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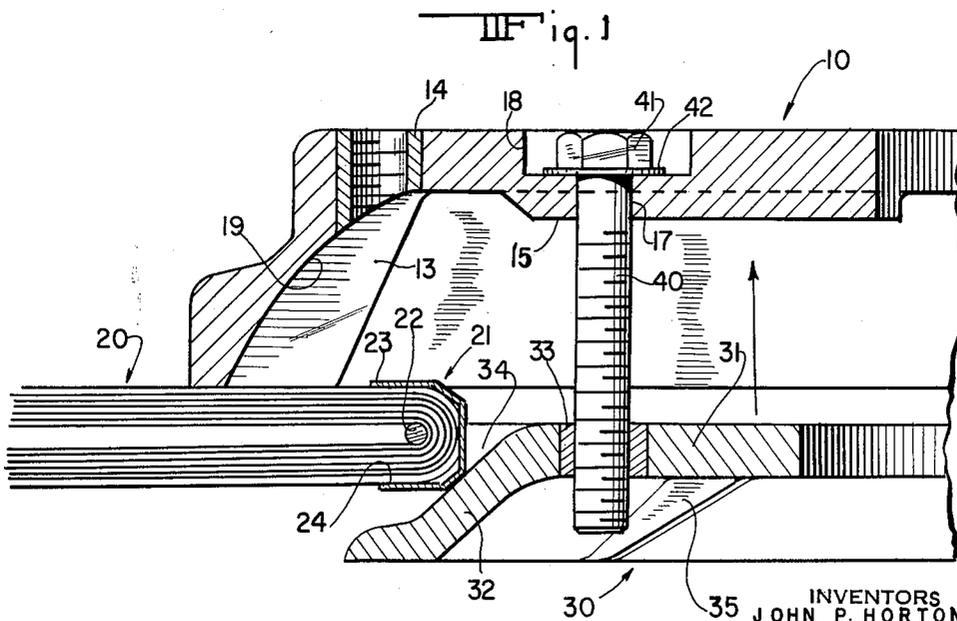
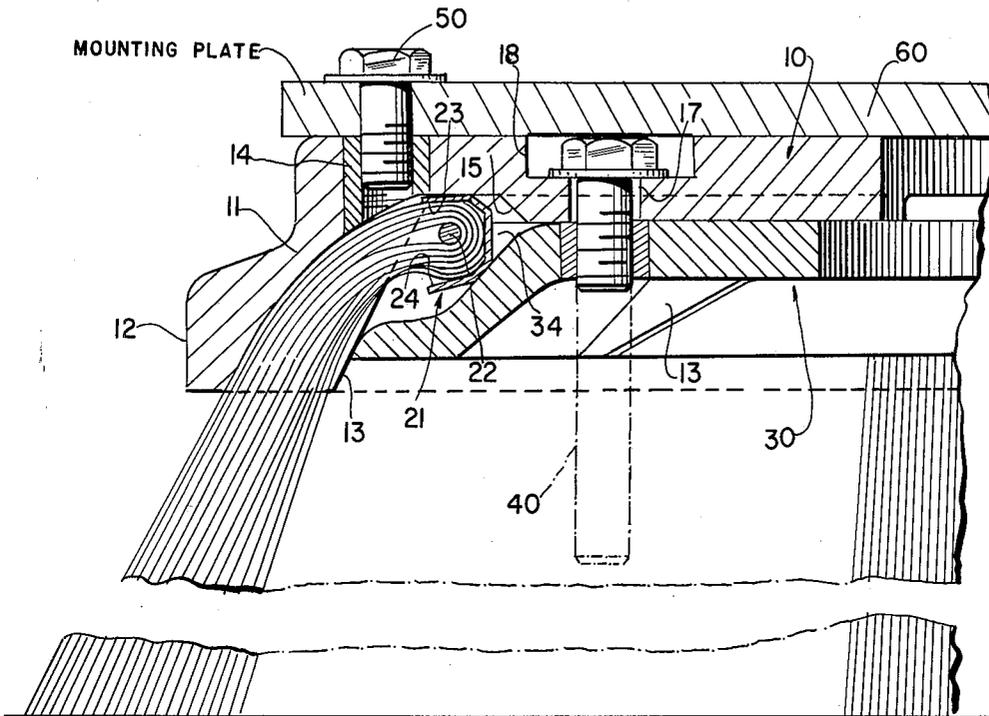
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ROTARY BROOM FOR STREET SWEEPER

Filed March 6, 1961

2 Sheets-Sheet 1



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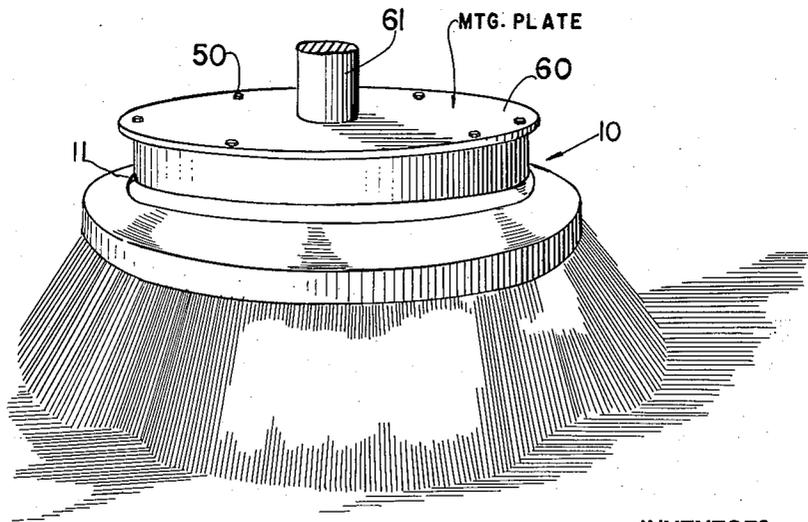
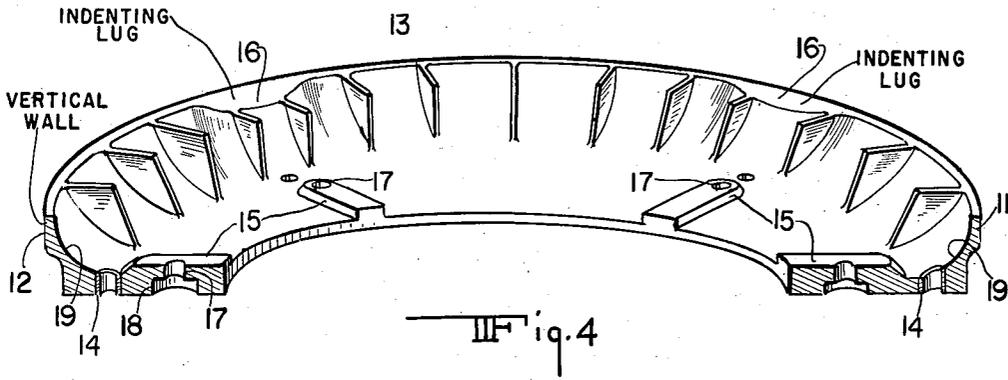
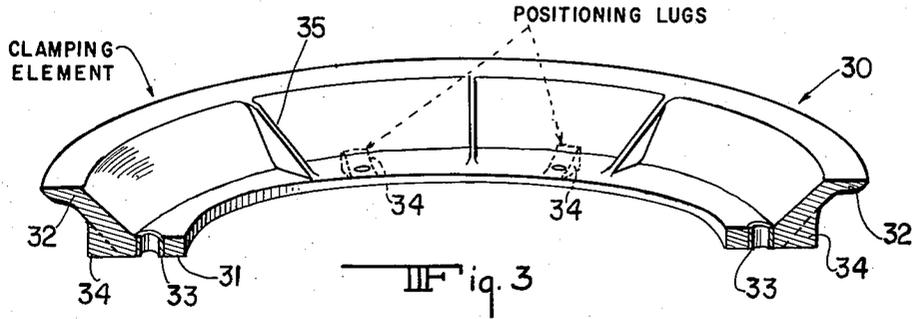
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III-III Fig. 5

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**ROTARY BROOM FOR STREET SWEEPER**

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This invention relates to a rotary broom for street sweepers.

Rotary brooms are often used as side brooms having a vertical axis of rotation in connection with a horizontally disposed brush roller. The rotary broom normally serves to sweep the street dirt from the gutter inward to the roller brush which then ensures the further removal of the dirt. For this type of use, the rotary broom should have a considerable diameter e.g. on the order of 40" at the farthest ends of the bristles. The brooms may weigh 100 pounds or more. Thus the problems associated with the provision of practicable brooms of this type are quite different from those associated with the provision of small industrial brushes of the same general shape.

In the conventional type of rotary broom, the brush back is a circular plate, or ring, or series of circular segments which, in the vicinity of a periphery, is provided with one or more circular series of holes extending therethrough having a square, or circular, cross section and extending obliquely outward in a direction corresponding to the desired direction of the bristles in the finished rotary broom. In each of the holes, a bunch of hair-pin shaped bristles is inserted from the rear side, or top side, of the brush back with its legs on either side of a pin or binder wire extending across the holes. The bristles are secured onto the back by tightening a ring, or plate, toward the rear, or top, side of the brush back proper. (Such rings, or plates, are often an integral part of the street sweeping machine on which the brush is mounted). The bent portion of the bunches of bristles are thus clamped between the additional plate and the pins or binder wire extending transversely across the holes of the brush back and between the legs of the bunches of bristles.

The manufacture of these known rotary brooms is very laborious and must, as far as a substantial part of the production is concerned, be effected manually and consequently the production costs are very high. Also such a structure puts very heavy strain upon the binder wire, if used, or the like. Any replacement of worn brush material must be done manually and is likewise expensive, representing an expense to the user comparable to the cost of a new broom. Since a considerable time is required to remove worn and insert new brush material, the user of the broom often feels compelled to keep spare brooms on hand in order to keep the sweeping machines operating, thus representing an increased economic burden.

Recently efforts have been made in Europe to overcome many of the aforementioned defects of conventional rotary brooms for streetsweepers. In accordance with one embodiment, a rotary broom for street sweepers is provided comprising a circular steel broom back having a frusto-conical, outwardly flared, steel flange welded thereto and an annular section of hair-pin shaped wire bristles secured in a U-shaped ring by wires and releasably clamped between the broom back and a circular steel plate ring having an outer diameter only slightly less than the outer diameter of the inside base face of the broom back.

In the production of this type of known rotary broom for street sweepers, a continuous layer of steel sweeper

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broom wire is positioned with its mid-point over an outwardly flared U-ring and then secured thereon by one, or more, binder wires so that the broom wire forms two outwardly flared wire sections secured against the base of the outwardly flared U-ring. The broom wire appears substantially V-shaped in radial vertical cross-section. In the assembly of this broom, the annular wire sections mentioned above is positioned between the frusto-conical broom back and the clamping plate ring and, by means of a special assembly device, the clamping ring is then forced in the direction of the inside face of the broom back until the U-ring is firmly clamped between the clamping ring and the inside face of the broom back. The ring plate is held in releasable clamping relation by a plurality of threaded bolts extending from the broom back through both the broom back and the clamping plate ring and held in clamping position by suitable nuts tightly screwed onto the bolt threads. In this way, the annular V-shaped assembly of bristles is forced downwardly in the direction of the broom back and the bristles are forced into contact with the frusto-conical flange and therebelow to form a frusto-conical crown of brush material. The clamping plate is provided with upwardly extending prongs which impede the rotation of the U-shaped ring and brush material. During the assembly of this broom, the sides of the U-shaped ring are close and thereafter assist in securing the hair-pin shaped wires in the ring through a clamping action. Considerable force is required to bring the broom back and clamping plate into contact with the U-shaped ring.

It is a general object of this invention to provide a novel rotary broom for street sweepers which preserves the advantages of the recently developed broom mentioned above while bringing about certain other advantages. It is another object of the invention to provide a rotary broom which is especially easy to assemble and disassemble with or without the use of special tools. It is an important object of this invention to provide a broom for a rotary street sweeper in which the bristles are maintained in a vertical position during use so that the stiff but flexible bristles will exert a flipping action on stones or the like when it comes in contact with such articles. It is a special object of the invention to provide a rotary broom which permits thorough cleaning of street gutters by close approach to the curb without danger of breakage of the broom back. It is yet another special object of the invention to provide a rotary broom in which the rotation of the brush element relative to the brush back is inhibited. It is yet another object of this invention to provide indentation, or pockets, in the frusto-conical brush crown that will facilitate a more effective removal of larger objects, such as stones, from the gutter. It is another important object of the invention to provide a broom for a rotary street sweeper which will achieve the above-mentioned objectives without overloading the suspension system of the sweeper. Other objects and features of the invention will become apparent from the more detailed description which follows.

It has now been found that an especially effective and especially easily assembled and disassembled relatively light rotary broom of the latter type disclosed above can be provided having a unitary back and a unitary section of annular brush material which can be releasably clamped to the brush back in such a way that the foregoing objectives can be achieved.

The features of the improved rotary broom of this invention can be best appreciated from a consideration of the problems experienced in the use of known rotary brooms for street sweepers, especially known rotary brooms of the latter type mentioned above. In the use of such brooms, it has been found it is extremely im-

portant that the wire of the brush section be held, not only originally but during operation, in a substantially radial direction. If the wires are not so held, they tend to slant back away from the direction of rotation of the broom and consequently lose a great proportion of the flipping action that is so desirable for a satisfactory sweeping operation. Furthermore, if the wires slant backwards, the vertical distance between the lip of the housing of the broom back and the ground is decreased even though there may be no wear on the brush wire and the life of the broom is correspondingly decreased. Thus both for better sweeping and longer life, it is important to hold the broom wire in a radial position.

It has been found that the wires can be held in a radial position by providing a downwardly extending portion of the brush back with inwardly extending radial holding elements such as ribs or fins. These radial holding elements serve a plurality of additional functions including reinforcing the broom back and a control of the wire down to the point where it leaves the housing of the broom back.

Also in the use of brooms having a steel structure as described in the prior art, it has been found that such materials add excessive weight to the broom to the point of overloading the suspension system on the sweeper. This overloading also causes the broom to bear too heavily on the street with a consequent excessive wear on the bristles. It appears that this difficulty could be overcome by making the broom back and the clamping element out of a lightweight material. For practical reasons, aluminum castings were selected to achieve control over the weight problem. It was found that rotary broom backs made from aluminum castings solved the weight problem but such brooms could not be attached to the mounting plate of the rotor of a sweeper in the customary manner by bolts extending through the mounting plate and screwed into the back of the broom due to the fact that threads cut into the aluminum castings were found to deform and strip in use. This disadvantage was overcome by directly casting threaded inserts into the aluminum casting made of hard and non-deformable metal such as steel. Where necessary, the steel inserts were provided with shoulders to prevent the insert from being stripped out of the aluminum casting during use.

Likewise, by providing threaded steel inserts in the clamping element, it was found that the clamping element could be releasably clamped to the broom back so as to hold the annular section of bristles in the broom by bolts extending through the broom back and directly screwed into these inserts. This procedure avoided the necessity for using bolts which were held in clamping relation by nuts tightened onto the threaded end of the bolt as disclosed in the prior art. Such a prior art procedure necessitates the use of conventional locking means which were not wholly satisfactory in use due to the fact that nuts tended to loosen during use of the broom. In accordance with this invention, it has been found that the problem of such loosening can be eliminated for most installations. This desirable result is accomplished by the recessing of the bolts in the top of the broom back a distance corresponding to the combined height of the bolt head and the washer used therewith. In this way, the bolt head is flush with the top of the broom back so that when the broom is mounted on a conventional sweeper mounting plate, the mounting plate covers the bolt heads and any tendency of the bolts to loosen in use is thereby prevented by the mounting plate being directly in contact with the top of the bolt heads.

In the use of gutter brooms containing frusto-conical flanges of the prior art, it has been found that careless use of the broom in the effective cleaning of gutters may result in the outwardly extending flanges of the broom back coming into contact with the curb whereby the flanges may be damaged or even broken. On the other hand, extreme care in avoiding damage to the broom by

avoiding all contact with the curb often impedes effective cleaning of the streets. Yet an outwardly flared flange is desirable to properly position the bristles relative to the back of the broom. These problems have been overcome in the instant broom by providing a brush back with a downwardly extending flange having an at least partially vertical outer wall and an outwardly tapering inner wall. By providing an outer wall at least having a vertical section at its outermost periphery, greater bearing surfaces are normally provided by multiple point contact with the curb when the sweeping machine closely approaches the curb thereby lessening the likelihood of damage, or breakage. Furthermore, due to the normal tilting of the rotary broom in the direction of the curb, any single point contact of the outside surface of the broom back with the curb will normally take place at a point removed from the outer periphery of the flange thereby lessening the leverage impact of such a contact.

In the use of rotary brooms containing true frusto-conical crowns of brush material, as disclosed in the prior art, it has been found that such brooms are not always effective in removing large articles, such as stones, which have a tendency to be tossed down the street ahead of such brooms rather than being swept in toward the center of the street where they can be removed by the horizontal roller sweepers. In order to overcome this difficulty, the broom back hereof have been provided with internally extending protuberances, such as lugs, at the inside of the lower extremity of the downwardly extending flanges. These lugs, or the like, cause circumferential indentions in the crown of the brush material which have a tendency to catch stones and the like and throw them away from the curb towards the horizontal roller sweeper.

Additionally, it has been found that the packaging, manipulation and assembly of the bristles which constitute the brush material used in the rotary broom, and replacement of the brush material, can be greatly facilitated if the brush material is pre-assembled into a unitary flat, or planar, annulus having its inner periphery fixedly positioned and bound as with a bonding material or a metallic clamping element. For example, a very satisfactory brush filler can be obtained from crimped wires of the type suitable for use in rotary brooms for street sweepers by placing layers of such wires across the open jaws of a U-shaped ring, forcing the central portion of the wires downwardly into contact with the inside base of the ring, as with binder wire, and thereafter hydraulically closing the jaws of the ring to force the wires into a substantially flat annular section of brush material held in the ring by the binder wire and the gripping effect of the closed jaws of the ring. This unitary annular wire filler may be easily packaged when shipped as a replacement and, easily clamped to the brush back by the owner of the street sweeping machine in the manner set out below.

Finally, it has been found that the brush material is more easily assembled to form the rotary broom if a specially designed clamping element is provided. It has been found that it is difficult to assemble very stiff wire bristles when the clamping element is of approximately the same diameter as the base face of the brush back as shown in the prior art. The clamping element is also preferably made of aluminum casting provided with threaded insets of harder material such as steel. The clamping element is cast so that its structure complements the functioning of the unitary brush back in a manner which will be apparent from the more detailed description below. In a preferred embodiment the clamping element constitutes a substantially bell-shaped ring having a flat annular upper surface. When the broom is assembled, the upper part of the bell-shaped portion of the clamping element serves as a shoulder to hold the assembled bristles into clamping relation with the back of the broom while the lower extremity of the bell-shaped portion assumes a position in close proximity to the radial fins of the broom back thereby facilitating the holding of the bristles in a

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vertical position relative to the broom back when the broom is in use.

The broom hereof may be readily assembled by placing the clamping element on a supporting device and positioning the clamping ring of the assembled bristles over positioning lugs provided on the clamping element. Then the broom back is placed over the assembled bristles with the bolt holes thereof in alignment with the threaded inserts in the clamping element. Upon inserting the bolts and tightening them by screwing them into the threaded inserts in the clamping element, the inner periphery of brush material is forced into releasable clamping relationship with the inside face of the broom back. By providing a clamping element with an appropriate outer diameter in the region where it contacts the inner region of the annular brush material, the broom may be assembled without the necessity for the use of a special tool. The required use of special tools has obvious commercial disadvantages. Furthermore, the diameter of the clamping element where it first contacts the inner region of the brush material and the outward taper to the inside of the flange of the brush back may be correlated so that upon assembling the broom the curvature imparted to the brush material does not place an undue stress on the bristles and the bristles conform to the taper over a large bearing area. In the use of a true frusto-conical flange as shown in the prior art, it is difficult to bring the bristles into contact with the flange over more than a limited area without putting undue stress on the bristles. Under either circumstance, the useful life of the bristles is importantly lessened.

The invention is more fully explained in the following description referring to the accompanying drawings representing a specific illustrative embodiment of the improved rotary broom, in which

FIG. 1 shows a fragmentary vertical cross sectional view of an assembled broom attached to the mounting plate of the rotor of a street sweeper;

FIG. 2 shows a fragmentary vertical cross sectional view of the various elements of the broom in a position ready for final assembly;

FIG. 3 shows a fragmentary bottom view of the unitary clamping element in perspective;

FIG. 4 shows a fragmentary bottom view of the unitary broom back in perspective and;

FIG. 5 shows a perspective view of the assembled broom mounted on the vertical rotor of a street sweeper.

Referring to the drawings where the same numbers are used to represent the various elements of the broom and the rotor to which it is designed to be attached, it will be seen the broom comprises a unitary aluminum back 10 having a unitary annular brush section 20 clamped to the back 10 by a unitary aluminum clamping element 30 releasably held in clamping relation by bolts 40 extending through the back 10 and screwed into the clamping element 30. As most clearly shown in FIGS. 1, 2, 4 and 5, the back 10 is provided with a downwardly depending flange 11 having a vertical peripheral outer side wall 12 and radial inwardly extending fins 13. The unitary back is provided with threaded steel inserts 14 cast thereinto for receiving the bolts 50 which firmly attach the back of the broom 10 to the mounting plate 60 attached to the rotor shaft 61. The back 10 is also provided with mounting pads 15, indenting lugs 16, a series of annular bolt holes 17 for receiving bolts 40, and recessed portions 18 for receiving the heads 41 of bolts 40 and the washers 42 used in association therewith. It will be noted the bolt holes 17 are located at a position removed from the axis of the broom and in a peripheral region of the top of the broom back relative to the axis of the broom. Due to the torque on the relatively large rotary brooms for street sweepers it is impractical to clamp the brush material to the brush back axially.

The inside surface 19 of the flange 11 is curved so as to conform substantially to the natural curvature of

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the broom bristles when the annular section of crimped steel wire 20 is held in clamping relation to the back 10. It will be observed further that the radial fins 13 extend into the annular section of brush material to the region of the lower lip of the clamping element 30 where they function to hold the broom wire in a vertical position when the broom is in operation and, at the same time, function to inhibit the rotation of brush material relative to the broom back 10.

The unitary annular section of brush material 20 is held in an annular ring, or rim, 21 by peripheral binder wires 22 and by the clamping action of the sides, or jaws, 23 and 24 of the ring 21.

As shown most clearly in FIG. 3, the unitary aluminum clamping element 30 having an annular flat top 31 and a bell-shaped flange 32 is provided with a series of threaded steel inserts 33 cast thereinto for receiving the threaded bolts 40. The clamping element 30 is provided with a suitable number of positioning lugs 34 so that the clamping ring 21 can be readily centered over the clamping element 30 to facilitate assembly and with a plurality of reinforcing ribs 35 which provide added strength to the clamping element without requiring excessive weight. The unitary clamping element 30 is constructed so that it functions to complement the functioning of the unitary back 10. Thus in the assembled broom, when the annular section of brush material 20 is firmly clamped in place, the flat top surface 31 comes in positive contact with the surface of positioning lugs 15 and the lower lip of the flange 32 is in close proximity to the radial fins 13 of the broom back 10 so that the broom bristles will be separated into a plurality of vertical sections by the radial fins. In this way, the bristles are supported at the point where they leave the broom housing yet they are not subjected to excessive fatigue due to the fact the bristles are supported linearly by the radial fins and one another rather than being clamped, or supported, only at the point where they leave the clamping ring.

It will be seen that some of the advantages of the radial fins which support the bristles and hold them in a vertical position could be supplied by outwardly extending radial fins on the clamping element 30 rather than as inwardly extending radial fins on the broom back 10. It will be apparent, however, that the radial fins on the broom back afford structural support for exposed flange 11 and afford better support for the bristles on the outer periphery of the brush crown where support is most needed.

As best illustrated in FIGS. 1 and 2, it can be seen the broom hereof may be economically produced and easily assembled and disassembled in the following manner.

Firstly, the unitary aluminum broom back 10 and the complementary unitary aluminum clamping element 30 are precast and the annular section of brush material 20 is preassembled in a manner disclosed above. Secondly, the clamping element 30 is positioned on a support (not shown) and the annular ring 21 holding the annular section of brush material 20 is positioned over the positioning lugs 34. Thirdly, the bolt holes 17 of back 10 are aligned with the threaded steel inserts 33 of clamping element 30 and bolts 40 inserted into bolt holes 17 supported on washers 41 and initially screwed into threaded inserts 33 as shown in FIG. 2. Finally the bolts are tightened until the flat top 31 of clamping element 30 comes into contact with mounting pads 15 as shown in FIG. 1. The contour of clamping element 30, the thickness of the jaws 23 and 24 of ring 21 are correlated so that when the top of the clamping element 30 is positively positioned against the mounting pads 15 the annular section of brush material 20 is firmly clamped between a shoulder of the flange 31 of the clamping element 30 and the inside face of the broom back 10 with jaw 24 resting on the shoulder of flange 32 and jaw 23 in contact with the inside face of the broom back 10. If desired, once the broom is assembled the bolts 40

used in assembling the broom may be replaced with shorter bolts to avoid damage or breakage in use.

As shown, the annular top 31 of the clamping element 30 has an outer diameter substantially less than the diameter of the inner face of the broom back 10 so that when the annular section of brush material 20 is held in clamping relation with the broom back 10 the bristles of the broom are bent over a gradual curvature not placing an undue stress on the bristles while at the same time contacting the curved inside surface 19 of the broom back 10 over a wide bearing area. It will be apparent that the outer diameter of the positioning lugs 34 of the clamping element 30 and the curvature of the outwardly tapered inner surface 19 of the flange 11 of the broom back 10 may be selected in conformity with the physical characteristics of the bristles contained in the annular section of brush material 20 so that the composite objectives of ease of assembly, proper sweeping angle for the brush material, and avoidance of undue stress on the brush material are achieved.

The local indentations in the outer periphery of the crown brush material imparted by the indenting lugs 16 are most clearly shown in the perspective view of an assembled and mounted broom in FIG. 5.

A rotary broom having the above disclosed features is very economical, assures ease of assembly and disassembly, has superior service life, and permits thorough cleaning of street gutters without the danger of damage or breakage.

The bristles used in the brooms of this invention may be those heretofore used in the production of rotary brooms. However, in order to obtain the objectives of the invention, the brush material should be stiff but flexible. Crimped steel wire has proven very satisfactory. Other materials such as straight steel wire, plastic filaments, etc. having these characteristics of stiffness and flexibility may also be suitable.

While the annular section of brush material is disclosed as a continuous section, it will be apparent that discontinuous sections of brush material, or tufts, could be provided which would be supported in a vertical position in the manner described above.

It will be understood that "flange" is used herein to indicate a member depending from the annular broom back or from the annular back of the clamping element and providing a circumferentially continuous surface therebelow.

It will be obvious that the invention is not limited to the particular representative structural elements shown in the drawings. Modifications in the structural details adapted to achieve the objectives of the invention will be apparent to those skilled in the art of producing rotary brooms for street sweepers without departing from the spirit of the invention or its scope as defined in the appended claims.

What is claimed is:

1. A rotary broom for street sweepers, comprising a brush back having a downwardly extending flange, clamping means underlying said back, means releasably holding said clamping means to said back, an easily removable annular section of brush material having an inner portion of continuous brush material clamped between said back and said clamping means and having other portions thereof passing through the space between said flange and said clamping means and extending downwardly from the periphery of said flange, and means associated with said flange and said clamping means and extending into said other portions of the brush material vertically supporting it in the peripheral region of said flange.

2. A rotary broom for street sweepers, comprising (a) a brush back having a downwardly extending flange provided with inwardly extending radial means, (b) clamping means underlying said back extending into proximity to

said radial means when in clamping position, (c) means releasably holding said clamping means to said back, (d) an easily removable annular section of brush material having an inner portion of continuous brush material clamped between said back and said clamping means and having other portions thereof passing through the space between said flange and said clamping means and extending downwardly from the periphery of said flange.

3. A rotary broom for street sweepers, comprising a brush back having a downwardly extending flange provided with peripheral inwardly extending radial fins, clamping means underlying said back having a downwardly extending flange extending in proximity to said fins when in clamping position, means releasably holding said clamping means to said back, an easily removable annular section of brush material having its inner portion clamped between said back and said clamping means and having other portions thereof passing through the space between said first flange and said clamping means and extending downwardly from the periphery of said first flange.

4. A rotary broom for street sweepers, comprising a brush back having a downwardly extending flange provided with outwardly tapered inner wall and inwardly extending radial fins, clamping means underlying said back having a downwardly extending flange extending in proximity to said fins when in clamping position, means releasably holding said clamping means to said back, an easily removable annular section of brush material having its inner portion clamped between said back and said clamping means and having other portions thereof passing through the space between said first flange and said clamping means and extending downwardly from the periphery of said first flange.

5. A rotary broom for street sweepers, comprising a brush back provided with a downwardly extending flange having outwardly tapered inner walls, inwardly extending fins and substantially vertical peripheral outer walls; clamping means underlying said back extending into proximity to said fins when in clamping position; means releasably holding said clamping means to said back; an easily removable annular section of brush material having an inner portion of continuous brush material clamped between said back and said clamping means and having other portions thereof passing through the space between said flange and said clamping means and extending downwardly from the periphery of said flange.

6. A back for rotary brooms comprising a unitary annulus of light weight metal provided with a flange having an outwardly flared and concavely curved inner wall and inwardly extending radial fins.

7. A back for rotary brooms comprising a unitary annular aluminum casting having a flange with outwardly tapered concavely curved inner walls, substantially vertical peripheral outer walls and inwardly extending radial fins; said back having threaded inserts of harder difficultly deformable metal located in peripheral regions in the top thereof with respect to the axis of the broom back adapted to receive threaded bolts for attaching the broom back to a mounting plate of a rotor.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

1,391,221	Tuttle	Sept. 20, 1921
1,418,088	Liddell	May 30, 1922
1,526,579	Albertson	Feb. 17, 1928
2,103,311	Atkin	Dec. 28, 1937
2,853,729	Link	Sept. 30, 1958
2,917,767	Lechene	Dec. 22, 1959

##### FOREIGN PATENTS

1,234,012	France	May 9, 1960
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