial displacement of the shaft 36 in a rearward direction and forward axial displacement of the shaft is prevented by a sleeve 54 that encircles the shaft 36 just behind the bearing 38. The shaft includes a rearward coaxial extension that forms a driven or input portion 56, and this portion is of square cross section and has a tapered rear end 58 to facilitate coaxial or telescopic connection to and disconnection from a flexible drive shaft 60 that extends coaxially through the conduit C. Figs. 2 and 7 illustrate that the drive shaft 60 has a forward end portion 62 that has an axial socket therein for telescopically receiving the male or driven portion 56 of the head shaft 36.

The coupling X is of tubular construction and its rigid wall has interiorly thereof a radial support 66 which bridges radially between the inner periphery of the coupling wall and the shaft 60 and which mounts an integral coaxial bearing 68. Within this bearing is an oil-impregnated bushing 70, but again any other type of bearing or bushing could be used. An oil hole or lubricating passage 72, normally closed by a threaded plug 74 received in the associated apertured wall of the coupling X, extends radially through the support 66 to the bushing or bearing 70. The shaft 62 includes a rearwardly opening coaxial socket 76 within which is soldered, brazed, crimped or otherwise secured the forward end 78 of the drive shaft 60, the arrangement being such that the shaft 60 and shaft 62 are rotatable in unison. The bearing 68 has an integral rearward coaxial extension 80 which receives a coaxial casing or housing 82 that surrounds the shaft 60. A set screw 84 represents one form of means for securing the forward portion of the housing 82 within the bearing sleeve extension 80, thus securing the housing 82 against rotation. As will be seen, the cross-sectional area of the housing 82 is materially reduced as compared with the cross-sectional area of the conduit C, thus affording the minimum obstruction to passage of air through the conduit. The shaft 60 is of materially less cross-sectional area, being housed within the casing or housing 82.

Coaxial coupling or connection of the coupling X to the head H is effected by means of a forwardly tapered coaxial extension 86 on the coupling X, which is received within the tubular part 24, said part having an interior taper 88 that corresponds to and receives the tapered extension 86 of the coupling X. Tapered connections of this character are conventional in some types of cleaners and are effective from the standpoint of permitting ready connection and disconnection. All that is required is to fit the parts together and rotate them slightly relative to each other and a suitable air-tight connection is established.

It is one of the features of the invention that the interior of the coupling X is of increased cross-sectional area as compared to the cross-sectional area of the conduit C and the cross-sectional area of the tubular connection at 86—88. One purpose of this enlargement is to compensate for the area used up by the bearing 68 and bearing support 66. Another purpose is to cause a drop in the velocity of the material passing through the conduit, realizing that the bearing and bearing support 66 form some obstruction. By dropping the velocity at this point (Bernoulli effect), accumulation or entanglement of string-like objects in the air stream is minimized. The change in cross section from the smaller cross section 86—88 to the larger cross section at 90 (intermediate the ends of the coupling X) and back to the smaller cross section of a tubular coaxial rearward extension 92 of the coupling X is effected gradually, as by tapered portions at 94 and 96 in the interior of the coupling. The extension 92 of the coupling X is conventionally associated with the forward end of the conduit C to establish a swivel (not shown, because such swivels are well known). A conventional rubber ring 98 is illustrated as establishing an air- and dust-tight seal.

Another feature of the invention is the means for disintegrating or otherwise ridding the coupling X of possible entanglements of air-borne objects that may encounter the bearing support 66. A preferred form of such means comprises an arm 100, constructed of rubber, fiber board, spring wire, etc., and secured to the shaft 62 just ahead of and substantially in shearing relationship to the forward edge of the bearing 66. Combined with the arm 100, or at least fixed to the shaft 62, is a dust cap 102 that embraces the forward end of the bearing 68, the relationship being identical to that shown at 32—42 in Fig. 7. It will be noted that the dust caps all point downstream as respects the air flow. The arm 100 tapers toward its free end so that centrifugal force tends to dislodge wrapping objects.

The coupling Y is very similar to the coupling X but is reversed in several respects. This coupling has an intermediate portion 104 of a cross-sectional area enlarged over the mean cross-sectional area of the conduit C. Integral with the intermediate portion 104 of the coupling are a forward extension 106 and a rearward extension 108. The extension 106 establishes a conventional type of swivel connection with the rear end of the conduit C, a rubber ring 110, identical to the ring 98, being shown as completing the external characteristics of the connection.

The coupling Y mounts in its interior by means of a radial support 112 a coaxial bearing 114 that has many of the attributes of the bearing arrangement in the coupling X. For example, the bearing 114 may contain an internal bushing to which lubricant may be supplied by a radial oil hole 116 normally closed by a removable threaded plug 118.

The rear or second end of the shaft 60 is rigidly united with a shaft sleeve 120 and projects beyond the bearing as a male telescopic connecting portion 122. A second sleeve 124 is secured to the shaft behind the bearing 114 and serves as means to prevent axial displacement of the shaft in a forward direction. A rotating arm 126, very much like the arm 100 although preferably constructed of metal, is carried by the shaft 60 just ahead of the bearing 114 and operates substantially in shearing relationship to the front edge of the bearing support 112. The arm also secures the shaft against axial displacement in a rearward direction. The housing 82 includes an end sleeve 128 secured to the housing as by a set screw 130 and cooperative with a shaft collar 132, which serves as means for connecting the housing against axial displacement. The base of the rotating arm 126 is in the form of a dust cap 134 that effectively seals the front end of the bearing 114 and is of the nature of the dust cap 42 on the sheave 40. A similar dust cap 136 is provided at the rear end of the front shaft sleeve 54 for cooperation with

the forward end of the front flexible shaft extension **62** (Fig. 7).

The airfoil nature of the bearing support **112** is best shown in Fig. 6, it being understood that the cross section of the front bearing support **34**, as well as that of the intermediate bearing support **66**, will be the same.

The enlargement of the cross-sectional area of the coupling Y is the same and is for the same purposes as the enlarged cross-sectional area of the coupling X. Since the two are the same, separate descriptions are not required.

The basic vacuum cleaner unit V has in the front of its housing **10** a suction port **138** (Fig. 2) to which connection is made by the rear end **108** of the coupling Y. In the commercial type of vacuum cleaner unit V, chosen for the purposes of illustration here, the cleaner housing **10** will have around the port **138** a coupling flange **140** which cooperates with a complementary flange **142** on the coupling part **108** for encirclement by an internally cammed ring **144**, the connection being such that the parts **140** and **142** are jutaposed and the ring **144** is given a partial turn in a clockwise direction to secure the flanges **140** and **142** together and thus to connect the conduit C to the housing **10** via the coupling Y. Since the nature of this connection may be varied according to the vacuum cleaner for which the attachment is designed, further detailed description is deemed to be unnecessary.

Also a part of the basic cleaner unit V is a motor or power shaft **146**, axially into the forward end of which is formed a female connecting or socket portion **148**, which is preferably square in cross section to receive the squared rear end **122** of the shaft **60**, thus effecting a telescopic connection that is achieved in unison with the coupling at **140—142—144**. Fig. 3 illustrates how the recess **148** in the power shaft **146** may be closed by a removable cap **150**. This cap has a pair of spring fingers **152** that secure the cap in place and thus prevent the entrance of dirt into the connecting recess or bore **148** when the attachment is not in use.

The conduit C is of a conventional type, constructed of reenforced fabric and rubber material so that in addition to its flexibility transverse to its principal axis when straight, it is also capable of at least slight axial changes in dimension, and is therefore capable of being elongated or shortened. In order to minir ize contact between the internal shaft housing **82** and the inner surface of the conduit C, and further to maintain the housing shaft **62** centrally of the conduit at all times, it is preferred that the conduit be placed in a slight state of axial compression, which compression is maintained by connecting the shaft housing **82** and shaft **60** in such manner between the bearings **68** and **114** that the axial distance between the said bearings is somewhat shorter than the maximum axial distance between the bearings as measured on the conduit were the conduit stretched to its maximum length. The shaft **60** and housing **82** are, of course, of such construction as to be normally incapable of elongation.

From the foregoing description it will be understood that the distance of the head H from the cleaner V may be varied by varying the length of the conduit C. This may be accomplished in several ways, one of which obviously consists in changing the length of the conduit itself. Another system would be to utilize separate conduits, some of which may be in the form of rigid tubular members internally equipped with shaft sections connectible, for example, between the front end of the shaft **62** and the head shaft portion **56**. Since it is conventional practice in vacuum cleaner attachments of well known types to use extension tubes or "wands," the foregoing general characterization of the possibility is deemed to be sufficient disclosure in the present instance.

In the use of the attachment, the advantages flowing from the combination of the rotary element or brush **28** in the intake port or opening **20** of the head H may be readily realized in the cleaning of furniture or the upholstery of automobiles, for example, in service stations

and the like. The swivel connection at **98** enables free use of the attachment, the conduit C being flexible, in a preferred embodiment of the invention, to accommodate various changes in position between the head and the cleaner V. Because of the coaxial mounting of the shaft **60** and its housing **82**, the attachment is of relatively light weight and has no external parts to interfere in any manner with its use. The bearings, in a commercial embodiment, would be of such nature as to require only infrequent lubrication and virtually no maintenance, assuring the attachment of the characteristics of long life, simplicity and economy.

Various other specific features of the preferred embodiment of the invention illustrated, not categorically enumerated herein, will undoubtedly occur to those versed in the art, as will many modifications and alterations in the preferred construction illustrated, all of which may be achieved without departing from the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. An attachment for a vacuum cleaner of the type having a housing including a suction port and a power shaft coaxial with the port, comprising: a hollow cleaning head formed with an intake opening, said head having connected thereto a tubular conduit including a free end provided with coupling means selectively connectible to and disconnectible from the housing coaxially with the port; bearing means mounted coaxially in the said coupling means; a drivable cleaning element carried in the head and cooperative with the intake opening; a drive shaft of materially reduced cross-section as compared to the cross-section of the conduit and extending through the conduit and coupling means, said shaft having one end portion connected to the drivable cleaning element and its other end portion coaxially connectible to and detachable from the power shaft in unison with connection and disconnection of the aforesaid coupling means, said shaft having a portion thereof journaled in said bearing means; said bearing means having a support extending radially from the shaft to the inner periphery of the coupling means, said support having a radial edge facing upstream as respects air flow through the conduit; and radial arm means fixed to the shaft for rotation therewith closely upstream of and substantially in shearing relationship with the radial edge of the support.

2. The invention defined in claim 1, in which: the arm means is constructed at least in part of resilient material so as to be capable of yielding in an axial direction upstream relative to the radial edge of the support.

3. The invention defined in claim 1, in which: the arm is of tapering shape in a radially outward direction to tend to centrifugally dislodge objects encountered thereby.

4. The invention defined in claim 1, in which: the bearing has a cylindrical portion facing upstream generally proximate to the radial edge of the support; and the radial arm means has a hub portion shaped as a cup facing downstream and closely covering said cylindrical portion.

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