This invention relates to a rotary brush for street sweepers and processes for assembling such brushes. Rotary brushes are often used as side brushes having a vertical axis of rotation in connection with a horizontally disposed brush roller. The rotary brush normally serves to sweep the street dirt from the gutter inward to the brush roller which then ensures the further removal of the dirt. For this type of use, the rotary brush should have a considerable diameter e.g. on the order of 40" at the farthest ends of the bristles. The problems associated with the provision of practicable brushes of this type are quite different from those associated with the provision of small industrial brushes.

In the known types of rotary brush, 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 brush. In each of these, a bunch of hair-pin shaped bristles is inserted from the rear side, or top side, of the brush back with its legs on each side of a pin or binder wire extending across the holes. The bristles are secured onto the back by tightening a ring, or plate, towards 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 brushes 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, or the like. Any replacement of worn brush material must be done manually and is likewise expensive, often representing an expense to the user comparable to the cost of a new brush. Thus the user of the brush often feels economically compelled to keep spare brushes in order to keep the sweeping machines operating.

The present invention has as an objective the provision of novel processes for the production of novel rotary brushes for street sweepers, which overcome disadvantages in known brushes of this type and, as well, disadvantages in their method of manufacture. An important object of the invention is the provision of a rotary brush for street sweepers which may be readily and easily assembled and disassembled. It is another object of this invention to provide a rotary brush for street sweepers in which the bristles of the brush are very securely attached to the brush back. A special object of the invention is the provision of a rotary brush for street sweepers which is less expensive than known rotary brushes of the same type wherein the brush material may be extremely easily and quickly replaced. Another special object of the invention is the provision of a rotary brush for street sweepers composed of a plurality of separate and integral elements which can be easily assembled and readily reassemblable to permit the replacement of worn or broken elements. Other objects and features of the invention will become apparent from the more detailed description which follows.

In accordance with an important embodiment of the invention, a rotary brush for street sweepers is provided having a brush back with a downwardly extending flange, an annular brush section, and a clamping means which firmly but impermanently, i.e. releasably, clamps the brush section to the back of the brush so that the flange serves to position the bristles of the brush in such a way that they accomplish the desired sweeping action when the brush is rotated on its axis. The brush back may be an integral part of the street sweeping machine but it is much more practical to have the brush bolted, or otherwise detachably attached to the street sweeping machine. The annular brush section is secured in the brush assembly by being clamped between the brush back and a clamping element located within the flange. Typically the clamping element is a ring attached to the brush back by bolts and the annular, or other continuous section of brush material, is clamped between clamping element and the brush back by tightening the clamping element towards the brush back. In this way, the brush material is forced downward to firmly engage the flange of the brush back and extends downward therefrom.

The bristles used in the brushes in this invention may be those heretofore used in the production of rotary brushes but, in order to obtain the objectives of the invention, the brush material should be stiff, but flexible. The pre-assembly of the brush material into a continuous brush section means a considerable simplification of the prior art procedure for producing rotary brushes for street sweepers, where the brush material is divided into a very great number of bunches which have to be mounted one by one in the brush back. The manufacture of the annular brush sections may be done purely mechanically in the conventional manner, and only the mounting of the brush sections in the brush back requires manual work, but as will appear from the following description, this work may be performed extremely easily and quickly and will to no noteworthy degree raise the cost of production of the brushes. A particular advantage of the rotary brush hereof is that, after removal from the sweeping machine, a replacement of the brush material due to wear only requires detachment of the clamping element, exchange of the worn brush section with a new section, and reattachment of the clamping element. Quite obviously, this work can be done by anyone in a very short time as it requires no unusual skill whatsoever.

In accordance with a special embodiment of the invention, the clamping element consists of a circular ring having substantially the same outer diameter as the base face of the brush back, the inner diameter of the annular brush section being smaller than the outer diameter of said ring to such a degree that the inner portion of the brush section may be clamped between the clamping element and the base face of the brush back. In this way a particularly
safe securing of the brush material in the brush back is obtained, especially when means are provided preventing slipping of the brush material relative to the clamping means such as prongs on the outer periphery of the clamping ring projecting in the direction of the brush back.

The clamping element and the brush back may advantageously be clamped together by means of a plurality of screws or bolts which are placed in a circle, the diameter of which is only slightly smaller than the inner diameter of the brush section. In this instance, the screws, or bolts, both during and after the assembling of the broom will cooperate to keep the brush section in proper place in relation to the brush back, and at the same time the bolts afford a simple and reliable connection between the clamping element and the brush back and, moreover, a connection which may easily be released and be reestablished on occasion, namely when the brush material is to be exchanged.

The invention also relates to a method of assembling rotary brushes as above defined. In this method, the bristles are first mechanically assembled to form a substantially plane annular brush section which is placed coaxially with a brush back and in contact with a flange portion thereof at the free edge of its guiding face, and the clamping element is placed across the inner portion of the brush section and is tightened towards the base face of the brush back until said inner portion is firmly engaged with said base face. In this method, it is an essential advantage that substantially plane brush sections are used because such brush sections may easily be manufactured mechanically. If desired, the plane brush section could, by a special operation, be pressed into a required cup-shape or conical shape. In the method explained, the necessity of such special operation may be dispensed with as the clamping element is utilized not only for retaining the cup-shaped brush section in the brush back but also for imparting the required cup-shape to the brush section.

Finally, the invention also relates to a tool for use in carrying out the method explained above. This tool comprises a base plate and a plurality of guiding pins which are perpendicular to said base plate and are preferably threaded for receiving nuts to perform a clamping pressure. The location of said pins advantageously conforms to that of some of the screw or bolt holes of the brush back and the base plate is preferably provided with a plurality of openings, the location of which conforms to that of at least some of the remaining screw or bolt holes of the brush back, and the size of which is such as to allow mounting and tightening of screws or bolts with nuts in said holes.

From the following explanation it will appear that by using such tool it is extremely easy to assemble a brush section with the associated brush back because the guiding pins of the tool ensure the correct location of both the clamping element and the brush section in relation to the brush back proper. A corresponding effect could be obtained without using guide pins by using sufficiently long and sufficiently threaded clamping bolts between the brush back and the clamping element but the presence of such excessively long clamping bolts would be substantially inconvenient in the finished brush.

The invention is more fully explained in the following description with reference to the accompanying drawing, in which

FIG. 1 shows an embodiment of a cup-shaped rotary brush according to the invention, viewed in axial section, and somewhat diagrammatically, and

FIG. 2 is an illustration similar to FIG. 1 of the same brush while being assembled by means of a tool according to the invention.

The brush back of the rotary brush illustrated in FIG. 1 comprises principally a plane circular plate 1 which along its outer periphery is provided with an annular guide ring expanding downwardly into a frusto-conical flange 2. This plate is provided with a central opening 3 which may be so large that the plate almost assumes the form of a plate ring. The plate 1 may be provided with further openings, as illustrated, to permit the attachment of the plate to a handle. Further, the plate 1 has an annular series of bolt or screw holes 4 for receiving, by way of example, twelve assembling bolts 5 having conical heads 6 located in corresponding conical countersinkings in the top side of the plate 1. The said bolts 5 extend through holes 8 in a clamping element consisting of a circular plate ring 9, the outer diameter of which is of substantially the same size as the outer diameter of the plate 1. By means of the nuts 7 of the bolts 5, the clamping element 9 may be tightened more or less firmly towards the plate 1 to clamp an annular brush section against said plate. The brush section comprises a great number of hair-pin shaped bristles 10, the bends or central portions of which are secured in the groove of a ring 12 having a U-shaped cross-section by means of a number of peripheral wires 11. The ring 12 consists of comparatively thin plate material. The said ring surrounds, without material clearance, the circular row of bolts 5 whereby the bolts prevent a radial displacement of the brush section in relation to the brush back. A circular row of prongs 13, projecting from the upper side of the circular base plate 4, inside the cavity of the outer periphery, serve to inhibit rotation of the brush material relative to the clamping element 9.

It will be seen that in the embodiment, shown in FIG. 1, of the cup-shaped rotary brush, the clamping element 9 serves not only for clamping the inner portion of the annular brush section against the base face of the brush back, i.e. the underside of the plate 1, but also for pressing the bristles 10 downwardly to firmly engage the guiding face formed by the inner side of the guide ring 2, the position of the contact points between the guide ring and the bristle material determines the inclination of the bristles in relation to the axial direction of the broom.

The assembling of the brush shown in FIG. 1 may be effected by means of the tool illustrated in FIG. 2. This tool consists substantially of a circular base plate 14, the diameter of which is slightly smaller than the outer diameter of the clamping element 9, and a circular row of threaded guiding pins 15 perpendicular to said base plate; the location of the pins 15 conforming to the location of some of the bolt holes 4 in the base plate 1 of the brush back. The other locations conforming to the location of the remaining bolt holes 4 in the base plate 1 have corresponding locations in the base plate 14 of the tool provided with openings 18 which are large enough to permit the mounting of nuts on bolts 5.

The method of using the described tool is easily understood by reference to FIG. 2. First the clamping element 9 is so placed on the upper side of the base plate 14 of the tool that the guiding pins 15 extend upwardly through some of the bolt holes 8 of the clamping element. The remaining bolt holes 8 will then be located centrally above the wide openings 18 of the base plate. A separately manufactured annular, substantially rigid plate in section 10, 11, 12 (the ring 12 of which need not be compressed into its final U-shaped cross-sectional shape) is then laid down on the upper side of the clamping element 9. During this operation, the pins 15 serve as guides to safeguard the correct radial location of the brush section in relation to the clamping element. Thereupon, the brush back 1, 2 is carried down on the pins 15 until the free edge of the flange 2 rests on the bristles 10. In the bolt holes 4, not occupied by the guiding pins 15, screws or bolts 5 may have been inserted in advance as shown in FIG. 2.

By means of nuts 17 and washers 16 on the threaded guiding pins 15, pressure is exerted on the upper side of the plate 1 so that the latter is forced downward into en-
gagement with the ring 12 of the brush section and occupies almost a position shown in FIG. 1. This being completed, the bolts 5 project through the holes 8 and the openings 18 thereby affording the required space for screwing the nuts 7 on the lower ends of the bolts and for tightening the nuts against the lower side of the clamping ring 9.

The brush is now preliminarily assembled and may be removed from the mounting tool by screwing off the nuts 17 thereof and pulling out the guiding pins 15 from the bolt holes 4, 8. Then, the remaining assembling bolts 5 may be introduced and the nuts 7 screwed on thereto. The ultimate compression of the ring 12 of the brush section need not be performed until all the assembling bolts 5 have been brought into place.

It will be understood that "flange" is used herein to broadly indicate a member, or element, depending from the brush back.

It will be obvious that the invention is not limited to the embodiments shown in the drawing. By way of example, the inner diameter of the ring 12 of the brush section need not fit tightly round the assembling bolts 5 but may, if so desired, be of such size that the ring is located in the corner between the base plate 1 of the brush back and its flange 2, so that by means of the clamping element 9 the ring 12 is tightened towards both of these parts. In such case the brush section may, if desired, be converted into a conical shape before mounting in the brush back. Other modifications in structural detail will appear to those skilled in the art of producing rotary brushes 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 brush for street sweepers, comprising a brush back, clamping means underlying said back and spaced therefrom, a substantially circumferentially continuous member attached to said back and located below and spaced from said back, said member surrounding said clamping means and being spaced therefrom, a continuous section of brush material having an inner portion held between said brush back and said clamping means and an outer portion passing through the space between said continuous member and said clamping means extending downwardly and upwardly therefrom.

2. A rotary brush for street sweepers, comprising a brush back having a downwardly extending substantially circumferentially continuous flange portion, clamping means underlying said brush back and spaced therefrom, an easily removable annular section of brush material having an inner portion gripped between said brush back and said clamping means and an outer portion passing through the space between said flange portion and said clamping means and extending downwardly from said flange and at least three fastening means spaced from the axis of the brush in proximity to said inner portion of brush material releasably holding said clamping means to the brush back.

3. A rotary brush for street sweepers, comprising a brush back having a downwardly extending continuous flange, clamping means underlying said back and spaced therefrom, an easily removable annular section of brush material consisting of bristles bent into hair-pin shape having its inner periphery clamped between said back and said clamping means and its outer periphery extending between the clamping means and the flange and downwardly beyond said flange and at least three fastening means spaced from the axis of the brush in proximity to said inner periphery releasably holding said clamping element to said back, said brush material being secured to said back by tightening said clamping means toward said back so as to force the brush material downward and into firm engagement with said flange.

4. A cup-shaped rotary brush for street sweepers, comprising a brush back having a downwardly extending frusto-conical flange, a clamping element underlying said back and spaced therefrom, an easily removable annular section of brush material consisting of bristles bent into hair-pin shape having its inner periphery clamped between said back and said clamping means and its outer periphery extending between the clamping means and the flange and downwardly beyond said flange and at least three fastening means spaced from the axis of the brush in proximity to said inner periphery releasably holding said clamping element to said back, said brush material being secured to said back by tightening said clamping means toward said back so as to force the brush material downward and into firm engagement with said flange.

5. A rotary brush for street sweepers, comprising a separable brush back having a downwardly extending continuous flange, separable clamping means underlying said back and spaced therefrom, a separable easily removable annular section of brush material having its inner portion clamped between a metal ring which is clamped between said back and said clamping means and having an outer portion passing through the space between said flange and said clamping means and extending downwardly from said flange, means projecting into said annular section of brush material clamping said inner portion of brush material and restricting its rotation relative to said back and at least three fastening means spaced from the axis of the brush in proximity to said inner portion of brush material releasably holding said clamping means to said back.

6. A rotary brush for street sweepers, comprising a brush back having a downwardly extending continuous flange, clamping means underlying said back and spaced therefrom, an easily removable annular section of brush material having its inner portion clamped between said back and said clamping means and having an outer portion passing through the space between said flange and said clamping means and extending downwardly from said flange and at least three rod-like means positioned substantially in a circle on said back having its center at the axis of the brush and having a diameter only slightly less than the inner diameter of said annular section of brush material coaxially positioning said brush material and releasably holding inner portions thereof clamped between said back and said clamping means.

7. A cup-shaped rotary brush for sweepers, comprising a circular brush back having a downwardly extending frusto-conical flange, an annular clamping means underlying said back and spaced therefrom, said clamping means having substantially the same outer diameter as the face of said back and being provided on its outer periphery with upwardly extending prongs, an easily removable annular section of brush material having its inner portion clamped between said back and said clamping means and having an outer portion passing through the space between said flange and said clamping means and extending downwardly from said flange to form a frusto-conical crown of brush material, and at least three rod-like means positioned on said back in a circle having its center at the axis of the brush and having a diameter only slightly less than the inner diameter of said annular section of brush material releasably holding said clamping means to said back and clamping said inner portion of brush material therebetween.

8. A method of producing a rotary brush, comprising the steps of (1) forming a circular brush back with a downwardly extending flange, (2) assembling an annular section of brush material with said portion having a diameter less than the innermost diameter of said flange and an outer diameter such that the brush material extends below said flange when said inner portion is positioned within said flange and against said back, and (3) coaxially and releasably clamping said inner portion of brush material within said flange between a circular clamping means and said back with at least three fastening
means spaced from the axis of the brush in proximity to said inner portion of brush material to force the outer portion of said brush material downward between said flange and said clamping means.

9. A rotary brush for street sweepers, comprising a circular brush back, downwardly depending side walls attached to the outer periphery of said back, an annular section of brush material having an inner diameter less than the innermost diameter of said side walls and an outer diameter such that said bristles extend below said side walls when the inner portion of said bristles are positioned within said side walls and against said back, an annular means binding the inner end of said annular section of brush material, a clamping element having maximum dimensions greater than the inner diameter of said section of brush material, and at least three fastening means spaced from the axis of the brush in proximity to said inner portion of brush material releasably clamping said annular binding means between said brush back and said clamping element.

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