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CONCENTRIC MOTOR AND COOLING PULLEY ASSEMBLY FOR ABRADERS AND THE LIKE

Filed May 31, 1963 3 Sheets-Sheet 1

FIG. 1

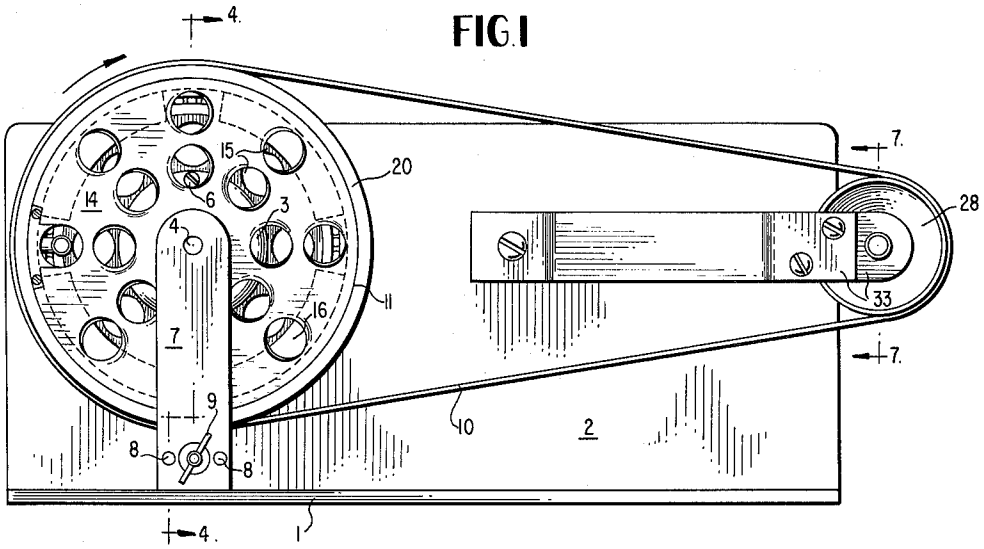


FIG. 2

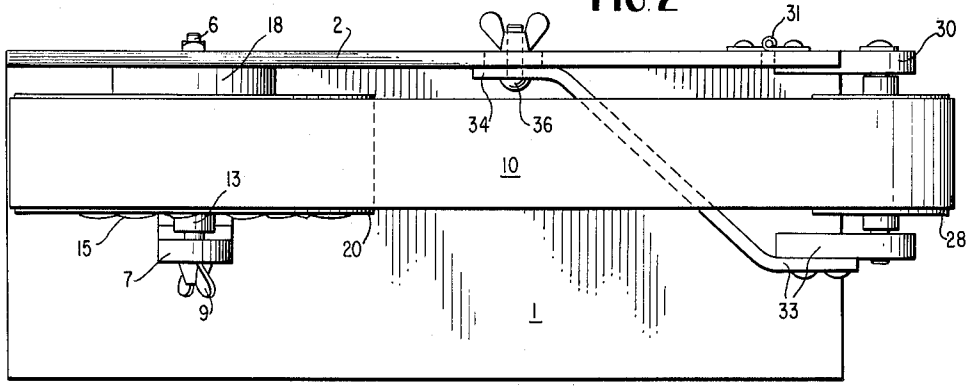
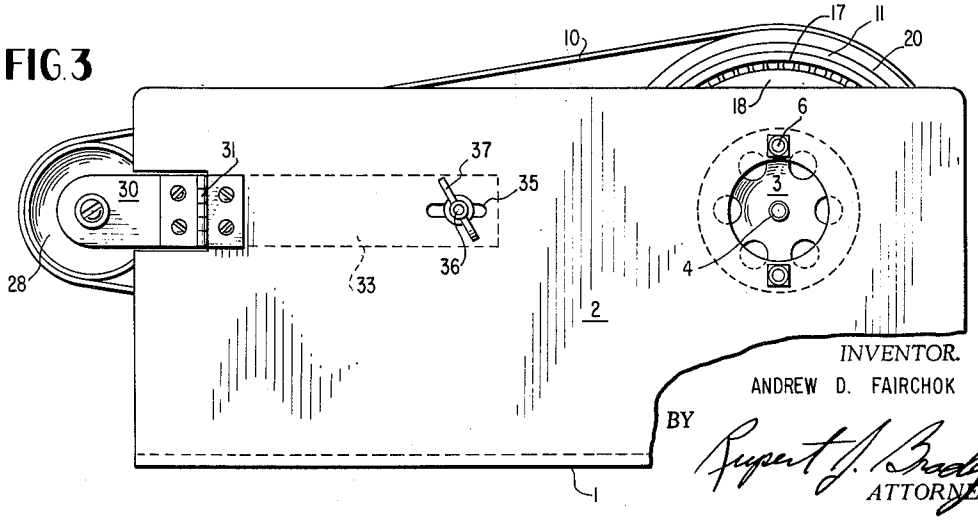


FIG. 3



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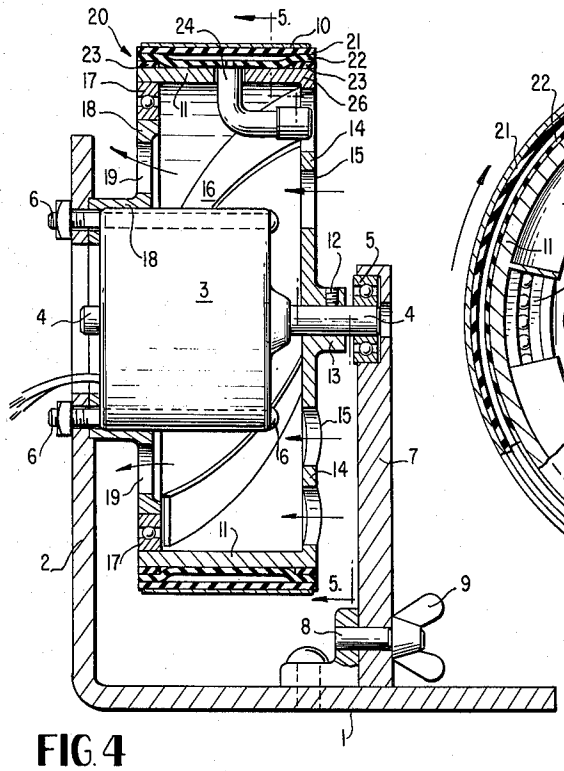

FIG. 4

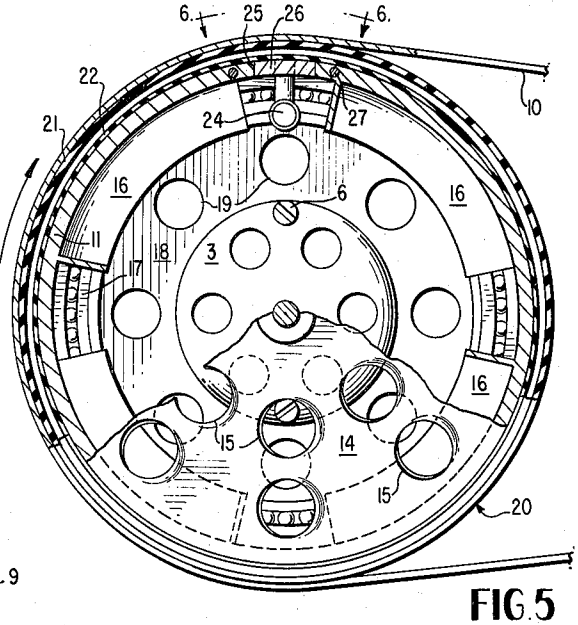

FIG. 5

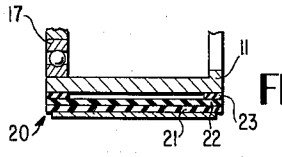

FIG. 4A

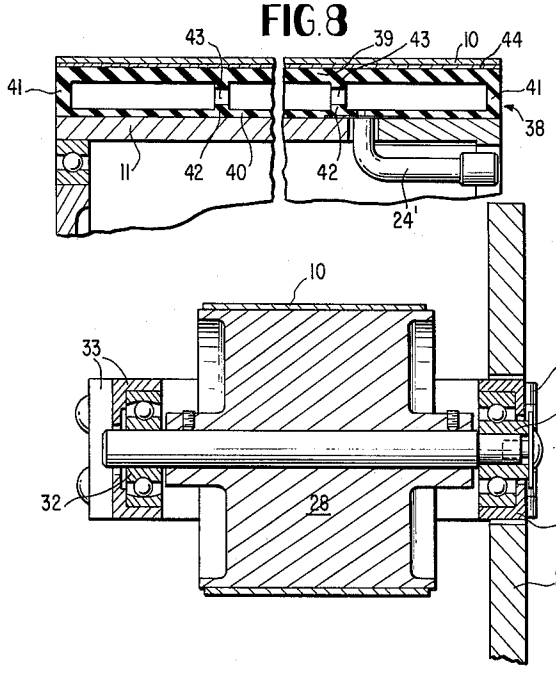

FIG. 8

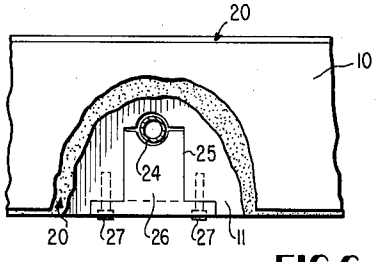

FIG. 6

FIG. 7

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FIG. 9

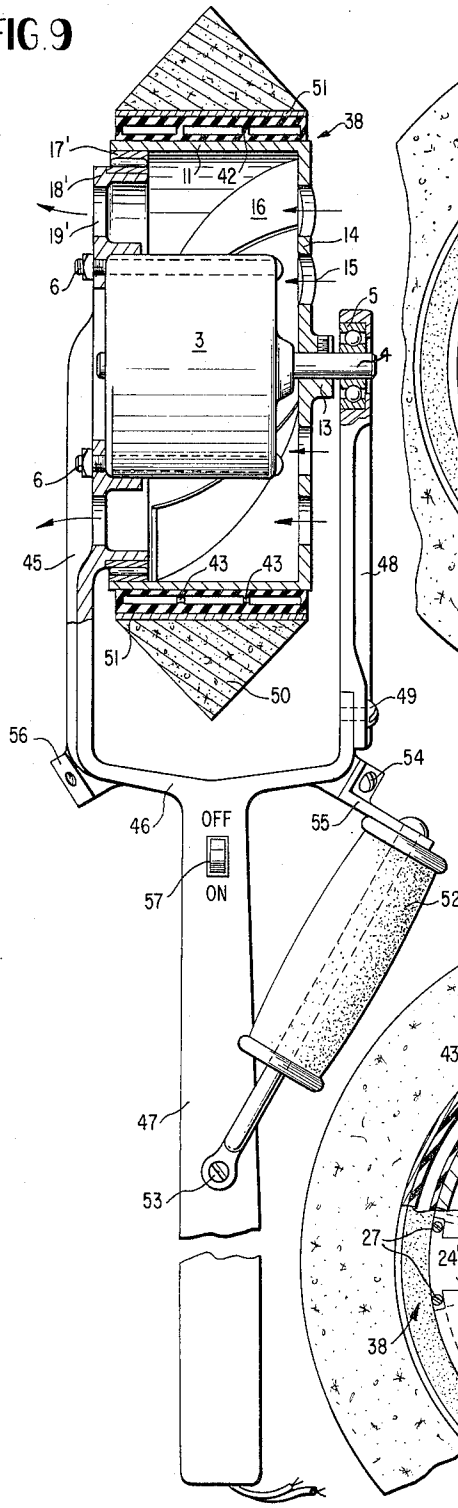


FIG. 10

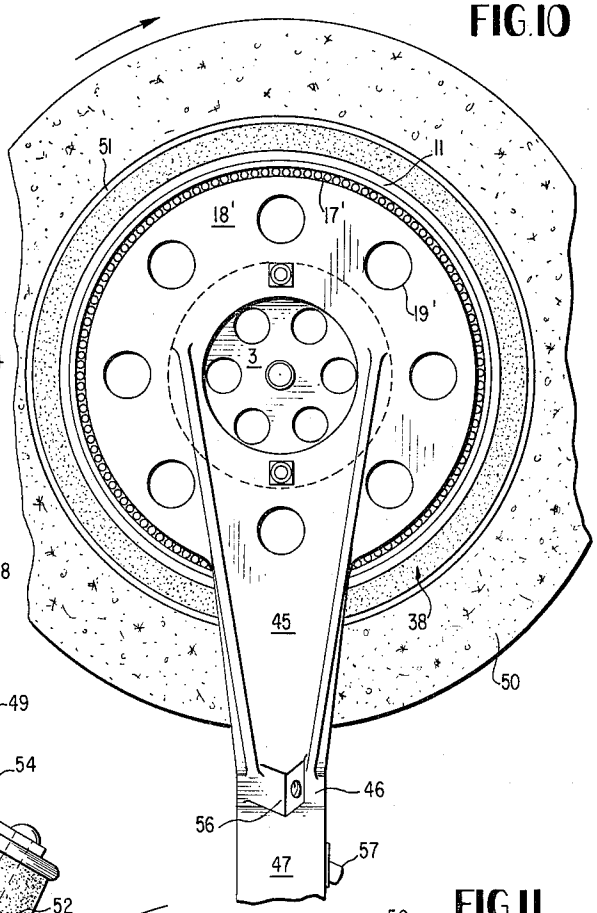
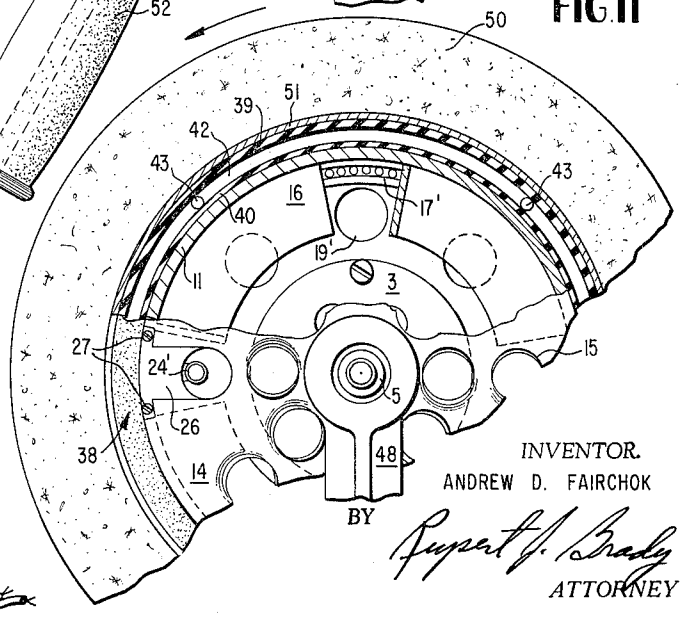


FIG. 11



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Patented Jan. 18, 1966

3,229,424

CONCENTRIC MOTOR AND COOLING PULLEY ASSEMBLY FOR ABRADERS AND THE LIKE

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Filed May 31, 1963, Ser. No. 284,403
11 Claims. (Cl. 51—148)

The invention relates broadly to motor ventilating pulleys, and more particularly to a concentric motor and cooling pulley assembly for drum and belt-type abrader and polishing machines and the like, and a novel means of connecting abrading media to the pulley.

One of the objects of the invention is to provide a construction of a drum or belt-type sanding, sharpening, and polishing machine which is electrically driven by a motor which is continuously cooled by the operation of the driving pulley of the machine.

Another object of the invention is to provide a construction of hollow cylindrical pulley concentrically surrounding a driving motor and wherein the pulley is equipped with inwardly directed fan blades arranged intermediate the pulley and motor to generate a forced flow of air around the driving motor while the pulley is in operation for driving a belt or the like associated with the motor for maintaining the motor at low temperature under conditions of long periods of operation or overloading of the motor.

Another object of the invention is to provide a compact construction for a pulley and its driving motor in which a rotatable cylindrical drum is secured to the motor drive shaft in a position concentrically surrounding and enclosing the motor.

Still another object of the invention is to provide a construction of motor and ventilating pulley assembly which reduces the size of abrading and polishing machines and the like, and insures operation of the motor under conditions of low temperature and prevents collection of dust and grit around the motor casing.

A further object of the invention is to provide a pulley drive construction in which the pulley drive means are enclosed by the pulley so as to eliminate all driving means connected exterior of the pulley.

Still another object of the invention is to provide a novel construction of motor enclosing pulley which is simple in construction, economical to manufacture, and which improves the appearance of sharpening, sanding, grinding, polishing machines, and the like, and which additionally eliminates the safety hazards of external drive gearing.

A further object of the invention is to provide novel means, which are simple in construction and economical to manufacture, for connecting endless loops of abrading media to the external surface of a pulley.

Still a further object of the invention is to provide a construction of inflated sleeve for tightening an endless loop of abrading media about the perimeter of a drive pulley.

Other and further objects of the invention reside in the provision of a novel mechanism for retaining an endless loop or belt of abrading material aligned on two pulleys at high speeds and wherein the belt operates over the surface of an inflated sleeve which is connected about the perimeter of an air-cooled drum or pulley concentrically surrounding a driving motor as set forth more fully in the specification hereinafter following by reference to the accompanying drawings, in which:

FIG. 1 is a front elevational view of an abrader constructed according to the invention;

FIG. 2 is a top plan view of the device of FIG. 1;

FIG. 3 is a fragmentary back elevational view of the

device of FIG. 1 and particularly showing the adjustable mounting of the idler roller;

FIG. 4 is an enlarged cross-sectional view taken substantially along line 4—4 of FIG. 1;

FIG. 4A is a fragmentary cross-sectional view similar to FIG. 4, but showing the inflated sleeve in its deflated position;

FIG. 5 is a longitudinal sectional view, partly in elevation, taken substantially along line 5—5 of FIG. 4 and showing the arrangement of the motor-pulley assembly of the invention and the expandible sleeve connected about the periphery thereof;

FIG. 6 is a fragmentary top elevational view taken along line 6—6 of FIG. 5, with parts broken away to show the manner in which the inflated sleeve is installed on the pulley surface;

FIG. 7 is an enlarged cross-sectional view taken along line 7—7 of FIG. 1 and showing the construction of the idler roller assembly;

FIG. 8 is an enlarged fragmentary cross-sectional view showing a modified form of inflated sleeve for greater drum widths and a sleeve for protecting the same from punctures;

FIG. 9 is a foreshortened front elevational view, partly in cross-section, showing a hand abrader embodying the teachings of the invention;

FIG. 10 is a fragmentary side elevational view of the left side of the device of FIG. 9; and

FIG. 11 is a fragmentary elevational view, partly in cross-section, showing the opposite side of the device of FIG. 9.

The invention is directed to a concentrically constructed motor and rotating pulley assembly particularly adapted for sanding grinding, sharpening and polishing machines in which a belt of abrasive material is stretched between the surface of a cylindrical drum which surrounds the driving motor and an idler roller where the idler roller is adjustably supported relative to the driving motor. The cylindrical drum which surrounds the driving motor is equipped with inwardly extending radially disposed fan blades which terminate in spatial relation to the exterior cylindrical wall of the motor housing and generate a forced axial flow of air over the motor housing as the belt is driven. The cylindrical drum is also provided at one end with radially extending air scoops for assisting in the forced flow of air through the drum and over the motor housing. This continuous forced flow of air in contact with the exterior of the motor housing insures the operation of the motor at relatively low temperature and prevents the accumulation of dust and fine particles released during the abrasive action of the surface of the belt with respect to the work being sanded, polished, etc. The motor housing is supported at one end by means which maintain the motor in a substantially horizontal operating position.

The assembly of the invention is also adaptable to drum sander, floor sander, and hand sander and grinder constructions wherein, in lieu of an abrasive belt stretched between the cylindrical drum and idler roller, only a cylindrical drum is provided with the driving motor positioned concentrically therein and with the cooling means positioned as previously indicated, and a continuous annular abrasive member or sleeve placed on the exterior surface of the drum. With either construction the abrasive material is secured to the cylindrical drum by means of an inflatable sleeve which overlies the surface of the drum and is positioned beneath the abrasive belt or sleeve. When inflated the sleeve expands to tightly secure the abrasive medium to the drum surface. In this way, continuous belts of abrasive material having

no overlaps can be rigidly secured to the surface of a cylindrical drum in a simple manner to eliminate the thump and nonuniform abrading action presently encountered where the slack in the abrasive sleeve or belt is taken up by an overlap or by providing a noncontinuous sleeve or belt having ends anchored in a slot or the like on the surface of the drum.

Referring to the drawings in more detail, reference character **1** designates the stationary support or base structure of the endless belt abrading and polishing machine of the invention shown in FIGS. 1–5. The motor housing **3** is secured at one end to the upstanding support bracket portion **2**, as indicated at **6**, to support the motor in a position elevated over the stationary support **1**. The motor housing **3** includes bearings at each end thereof in which the shaft **4** is journaled. The shaft **4** projects beyond one end of the motor housing **3** as shown more clearly in FIG. 4 and terminates in a slide fit with bearing **5** at the end of the motor housing opposite the bracket **2**. Bearing **5** is rigidly connected to auxiliary support arm **7** which is removably secured at its base to stationary support **1** by means of an arrangement of a pair of aligning pins **8** and a securing wing nut **9**. Support arm **7** serves as an auxiliary support for the motor but must be removed each time the belt or sleeve of abrasive material **10** is replenished as explained more fully hereinafter following.

The projecting end of shaft **4** serves as a means for fastening the cylindrical drum or pulley **11** to the motor rotor. This is accomplished by an Allen or set screw **12** which passes through a bushing **13** on the end of the drum or pulley **11** and secures the drum or pulley firmly to the motor drive shaft **4**. The end wall **14** of the drum or pulley **11** is spaced from the end of the motor housing **3** and the end wall **14** adjacent the bushing **13** is provided with a plurality of outwardly projecting air scoops **15** which serve to generate a forced axial flow of air over the exterior surface of motor housing **3** when the drum or pulley **11** is revolved.

Each of the air scoops **15** comprises an aperture drilled on a bias through the end wall **14** with the curved edge of the aperture extending slightly outwardly so as to draw air into the aperture as the drum is rotated.

The interior wall of the cylindrical drum or pulley **11** is provided with a multiplicity of inwardly projecting radially disposed curved fan blades **16** which terminate in spaced relation to the external surface of motor housing **3**. The drum or pulley **11** is supported on the end opposite end wall **14** by means of a sealed annular bearing **17** on a flange **18** which may be integral with motor housing **3** or a separate member secured to bracket portion **2** with the motor housing as shown in the drawings. Flange **18** is provided with a plurality of exhaust apertures **19** between bearing **17** and motor housing **3** so that air drawn in by air scoops **15** is progressed axially through the assembly between the motor housing and pulley and is exhausted through aperture **19**.

As shown more particularly in FIGS. 4 and 5, an inflatable sleeve **20**, shown in its deflated state in FIG. 4A and its inflated state in FIGS. 4 and 5, is positioned concentrically about the surface of cylindrical drum **11** with the sleeve being substantially coextensive with the width thereof. This member comprises a first continuous sleeve **21** of resilient material, such as rubber, bonded or sealed along its peripheral edges to a second continuous sleeve **22**. Sleeve **22** is of a diameter somewhat less than sleeve **21** and is constructed of a material somewhat more resilient than sleeve **21**. By way of example, sleeve **21** may be constructed of 1500 p.s.i. rubber, preferably reinforced with fabric, while sleeve **22** is constructed of 600 p.s.i. rubber. A pair of annular spacer members **23** of resilient material are connected beneath sleeve **22** adjacent its opposite edges. The structure of the sleeve is completed by a curved valve member **24**, connected to the bottom wall of sleeve **22** to form a passage to the unsealed adjacent surfaces of sleeves **21** and **22**.

Inflated sleeve **20** is installed on the external surface of drum **11** while in its deflated state as shown in FIG. 4 with spacer members **23** engaging the drum surface in rather tight-fit relation. A continuous sleeve of abrasive material, having no overlaps or joints, or an endless belt of abrasive material as shown at **10**, is then slipped over the external surface of the inflatable sleeve and the sleeve is inflated by means of valve **24** to the state as shown in FIGS. 4 and 5 to form an annular cavity between sleeve members **21** and **22**. Since sleeve **22** is more resilient than sleeve **21** it expands more readily and as shown in FIG. 4 its wall moves into alignment with spacer members **23** such that an air cavity is formed at the point originally occupied by this portion of wall **22**. In actual practice a slight crown is formed on the surface of sleeve member **21** due to the increased pressure within the sleeve and this crown tends to hold the abrasive belt or sleeve **10** on the drum even when running at high speeds and prevents the belt from edging off the end of the drum during operation.

The inflatable sleeve **20** is preferably inflated with nitrogen due to its low expansion coefficient under heating conditions and due to its nonflammable properties. This is particularly advantageous when the teachings of the invention are used in large drum sanders, such as the type used by lumber mills for producing finished lumber. The drums of these sanders are usually four to six feet wide and approximately twelve inches or more in diameter and are subject to heating due to their constant abrasive contact with the work. The inflatable sleeve **20** is inflated under low pressure just sufficient to expand the belt or sleeve of abrasive material **10** to snugly secure the same on the surface of the drum. As the sleeve expands it snugly contacts both the under surface of the abrasive belt and the surface of drum **11** and frictional engagement prevents slippage of the abrasive member relative to the drum surface.

The surface of pulley or drum **11** is provided with a slot **25** extending inwardly of one edge to receive valve **24** when the inflatable sleeve **20** is installed on the outer perimeter of the pulley. This allows valve **24** to extend beneath the drum surface and outwardly through one of the air scoop openings **15** so that it is readily available for inflation of the sleeve. After the sleeve is installed on the pulley or drum, a filter member **26** is inserted into slot **25** and is secured in place by means of screws **27** to prevent the bottom wall portion **22** of the sleeve from being squeezed downwardly into the slot when the sleeve is inflated. To remove the sleeve from the surface of the drum filler member **26** is first removed and the sleeve is then disengaged from the drum surface after it has been deflated.

In the endless belt type abrader of the invention, as shown in FIGS. 1–3, the structure of which is adaptable to knife sharpeners, hand-sanders, bench sanders, etc., the portion of the endless belt **10** opposite the cylindrical drum **11** passes over an idler roller **28** whose shaft is journaled at one end in bearing **29** securely connected in plate member **30** which in turn is hingedly connected at **31**, on an axis substantially at right angles to the axis of rotation of roller **28**, to support bracket portion **2**. The opposite end of the shaft of the idler roller **28** is journaled in spherical bearing **32** which is rigidly carried on one end of adjustment arm assembly **33**, which assembly curves inwardly through endless belt **10** and terminates in a lug portion **34** in abutment with support bracket **2**. An elongated slot **35** is provided in support bracket **2** and a bolt **36** securely connected to lug **34** of the arm assembly passes through this slot with the arm secured in position therein by means of wing nut **37**.

By loosening the wing nut **37**, arm assembly **33** can be adjusted back and forth as desired in slot **35**, causing the shaft of idler roller **28** to pivot slightly in spherical bear-

ing 32 and at the same time causing the axis of rotation of idler roller 28 and plate 30 to pivot slightly about hinge axis 31. With this adjustment idler roller 28 can be accurately and easily aligned with cylindrical drum 11 to maintain endless belt 10 in stretched position between roller 28 and drum 11, even at high belt speeds. With this construction, manufacturing tolerances can be reduced as this device enables the rollers to be accurately aligned. This device is particularly advantageous on a two-pulley endless belt, sander or the like, when the inflated sleeve 20 of the invention is not utilized. When the inflated sleeve 20 is used, idler roller 28 may be securely journaled directly to support bracket 2 as it has been found that the inflated sleeve 20 due to its resiliency compensates for any slight inaccuracies in alignment between the two rollers and efficiently retains the belt in stretched position between idler roller 28 and drum 11 at high speeds even when some slight misalignment may exist between these members.

The inflatable sleeve 20 shown in FIGS. 4, 4A and 5, has been found to operate very efficiently when constructed in widths of approximately two to five inches. For sleeve widths greater than this, up to six feet or more, such as would be used with cylindrical drum sanders, a modified construction of inflatable sleeve 38 as shown in FIGS. 8–11 performs the function of connecting continuous abrasive means to the exterior surface of a drum as it reduces the crowning effect over the wider width span of the sleeve when the same is inflated, thus providing more evenly distributed holding pressure to the abrasive sleeve or ring. Inflatable sleeve 38 is comprised of a continuous top wall portion 39 and a continuous bottom wall portion 40 coextensive therewith and spaced inwardly therefrom. The entire sleeve is preferably constructed of rubber or the like, and top wall portion 39 is preferably thicker than bottom wall portion 40 to aid in the reduction of the bowing or crowning effect on the outer surface of top wall portion 39 when the sleeve is inflated. Top wall portion 39 and bottom wall portion 40 are joined along their peripheral edges in spaced relation by side wall portions 41 of the same thickness as top wall portion 39 and a plurality of continuous intermediate walls 42 are disposed between opposite side wall portions 49 to connect the top and bottom side wall portions at spaced intervals. This construction thus provides a plurality of annular cavities disposed between top and bottom wall portions 39 and 40, and side wall portions 41 which are separated by intermediate walls 42. A plurality of communicating openings 43 are provided at spaced intervals along and through each intermediate wall 42 such that all of the annular cavities are in communication with each other. A valve 24' is connected through bottom wall portion 40 in communication with one of the annular cavities within the inflatable sleeve in the same manner as sleeve 24, as described in connection with inflatable sleeve 20. When air, nitrogen, or the like is passed through this valve, under pressure, all of the annular air cavities within the sleeve 38 will be inflated to the same degree since all of the cavities are in communication by means of apertures 43. When the sleeve is inflated bottom wall portion 40 and top wall portion 39 expand outwardly relative to each other with the added thickness of top wall portion 39 and the intermediate walls 42 maintaining the outer surface of the top wall portion as even as possible and keeping the bulging or crowning effect from the increased pressure within the sleeve to a minimum. Bottom wall portion 40 expands into friction contact with the outer surface of pulley or drum 11 while top wall portion 39 extends into contact with the abrasive sleeve or belt 10.

As shown in FIG. 8, when adapting the teachings of the invention to drum or floor sanders, or the like, where there is the danger of wood splinters piercing the abrasive sleeve 10, a thin sleeve of relatively rigid material 44, which forms a barrier against piercing splinters is disposed between the abrasive sleeve 10 and upper wall portion 39 of the inflatable sleeve. This continuous sleeve 44 may be constructed of thin stainless steel, or other suitable material which will yield slightly outwardly under pressure of the inflatable sleeve so as to tightly stretch the abrasive sleeve as sleeve 38 is inflated. Sleeve 44 thus in effect creates a armour coat for the more expensive inflatable sleeve 38 and protects the same from piercing splinters and at the same time reduces wear of the top wall portion 39 by the abrasive sleeve 10. The stainless steel sleeves 44 can be cheaply produced and easily replaced when damaged or worn.

In FIGS. 9–11 the teachings of the invention are shown adapted to a hand grinder or sanding device wherein motor housing 3 is fastened at 6 to arm portion 45 of the U-shaped bracket 46 which terminates in an extended handle 47. Arm portion 45 integrally carries a circular flange 18' which forms a support for sealed needle bearing 17' connected between flange 18' and pulley or drum 11, in substantially the same manner as shown in FIG. 4. As in the previously described form of the invention a plurality of ventilating apertures 19' are formed in flange 18' outwardly of the motor housing as indicated. Components corresponding to those previously described are indicated by like reference numerals.

Bearing 5 is rigidly connected to the opposite arm portion 48 of U-shaped bracket 46 with this arm portion being detachably connected to bracket 46 by means of a pair of screws or the like as indicated at 49. An annular ring of abrasive medium, such as Carborundum, etc., indicated generally at 50 and having an outer surface contour of any desired shape for performing a particular function, is provided with an integrally connected metallic base ring 51 on its inner surface. To install the abrasive ring 50 on the hand grinder screws 49 are removed and through the sliding fit of bearing 5 with shaft 4 arm portion 48 is removed and the abrasive ring is slipped over the inflatable sleeve 38. The sleeve is then inflated with air, nitrogen or the like and it expands into firm contact with metallic ring 51 and drum 11 to securely connect the abrasive ring to the exterior surface of the drum. The arm portion 48 is then re-connected and the grinder is ready for use. To remove the abrasive ring 50, or a sleeve of abrasive paper in lieu thereof, sleeve 38 is deflated and the previously described operation is performed in reverse. The hand grinder is provided with a hand grip 52 which is pivoted at 53 to the main handle 47 and at its opposite ends secured to the U-shaped bracket at 54 through the pivot support 55. As shown the handle 42 is connected for use by a right-handed person and to adapt the device for use by a left-handed person pivot support 55 is disconnected at 54 from the U-shaped bracket and the handle is pivoted about 53 to the left side of bracket 46 and re-connected to surface 56 of the U-shaped bracket. In use, handle 42 is gripped by one hand and handle 47 is gripped by the other. The wires from motor housing 3 (not shown) extend down along arm portion 45 and through the center of handle 47 with the power switch provided at 57 on handle 47 within easy access by the hand of the user which grips hand grip or handle 52.

The coaction of the inwardly extending radially disposed curved blades 16 with the radially extending air scoops 15 insures a continuous forced axial flow of air over the surface of the motor housing 3 for reducing the temperature of the motor over long operating periods. This forced flow of air also prevents the accumulation of dust and fine abrasive particles around the motor housing with the inherent seepage thereof into the interior of the motor housing to the detriment of the circuitry, the collector rings or commutator or the parts of the armature or exposed portions of the field. In other words, the dust and abrasive particles are swept away from all moving parts of the motor at the same time that the motor is maintained in a cool state by the means built into the pulley or drum 11 over which the abrasive sleeve or belt operates.

The fact that the cooling means are built into the same means which drive the abrasive sleeve or belt enables the device of the invention to be constructed in extremely compact form at low cost in mass production. The compact and simple construction of the inflatable sleeve for securing abrasive media to the device also enhances the compact construction and low cost in mass production.

While the invention has been described in certain preferred embodiments it is realized that modifications may be made and that applications of the invention are numerous and it is to be understood that no limitations upon the invention are intended other than may be imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. An electric stationary motor comprising a motor housing, a driven shaft extending horizontally through said housing and journaled with respect thereto, a hollow cylindrical drum enveloping said stationary motor housing and secured at one end thereof to said driven shaft for rotation therewith, bearing means connecting the opposite end of said drum to said stationary motor housing and providing openings intermediate the drum and housing, and means carried by said drum for generating a forced lateral flow of cooling air across said motor housing intermediate the outside of said stationary motor housing and the inside of said drum.

2. An electric motor as set forth in claim **1** in which said means carried by said drum for generating a forced flow of cooling air around said driving motor comprises a plurality of inwardly extending fins connected with the interior wall of said drum and terminating in air gaps adjacent the lateral exterior of said stationary motor housing and intermediate said stationary housing and said terminating edges of said inwardly extending fins for effecting forced circulation of air around said motor.

3. An electric motor as set forth in claim **1** in which said means carried by said drum for generating a forced flow of cooling air around said driving motor comprises a plurality of radially extending inwardly directed fins carried by the interior wall of said drum and a multiplicity of radially extending outwardly directed air scoops carried by one end of said drum, all of said fins and air scoops coacting to develop a forced lateral flow of air around said stationary motor housing.

4. An abrading and polishing machine comprising an electric motor having a housing, means for fixedly supporting said housing, a driven shaft extending through said housing and projecting from one end thereof, a hollow drum concentrically surrounding said fixed housing and attached to the projecting end of said shaft whereby upon rotation of said shaft said drum revolves around said fixed housing, inwardly extending fins connected to the inner surface of said hollow drum for creating an axial air draft intermediate said fixed housing and said hollow drum, an inflatable sleeve concentrically surrounding the exterior surface of said hollow drum and disposed in friction engagement therewith, and a continuous belt looped over the surface of said inflatable sleeve, whereby upon inflation of said sleeve said continuous belt is securely connected to said drum for rotation therewith.

5. An abrading and polishing machine as set forth in claim **4**, including a continuous sleeve of relatively thin metallic material surrounding said inflatable sleeve intermediate said inflatable sleeve and continuous belt and in which said continuous belt is concentrically disposed about said continuous sleeve and said inflatable sleeve.

6. As a subcombination an inflatable sleeve for connecting continuous loop and annular abrasive means to the surface of a drum comprising, a first continuous sleeve of resilient material, a second continuous sleeve of resilient material concentrically aligned within said first continuous sleeve, said first and second sleeves sealed together along opposite edges about their perimeters to form a sealed unit, a pair of continuous loops of resilient material connected to said second continuous sleeve along the opposite edges thereof and on the side opposite said first continuous sleeve, and valve means connected to said sealed unit whereby upon inflation of said sealed unit a chamber is formed intermediate the surfaces of said first and second continuous sleeves and intermediate the sealed edges with the portion of said second continuous sleeve intermediate said pair of continuous loops moving into alignment therewith.

7. An inflatable sleeve as set forth in claim **6** in which said pair of continuous loops are disposed in spaced relation and have a width substantially less than the width of said first and second continuous sleeves.

8. An inflatable sleeve as set forth in claim **6** in which said first and second continuous sleeves are constructed of materials of different resiliency.

9. An inflatable sleeve as set forth in claim **6** in which the adjacent surfaces of said first and second continuous sleeves are disposed in side by side overlying engagement throughout their widths in the deflated state.

10. In an abrading and polishing machine, a driving drum, an idler roller spatially related to said drum, a belt extending around said drum and around said idler roller, means for rotatably driving said drum for continuously moving said belt around said drum and idler roller, a shaft extending from opposite ends of said idler roller, a hinge member having a pivot axis adjacent one end of said shaft substantially perpendicular to the axis of said shaft, one end of said shaft journaled to said hinge member for movement about said pivot axis, a support arm connected for movement laterally of said drum and idler roller and substantially normal to the axis of said shaft journaled to the opposite end of said shaft, said support arm connected for movement relative to said hinge member, whereby said idler roller can be accurately aligned by lateral movement of said suport arm for maintaining said belt in position around said drum and idler roller.

11. An inflatable sleeve comprising an annular top wall portion of resilient material, an annular bottom wall portion of resilient material concentric with said top wall portion and connected thereto along opposite edges to form a sealed unit, said bottom wall portion forming the bore of the inflatable sleeve, said bottom wall portion having inwardly directed portions constricting the bore of the sleeve adjacent opposite edges thereof, and valve means connected to said sealed unit whereby upon inflation of said sealed unit through said valve means an expanded chamber is formed intermediate said top and bottom annular wall portions.

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ROBERT C. RIORDON, *Primary Examiner.*

LESTER M. SWINGLE, *Examiner.*