March 6, 1962 R. C. PEABODY ET AL 3,023,440

ADJUSTABLE DIAMETER CYLINDRICAL BRUSH

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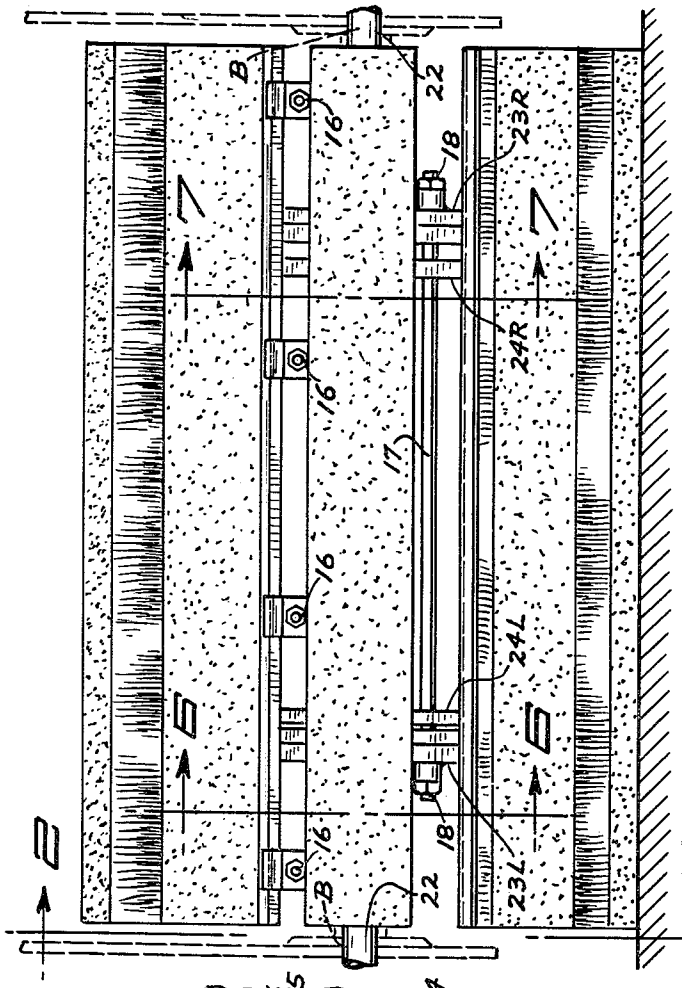


FIG. 1

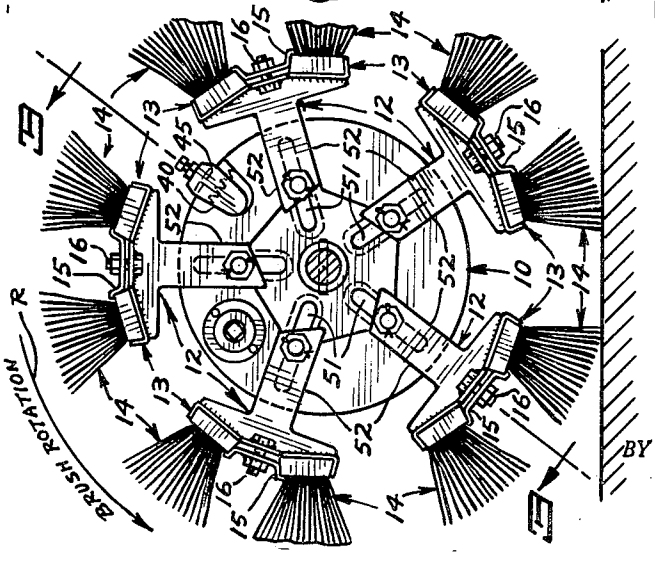


FIG. 2

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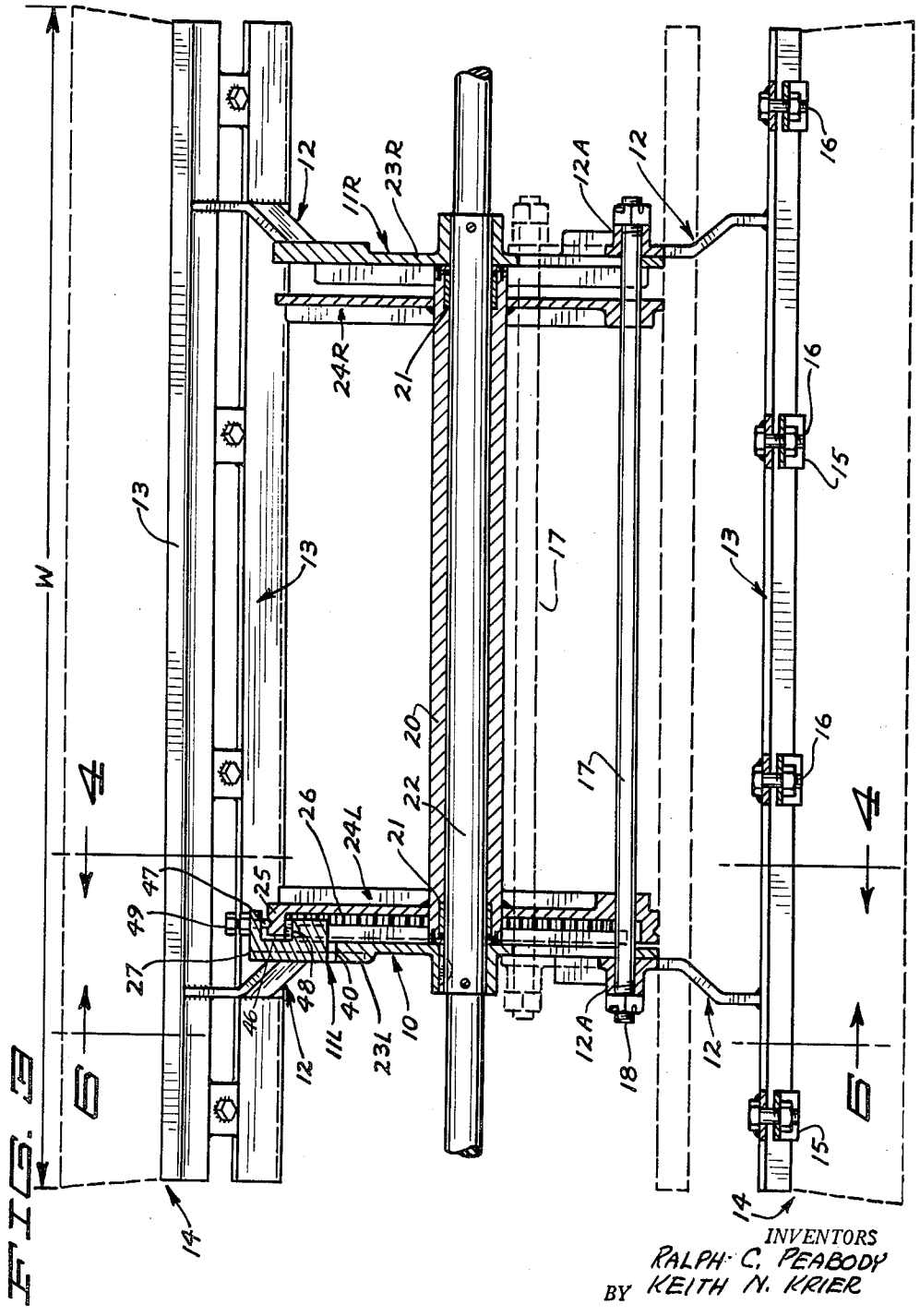


FIG. 3

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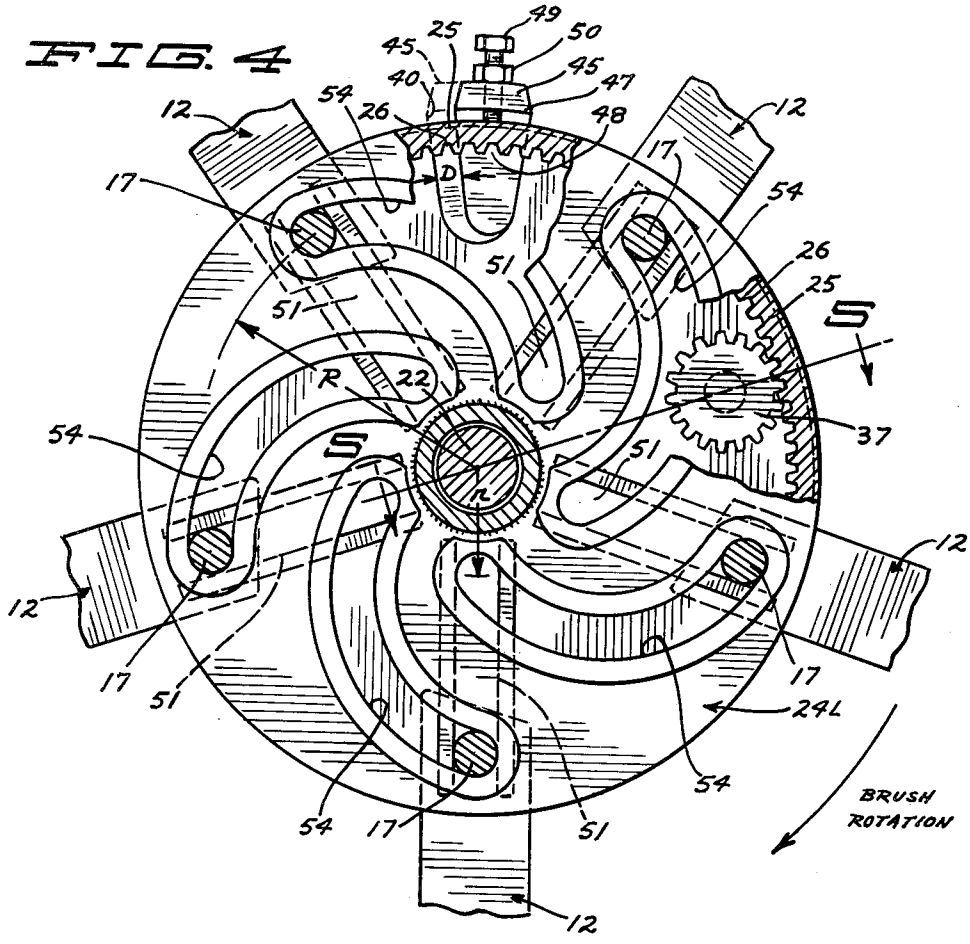
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ADJUSTABLE DIAMETER CYLINDRICAL BRUSH

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FIG. 4



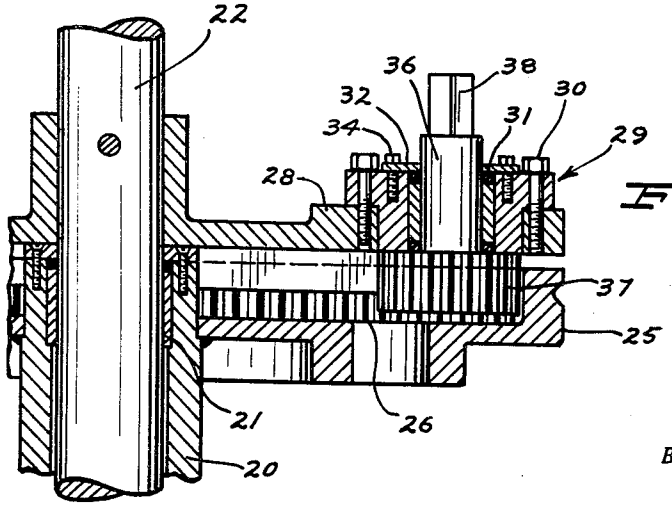


FIG. 5

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ADJUSTABLE DIAMETER CYLINDRICAL BRUSH

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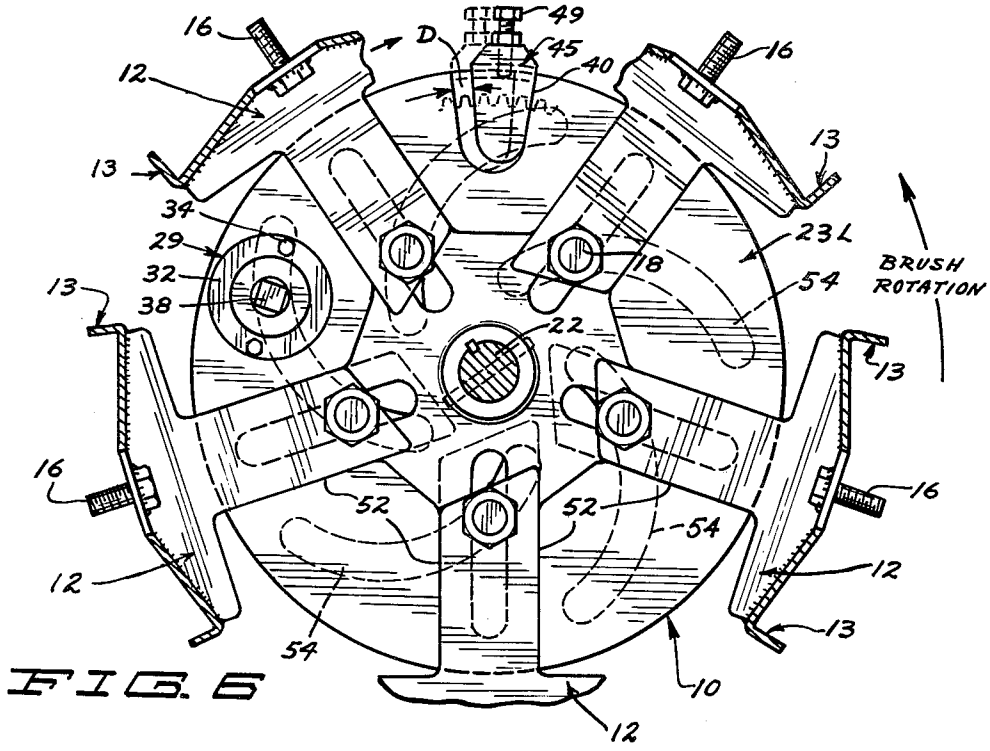


FIG. 6

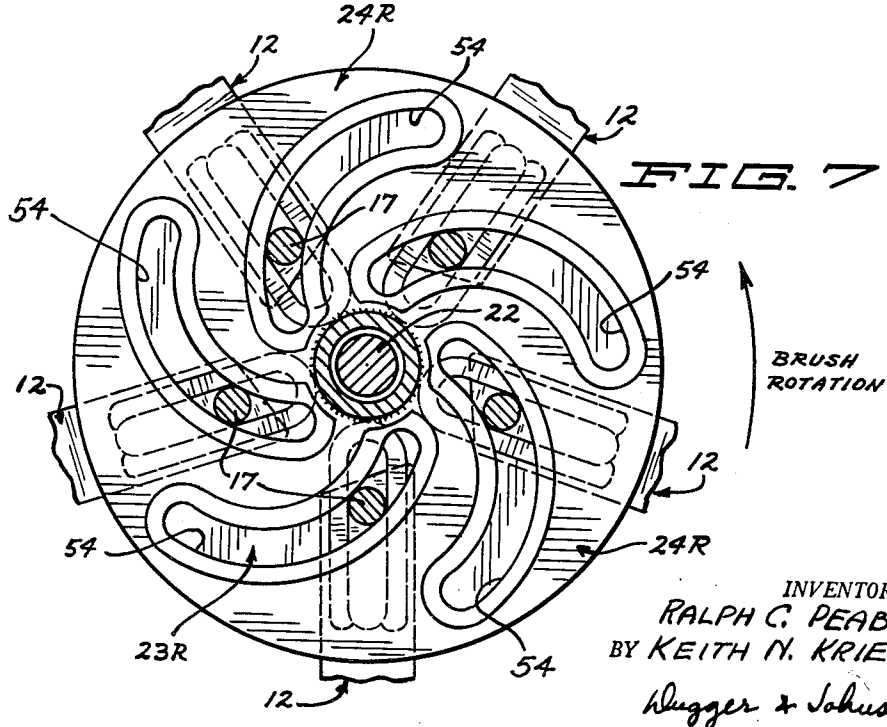


FIG. 7

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United States Patent Office 3,023,440 Patented Mar. 6, 1962

3,023,440

ADJUSTABLE DIAMETER CYLINDRICAL BRUSH

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Filed Feb. 18, 1959, Ser. No. 794,065
12 Claims. (Cl. 15—183)

This invention relates to adjustable diameter cylindrical brushes and more particularly to brushes of large and rugged construction suitable for use in large power-driven sweeping machines, wherein the diameter is adjusted so as to maintain a relatively constant diameter during the life of the brush.

In large sweeping machines of the power-driven type, primary sweeping is done by a cylindrical brush which is rotated about an axis transverse to the direction of motion of the machine. In such sweeping machines of a particular design the brush bristle tips rotate relatively close to a scroll or housing against which the swept material is moved and discharged into a receptacle. For accurate operation, and good sweeping, it is essential that the brush be capable of adjustment for maintaining its diameter as the length of the bristles decreases during wear. At the same time it is essential that the brush be of exceedingly rugged construction, and capable of easy adjustment with simple tools and capable of easy replacement of bristle elements.

It is an object of the present invention to provide an improved adjustable diameter cylindrical brush. It is a further object of the invention to provide an improved cylindrical brush of the large and rugged type for power sweeping machines capable of having its diameter adjusted during use. It is a further object of the invention to provide an improved adjustable diameter cylindrical brush wherein the diameter may be maintained substantially constant and in which, when the bristle sticks are replaced, the diameter may be quickly readjusted for receiving such new and longer length bristles. It is a further object of the invention to provide an adjustable diameter cylindrical brush wherein the adjustment is held ruggedly under the most adverse conditions.

Other and further objects are those inherent in the invention herein illustrated, described and claimed and will become apparent as the description proceeds.

To the accomplishment of the foregoing and related ends, this invention then comprises the features hereinafter fully described and particularly pointed out in the claims, the following description setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principles of the invention may be employed.

The invention is illustrated with reference to the drawings where in corresponding numerals refer to the same parts and in which:

FIGURE 1 is a vertical elevational view of a brush constructed in accordance with the present invention in which the machine side frame and bearings are shown in dotted lines;

FIGURE 2 is an end elevational view of the brush made in accordance with the present invention;

FIGURE 3 is a longitudinal sectional view through the brush taken along the line and in the direction of arrows 3—3 of FIGURE 2;

FIGURE 4 is an enlarged fragmentary vertical sectional view of the central portion of the brush structure of the present invention, this view being taken along the line and in the direction of arrows 4—4 of FIGURE 3;

FIGURE 5 is an enlarged fragmentary sectional view

taken along the line and in the direction of arrows 5—5 of FIGURE 4;

FIGURE 6 is an enlarged end elevational view partly broken away, with the brush elements removed, corresponding to that shown in FIGURE 2 and illustrating the adjustment of the brush diameter. The position at which the view shown in FIGURE 6 is taken is along the line and in the direction of arrow 6—6 of FIGURES 1 and 3;

FIGURE 7 is a fragmentary vertical sectional view corresponding to FIGURE 6 but taken along the line and in the direction of arrows 7—7 of FIGURE 1.

Throughout the drawings, the corresponding numerals refer to the same parts.

Referring to the drawings, the variable diameter brush structure comprises a central reel mechanism generally designated 10 in FIGURES 2 and 3. This reel is in the general form of a spool at opposite ends of which there are flange structures generally designated 11L and 11R, which serve as mountings for radially adjustable supports generally designated 12 at each end of the structure. While any number of such radially adjustable supports 12 may be used, in this instance there are shown five equally angularly spaced such elements, see FIGURE 2. The elements 12 are mounted so as to slide radially on each of the flanges 11L and 11R and the elements 12 are supports upon which there are positioned channel elements generally designated 13 which extend parallel to the axle of the reel from one end of the reel to the other and these channels serve as mountings for the brush elements generally designated 14, the latter being clamped in place by clip bars 15 that are in turn held in place by bolts 16.

From the standpoint of nomenclature, the "width" of a brush really means the width of the path swept, but this dimension, shown at "W" in FIGURE 3, is really the axial length of the brush cylinder. It is noted that the brush elements 14 overhang the reel 10 at each end.

The radial supports 12 move inwardly and outwardly in a radial direction and outwardly beyond the diameter of the central reel, structure 10 the ends of the elements 12 are offset, as shown in FIGURE 3. At their outer ends, each of the elements 12 has a generally T-shaped head which is welded solidly to the undersurface of the channel 13 with which it is thus integrally connected. Also, the heads of bolts 16 are welded into the channels so as to hold these bolts firmly. This eases the maintenance problem.

At their inner ends, the elements 12 are provided with bosses 12A and through these extend long rods 17 which are threaded at each end and provided with castellated nuts 18 which are held by cotter pins. The rods 17 do not act as a clamping bolt for the inner ends of the support members 12, but merely as a steadying bolt and a pin upon which the cam surfaces of the reel mechanism bears for positioning the element 12 inwardly and outwardly with reference to the axis of the spool 10, as will be described.

Essentially the reel 10 consists of an inner and outer spool each having an axle with a flange at each end. The inner spool which, as will be explained, acts as a cam, has a tubular axle 20 provided with bearings at 21—21 which journal shaft 22 which is a part of the outer spool. Shaft 22 has flanges 23L and 23R and these are positioned proximate flanges 24L and 24R respectively. The flanges 24R and 24L of the inner spool are welded to the tubular shaft 20 and the entire inner spool 24R—20—24L rotates as an entity, being journalled on the bearings 21 which revolve on the shaft 22 of the outer spool. The shaft 22 has its flanges 23R and 23L pinned on and the outer spool hence is an entity composed of flange 23L, inner shaft 22, and flanges 23R and will likewise rotate as one unit.

The flanges 23L and 24L are made so that relative rotation of the flange 24L with reference to the flange 23L can be accomplished in a controlled manner by small or large increments. This is accomplished by providing on the flange 24L an axially extending portion 25 which is provided with gear teeth 26 on its inner surface. The portion 25 of flange 24L faces flange 23L and the outer diameter of both flanges is the same. At one place on the outer flange 23L there is provided a bearing boss 28, see FIGURES 2 and 5, in which the bearing structure generally designated 29 is positioned and held by means of the cap screws 30. This bearing structure is so made that it contains a suitable bearing 31 held in place by a collar 32 that is in turn held in place by cap screws 34. Adequate bearing seals are provided in each end of the bearings. This bearing structure 29 serves as a trunnion for a shaft 36 on which a small spur gear 37 is integrally formed. This spur gear 37 is of a diameter such that when it is in place it will mesh with the gear teeth 26 on the inside of the portion 25 of the flange 24L, see FIGURE 4. The shaft 36 has a squared end 38 (see FIGURE 5) on which a wrench or crank can be conveniently placed. By turning the shaft 36 the gear 37 is rotated and this accordingly causes rotation of the flange 24L with reference to the flange 23L and in this way the entire spool composed of the tubular shaft 20 and flanges 24R and 24L is caused to rotate as a unit with reference to the spool composed of the shaft 22 and the flanges 23L and 23R.

At one place around the periphery of the flange 23L there is provided a notch 40 (see FIGURES 2, 4, and 6) which extends radially inwardly for a sufficient distance so as to be well within the inner face of portion 25 on which the gear teeth 26 are provided, see FIGURE 4. Accordingly, the teeth 26 are fully exposed through the notch 40 when the lug 45 is removed and the spool-hub structure is viewed as shown in FIGURES 2 and 5.

In this notch there is adapted to be placed a removable stop generally designated 45. This stop has the shape shown in FIGURES 2, 3, 4, and 6 and on its inner face (i.e. the back face as viewed in FIGURES 2 and 6) there is a deep groove 46. The outer surface (upper surface in FIGURE 3) of the groove at 47 is spaced outwardly a little ways from the periphery of portion 25 of the flange 24L. The inner surface 48 of this groove 47 is fashioned so as to provide teeth shaped so that they will mesh with the teeth 26 of flange 24L. The outer portion of the stop 45 is provided with a set screw 49 which is adapted to be locked in place by the lock-nut 50. Each side of the stop 45 is shaped so that it will bear evenly against one or the other of the sides of the notch 40.

The width of the stop 45 is less than the width of the notch 40, so as to provide a space D (see FIGURES 4 and 6) for movement of the stop 45 within the limits of the notch 40. With the stop in place as shown in FIGURE 4, the entire inner spool structure 24R—20—24L is thus permitted to rotate back or forth the amount of the dimension D relative to the outer spool structure 23R—22—23L. When the stop 45 is removed the inner spool can be freely rotated with reference to the outer spool by turning the little gear 37 by means of its shaft 36—38.

The flanges 23R and 23L of the outer spool structure are provided with radially extending slots 51 and the outer portions of the flanges 23R and 23L are thickened throughout about half way between the circumference of the flange and the center of the flange except adjacent the slots 51. Accordingly, between the thickened portions of the edge, there are provided slots which are defined by the edges 52—52 and these slots serve as radial slideways to support the edges of the members 12—12. Hence, each of the flanges 23R and 23L is provided with the slots 51 and with the grooves formed by the thickened peripheries, which present the edges 52—52 to the brush element supports 12—12. The flanges 24R and 24L of the

inner spool structure are likewise provided with slots extending from near the middle of these flanges outwardly toward the peripheries of the flanges. In the form of the structure illustrated herein, these slots are made as smooth arcs 54, which bend in a direction opposite to the direction of rotation of the brush, see FIGURES 6 and 7. The position of intersection of the slot 54 in flange 24L with its cooperating slot 51 in flange 23L therefore varies in a radial direction as the one flange is rotated relative to the other. An outer or extreme position is shown in FIGURE 4 whereas an intermediate position is shown in FIGURES 6 and 7. The innermost position of intersection occurs when the inner parts of the slots overlie each other. (Precisely the same slot construction is used for flanges 24R and 23R.)

In the exemplary form of invention shown herein, the slots 51 are made radial and the slots 54 are formed as smooth arcuate curves slanted in a direction opposite to the direction of rotation. Other configurations for each of the slots 51 and 54 may be used, the essential criteria being that as one set of slots 54L (or 54R) is moved relative to their cooperating slots 53L (or 53R), the area of intersection of the slots shall vary in a radial direction. The form of slots configuration herein illustrated accomplishes this function and is preferred because a reasonably sharp direction of crossing of slots 54 relative slots 51 is provided. While the angle of this direction of crossing varies somewhat as the location of slot 54 changes from "inner" to "outer" positions of adjustment, still the angle of crossing is always reasonably sharp. Compare FIGURES 6 and 4. This insures firm retention of rods 17.

The through rods 17 extend through the slots 51–54 where they intersect and accordingly as the inner spool structure is rotated with reference to the outer spool structure, the radial dimension for the area of the intersection (through which rods 17 pass) will vary from minimum dimension "r" to maximum dimension "R," (FIGURE 4). This changes the effective brush diameter.

The brush structure is supported in suitable bearings B—B on the machine frame, see FIGURE 1, and is rotated by applying power to the shaft 22. This serves to rotate the outer spool structure composed of the flanges 23R, shaft 212, and flange 23L, and also serves to rotate the brush supports 12—12, carrying the brush supporting channels 13—13 and hence the brushes 14—14. The rotation of the entire brush structure produces a centrifugal force on the brush elements and they and their supports, including the rods 17, tend to move radially outwardly, but this movement is restrained by the hold provided by the intersecting effect of the slot 54 on the rod 17, the rod 17 being restrained in the groove 51. The action of the centrifugal force would merely cause relative rotation of the inner spool 24R—20—24L relative to the outer spool 23R—20—23L with consequent increase in diameter of the brush as a whole, until the limits of grooves 51 and 54 are reached, were it not for the restraint imposed by lug 45 and notch 40. The fact that the clamp element 45 is in place and bears against that face of the slot 40 prevents such rotation and any selected diameter setting is thus held. Therefore, outward movement of the brush support is restrained by the stop 45.

The brush is shown in running position in FIGURE 2 where, it will be noted, lug 45 bears against the leading edge of notch 40.

As the brush bristles wear the effective diameter of the brush decreases, and an adjustment is made for increasing the diameter as follows: The stop 45 is loosened by loosening the nut and cap screw, 49—50 and is then slipped out axially in respect to the structure 10 and is replaced in the position shown in FIGURE 6, where the lug 45 bears against the trailing edge of the slot 40. Note that in FIGURE 4 the leading edge of the slot 40 is to the right, whereas in FIGURE 6 the leading edge is to the left (in the former, the brush rotation appears clockwise, and in the latter, the brush rotation appears counterclock-

wise). These views are taken in opposite directions. With the stop accordingly placed in its new position against the trailing edge of the slot (as shown in full lines in FIGURE 6 and in dotted lines in FIGURE 4) the machine is then started and as the centrifugal force builds up the brush elements will tend to move outwardly and the reaction of these forces causes the rods **17** to rotate the flanges **23R** and **23L** relative to the flanges **24R** and **24L** in a direction so as to again bring the clamp **45** against the leading edge of the slot **40** as shown in FIGURE 4. This effects a prescribed outward movement of the brush, the amount of which depends upon the width of the slot, and other factors. If more adjustment is needed, this procedure is repeated.

After all of the effective lengths of the bristles has been used, the clamp **45** is removed and a wrench is applied to the shaft end **38**, see FIGURE 5, and by rotating the gear **37** thereby the brush supports **12—13—17** are drawn radially inwardly. The bolts **16** are then loosened and the old brush elements **14** are replaced by new ones. The machine is then ready to be restarted. Note that during this adjustment the nuts **18—18** are not changed. These are initially fitted so as to produce a snug but not tight fit of the inward ends of the members **12** against the outer faces of the flanges **23R** and **23L**, where they slide. It is noted that the inner ends of the members **12** are chamfered as illustrated in FIGURES 2 and 6 so as to provide clearance when they are drawn inwardly to minimum diameter position of the brush. The chamfer is slanted so that the leading edge surface of the member **12** is longer than the trailing edge surface. This is to provide more bearing surface on the leading edge surface.

As many widely apparently different embodiments of this invention may be made without departing from the spirit and scope thereof, we do not limit ourselves to the specific embodiments herein.

What we claim is:

1. A variable diameter brush comprising an axle, first and second wheels secured in spaced relation on said axle, each of said wheels being shaped so as to provide a selected number of angularly spaced radially extending slideways, the slideways of the first wheel being angularly aligned with corresponding slideways of the second wheel, frame supports mounted in each slideway of each wheel, said supports extending radially outward beyond the periphery of the wheels, brush element support bars extending parallel to the axle, said bars being solidly connected at opposite ends to the frame supports in aligned slideways, brush elements having radially extending bristles secured to each support bar, and constant diameter adjustment means rotatable on said axle for engaging said support bars for simultaneously moving them radially.

2. A variable diameter brush comprising a tubular spindle having a flange secured at each end so as to form a first spool, a shaft journalled in said spindle, said shaft being of a length so as to project from each end of the tubular spindle, said shaft having a flange secured at each end thereof to form a second spool, adjacent flanges at the two ends of the two spools being proximate, slots extending outwardly from near the center of each flange there being the same number of slots in each flange, the slots of the flanges of each spool being of corresponding shape and dimension and in corresponding angular orientation, the slots in the flanges of at least one of the spools being displaced from radial sufficiently so as to intersect the slots in the flanges of the other spool when the spools are rotated relatively, adjustable stop means for engaging both spools to hold the spools from relatively rotating, said spools being rotatable when the stop means is moved to a disengaged position relative at least to one of the spools, frames having brushes thereon mounted on the spools longitudinally of the spools and spaced radially outwardly from the flanges, said frames being mounted on the spools for movement radially in respect to the spools, and means on the frames engaged in the slots where they intersect for holding said frames against radial outward movement.

3. A variable diameter brush comprising an axle, first and second wheels secured in spaced relation on said axle, each of said wheels being shaped so as to provide a selected number of angularly spaced radially extending slideways, the slideways of the first wheel being angularly alined with corresponding slideways of the second wheel, frame supports mounted in each slideway of each wheel, said supports extending radially outward beyond the periphery of the wheels, brush element support bars extending parallel to the axle, said bars being solidly connected at opposite ends to the frame supports in alined slideways, brush elements having radially extending bristles secured to each support bar, and diameter adjustment means rotatable on said axle for engaging said supports for simultaneously moving all of the brushes radially, said means including a rotatable cam means adjacent each wheel for engaging said supports for moving them radially, said rotatable cam means being mounted on the axle for rotation thereon, and means for connecting said rotatable cams to insure each of said rotatable cam means being rotated to move the respective support equal radial distances relative to said axle.

4. The brush specified in claim 3 further characterized in that at least one of said first and second wheels is provided with gear means connecting it to the adjacent rotary cam means for moving the adjacent cam means, said adjacent cam means through the cam means connecting means causing the other rotary cam means to move at the same time.

5. A variable diameter brush comprising a tubular spindle having a flange secured at each end so as to form a first spool, a shaft journalled in said spindle, said shaft being of a length so as to project from each end of the tubular spindle, said shaft having a flange secured at each end thereof to form a second spool, adjacent flanges at the two ends of the two spools being proximate, slots extending outwardly from near the center of each flange, there being the same number of slots in each flange, the slots in the flanges of each spool being of corresponding shape and dimension and in corresponding angular orientation, the slots in the flanges of at least one of the spools being displaced radially sufficiently relative to the slots of the other flange so as to intersect the slots in the flanges of the other spool when the spools are rotated relatively, an adjustable stop for holding the spools from relatively rotating, said spools being rotatable when the stop is moved to a disengaged position, frames having brushes thereon mounted on the spools longitudinally of the spools and spaced radially outwardly from the flanges, said frames being mounted on the spools for movement radially in respect to the spools, means on the frame engaged in the slots where they intersect for holding said frames against radial outward movement, and means mounted on the adjacent flanges of the two spools for moving them relative to each other when the stop is disengaged.

6. A variable diameter brush comprising a tubular spindle having a flange secured at each end so as to form a first spool, a shaft journalled in said spindle, said shaft being of a length so as to project from each end of the tubular spindle, said shaft having a flange secured at each end thereof to form a second spool, adjacent flanges at the ends of the two spools being proximate, slots extending outwardly from near the inner center of each flange, there being the same number of slots in each flange, the slots of the flanges of each spool being of corresponding shape and dimension and in corresponding angular orientation, the slots in the flanges of at least one of the spools being displaced radially sufficient so as to intersect the slots in the flanges of the other spool when the spools are rotated relatively, an adjustable stop for holding the spools from relatively rotating, said spools being rotatable when the stop is moved to a disengaged position, frames having

brushes thereon mounted on the spools longitudinally of the spools and spaced radially outwardly from the flanges, said frames being mounted on the spools for movement radially in respect to the spools, means on the frame engaged in the slots where they intersect for holding said frames against the radially outward movement, said adjustable stop including gear teeth on one of the flanges at one end of the spool and a lug which is detachably securable to said gear teeth, the adjacent flange of the other spool being formed so as to present stop surfaces against which said lug is adapted to abut.

7. A variable diameter brush comprising a spool having an axle and first and second wheels secured in spaced relation on said axle, each of said wheels being shaped to provide a selected number of angularly spaced radially extending slideways, the slideways of the first wheel being angularly alined with the corresponding slideways of the second wheel, frame supports mounted in each slideway, of each wheel, said supports extending radially outward beyond the periphery of the wheels, brush element support bars extending parallel to the axle, said bars being connected at opposite ends to the frame support in alined slideways, brush elements having radially extending bristles secured to each support bar, diameter adjustment means rotatable on said axle for engaging said supports for simultaneously moving them radially, and adjustable stop means for engaging both the diameter adjustment means and the spool for selectively holding said spool and diameter adjustment means from relatively rotating and permitting said spool and said diameter adjustment means being rotatable when said stop means is moved to a disengaged position.

8. The brush specified in claim 7 further characterized in that the first wheel has a slot provided in the outer periphery thereof, that the diameter adjustment means includes a third wheel mounted on the axle in closed proximity to the first wheel, and that the stop means is mountable on the outer periphery of the third wheel to extend into the slot to abut against the first wheel.

9. A variable diameter brush comprising a tubular spindle having a flange secured at each end so as to form a first spool, a shaft journaled in said spindle, said shaft being of a length so as to project from each end of the tubular spindle, said shaft having a flange secured at each end thereof to form a second spool, adjacent flanges at the ends of the two spools being proximate, slots extend outwardly from near the center of each flange, there being the same number of slots in each flange, the slots of the flanges of each spool being of corresponding shape and dimension and in corresponding angular orientation, the slots in the flanges of at least one of the spools being displaced radially sufficient so as to intersect the slots in the flanges of the other spool when the spools are rotated relatively, an adjustable stop for holding the spools from relatively rotating, said spools being rotatable when the stop is moved to a disengaged position, frames having brushes thereon mounted on the spools longitudinally of the spools and spaced radially outwardly from the flanges, said frames being mounted on the spools for movement radially in respect to the spools, means on the frame engaged in the slots where they intersect for holding said frames against radial outward movement, said adjustable stop including gear teeth on one of the flanges at one end of the spool and a lug which is securable to said gear teeth, the adjacent flange of the other spool being formed so as to present stop surfaces against which said lug is adapted to abut, said stop surfaces being arcuately spaced at a sufficient angular distance to permit said lug to move a limited distance.

10. A variable diameter brush comprising a spool having an axle and first and second wheels secured in spaced relation on said axle, the first wheel having a slot in the outer periphery thereof and each of said wheels being shaped to provide a selected number of angularly spaced radially extending slide ways, the slide ways of the first wheel being angularly aligned with the corresponding slide ways of the second wheel, frame supports mounted in each slide way of each wheel, said supports extending radially outwardly beyond the periphery of the wheels, brush element support bars extending parallel to the axle, said bar being connected at opposite ends to the frame supports in aligned slide ways, brush elements having radially extending bristles secured to each support bar, diameter adjustment means rotatable on said axle for engaging said supports for simultaneously moving them radially, said diameter adjustment means including a third wheel mounted on the axle in close proximity to the first wheel, and adjustable stop means for engaging both the diameter adjustment means and the spool for selectively holding said spool and diameter adjustment means from relatively rotating and permitting said spool and said diameter adjustment means being rotatable when said stop means are moved to a disengaged position, said stop means being mountable on the outer periphery of said third wheel to extend into the slot to abut against the first wheel, at least one of the said first and second wheels being provided with means connected to the diameter adjustment means for moving the adjustment means relative to the spool when the stop means are disengaged, and said diameter adjustment means including a fourth wheel on the axle adjacent the second wheel and elongated means extending between the third and fourth wheels in engagement with the frame supports and all the wheels for transmitting the movement of the first and second wheels relative to the third and fourth wheels to the frame supports to move said frame supports in a radial direction.

11. A variable diameter brush comprising an axle, first and second wheels secured in spaced relation on said axle, said wheels being shaped so as to provide a selected number of angularly spaced radially extending slideways, the slideways of the first wheel being angularly aligned with corresponding slideways of the second wheel, frame supports mounted in each slideways of each wheel, said supports extending radially outwardly beyond the periphery of the wheels, brush element support bars extending parallel to the axle, said bars being solidly connected at opposite ends to the frame supports in aligned slideways, brush elements having radially extending bristles secured to each support bar, and diameter adjustment means rotatable on said axle for engaging said supports for simultaneously moving all the brushes radially, said means including a rotatable cam means adjacent each wheel for engaging the supports for moving them radially, said rotatable cam means being mounted on the axle for rotation thereon and including cam wheels adjacent said first and second wheels, and said diameter adjustment means including means connected to the supports for moving said support bars when the cam wheels are rotated relative to the first and the second wheels, said cam wheels each being shaped to provide non-radial cam slots for engaging the last mentioned means to move said last-mentioned means when the cam wheels are rotated.

12. A variable diameter brush comprising a first spool having at each end a flange, a shaft journaled in said first spool, said shaft being of a length so as to project from each end of the first spool, said shaft having a flange secured at each end thereof to form a second spool, adjacent flanges at the ends of the two spools being proximate, slots extend outwardly from near the center of each flange, there being the same number of slots in each flange, the slots of the flanges of each spool being of corresponding shape and dimension and in corresponding angular orientation, the slots in the flanges of at least one of the spools being displaced radially sufficient so as to intersect the slots in the flanges of the other spool when the spools are rotated relatively, means for selectively holding the spool from relatively rotating, frames

having brushes thereon mounted on the spools longitudinally of the spools and spaced radially outwardly from the flanges, said frames being mounted on the spools for movement radially in respect to the spools, a plurality of rods, each rod at each end being secured to a frame and extended into the slots of adjacent flanges where the slots intersect for holding the respective frames against radial outward movement when the spools are held against relative rotating.

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