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W. A. LOMBARDI

2,762,073

BRUSH CONSTRUCTION

Filed July 26, 1951

FIG. 2.

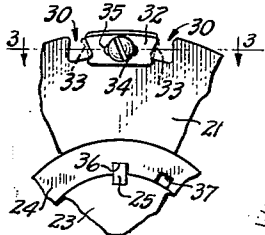


FIG. 3.



FIG. 4.

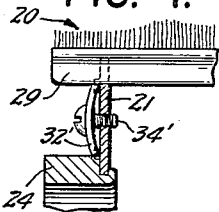


FIG. 1.

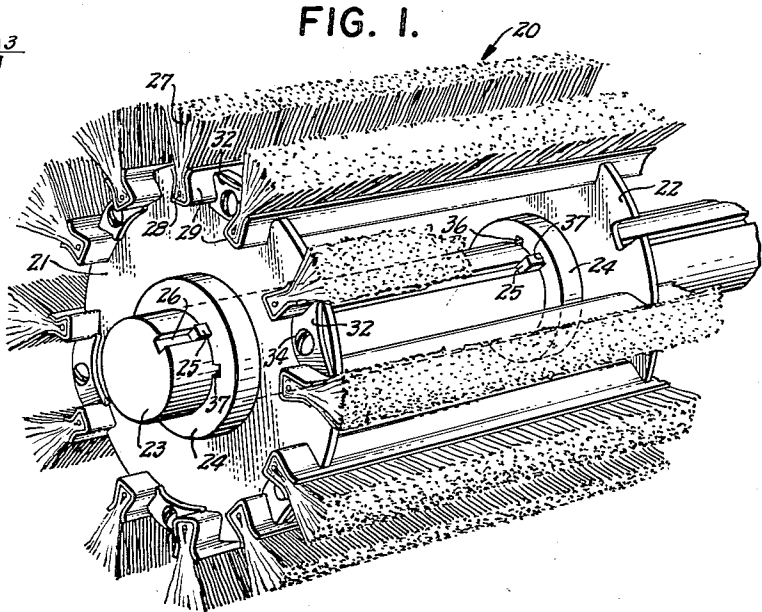


FIG. 5.

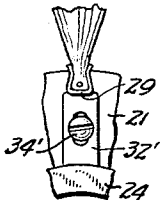


FIG. 6.

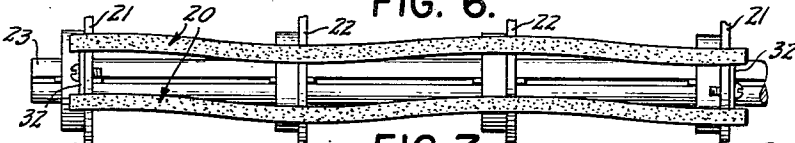


FIG. 7.

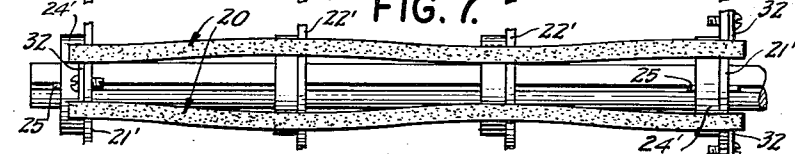


FIG. 8.

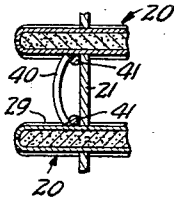


FIG. 9.

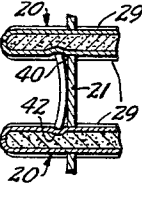


FIG. 10.

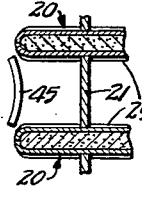


FIG. 11.

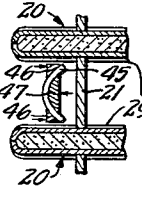


FIG. 12.

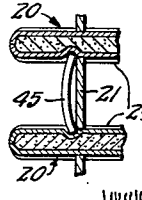


FIG. 13.

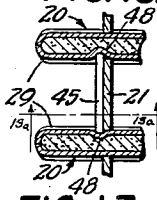


FIG. 13a.

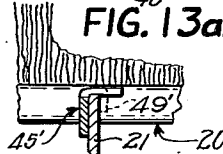
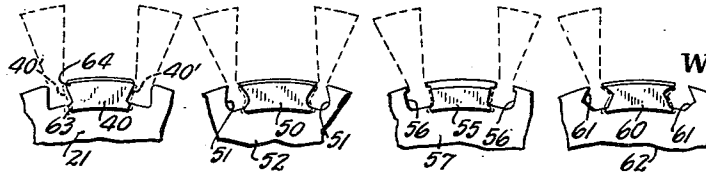


FIG. 14.

FIG. 15.

FIG. 16.

FIG. 17.



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2,762,073

BRUSH CONSTRUCTION

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18 Claims. (Cl. 15—183)

My invention relates to brush-mounting means and to a brush assembly utilizing such mounting means.

It is an object of the invention to provide improved means of the character indicated.

It is another object to provide improved deformable means for forcibly retaining bound brush strips in a brush assembly.

It is a further object to provide simplified constructions, utilizing the inherent resiliency and deformability of the materials, for securely and permanently retaining brush strips in a brush assembly.

It is a further object to provide improved clip means for retaining assemblies of the character indicated.

It is a general object to meet the above objects with constructions involving a minimum of assembly effort and labor and at the same time a maximum of holding security, smoothness of contour, and neat appearance.

Other objects and further features of the invention will be pointed out or will occur to those skilled in the art from a reading of the following specification in conjunction with the accompanying drawings. In said drawings, which show, for illustrative purposes only, preferred forms of the invention:

Fig. 1 is a fragmentary view in perspective of a brush assembly incorporating features of the invention; Fig. 2 is an enlarged fragmentary end elevation of brush-retaining means employed in the construction of Fig. 1;

Fig. 3 is a top view of the fragment of Fig. 2, partly broken-away and sectioned in the plane 3—3 of Fig. 2;

Fig. 4 is a fragmentary sectional view of a modified adaptation of the retaining means of Figs. 2 and 3;

Fig. 5 is a left-end view of the modification of Fig. 4;

Figs. 6 and 7 are fragmentary plan views showing with exaggeration alternative structural features in the assembly of Fig. 1;

Figs. 8 to 13, inclusive, are enlarged fragmentary sectional views illustrating cooperation between retaining means and brush binders retained thereby, for several modifications of retaining means; and

Figs. 14 through 17 are fragmentary end views illustrating end-contouring for the retaining means of the previous figures for various brush-binder configurations.

Briefly stated, my invention contemplates novel clip means for retaining brush strips in slotted openings in which they may be initially loosely retained. In all forms of the invention, the clip means is merely a metallic strip, which in an arched position need not interfere with the free insertion of brush binders in the slots in a first assembly operation, but which when deformed from said arched position may spread or elongate to effectively confine the cross-section of the brush-receiving slots, so that the brush binders will be securely held in place by a squeezing action between part of the slot opening and the clip means. Numerous modifications of the clip are described; in all forms, the clip may produce a spreading action, whether applied differentially, as between adjacent

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brush binders, or unilaterally, as between a fixed reference point and the bottom of a brush binder.

Referring to Figs. 1, 2, and 3 of the drawings, my invention is shown in application to an elongated generally cylindrical brush-assembly configuration. The assembly may comprise a plurality of elongated brush-strip assemblies 20 received and located in a plurality of longitudinally spaced mounting members 21—22, carried on a central shaft 23. The mounting members 21—22 may be plates welded directly to the shaft 23, but, in the form shown, each mounting member 21—22 is provided with a central boss or hub 24 locked to the shaft 23, as by welds or by key means 25 in a single keyway 26. Each of the brush strips 20 may be a preassembled unit comprising bristles 27 wound around a core 28 and held clamped around the core by means of a crimped binder 29. Depending upon the rolling operation employed in crimping the strip assemblies 20, the binder 29 may have one of a number of cross-sections, some of which are illustrated and further described in connection with Figs. 14 to 17.

In the form shown in Figs. 1 to 3, the retained part of the brush binder 29 is of generally trapezoidal shape and may be retained in a similarly shaped brush-receiving slot or opening 30, there being one such slot 30 for each intersection of a brush strip with a mounting plate 21—22. The peripheries of the plates 21—22 may thus be provided with an angularly spaced plurality of such slots 30, and each such slot 30 may be characterized by a mouth at which the slot walls converge; the extent of wall convergence may define a minimum slot width less than the maximum bulbous extent or width of the brush binder 29, so that the slots 30 may of themselves retain the brush binders 29 against radial loss. I prefer that each slot opening 30 shall have a cross-section of greater area than the inserted cross-sectional area of the brush binder 29 to be received therein. Brush binders 29 may thus be loosely retained and therefore readily inserted longitudinally into the slots 30.

In accordance with the invention, I provide novel clip means reacting between a reference point carried on a brush mount or plate 21 and a part of the brush binder itself, so as effectively to constrict the brush-receiving slot and at the same time to crowd the brush binder 29 against one or more walls of the slot. In the forms shown in Figs. 1 to 3, such clip means comprises an arched strip of metal 32 reacting between every other adjacent brush binder 29. Thus, each fixed reference point for the form shown in Figs. 1 to 3, may be considered to be an adjacent brush binder, and clip action will be seen to be differentially applied between adjacent binders. The clip 32 may be formed with end contours to conform generally with the brush binder contour to be engaged, and the total extent of the clip when flat preferably exceeds the normal span between the reference point and the brush binder side to be engaged. This design factor is illustrated in Fig. 2, in which the flattened limits of the clip 32 are identified by dotted lines 33 projecting over adjacent walls of adjacent slots 30 and therefore effectively limiting the cross-sectional area of the slots 30.

In application of the clip means 32 to the brush assembly, the clip may be of springy material and initially formed flat, a tool being required to resiliently deform the clip 32 into an arch to retract or reduce its total effective span and to permit ready longitudinal insertion between adjacent brush binders 29; thus handled, the clip 32 would be released after insertion, and allowed to seek its flattened position. However, in the form shown, I initially form the clips 32 in an arched shape as shown in Fig. 3; thus formed, the total effective span of the clip 32 may be sufficiently reduced that the clip 32

offers no substantial impediment to the longitudinal insertion of brush binders 29 in slots 30. Various means may be employed for compressing the arch of the clip 32 after insertion of brush binders, and in the form shown I have employed a screw 34 passing through an opening 35 in the clip 32 for threaded engagement with the plate 21. Opening 35 may be slotted to allow for size variations in adjacent binders 29. It will be appreciated that, whether the clip 32 is formed of springy or of relatively non-resilient material, a setting of the screw 34 will result in elongation of the clip 32 and in locking adjacent brush binders 29 in their respective slots.

As indicated generally above, my clip means involves reaction between a reference point and the brush binder 29 to be secured; in Figs. 1-3, the action is differentially applied between adjacent binders 29; and in Figs. 4 and 5, the action is unilateral, employing a fixed reference point on the mounting means 21. The fixed reference point may be a lug struck out of the plate 21; or, as in Figs. 4 and 5, the hub 24 of holder 21 may provide the fixed reference point, and the clip 32' may react between the hub 24 and a brush binder 29. Thus, the action may be radial and against the bottom of the brush binder 29. Screw means 34' may again take into the mounting plate 21 in order effectively to constrict the slotted opening in which the brush binder 29 is received, and the fully anchored brush binder of Figs. 4 and 5 will be wedged against the converging walls of the slot in which the brush binder is received.

It will be appreciated that with the clip means described, particularly with the clip means of Figs. 1 to 3, the action produced by any one clip 32 may serve to anchor the two adjacent brush binders. Thus, clips need only be applied at every other space between brush binders. The clips also anchor the binders 29 against longitudinal movement and therefore need not be provided at every holder 21-22.

In Figs. 6 and 7, I show how further economies may be effected in the employment of brush clips 32, without impairing the security of the complete assembly. In the configurations of Figs. 6 and 7, the brush strips 20 span more than three longitudinally spaced mounting members or plates 21-22, and the number 22 identifies plates intermediate the end plates 21. Actually, the clip means 32 described may adequately secure the entire assembly if applied only on the end plates 21. Plates 22 intermediate the ends of the assembly may adequately secure the brush strips 20 if deliberate misalignment is introduced as between adjacent plates 21-22, 22-22, and 22-21. In the form shown in Fig. 6, the slotted peripheries of all plates 21-22 may be the same or substantial duplicates of one another, and the deliberate misalignment may be introduced by keying or otherwise securing alternate mounting members to the shaft 23 in slightly angularly spaced relation. Such keying may be effected with duplicate mounting members (that is, all mounting plates 21-22 may be substantial duplicates of each other) by providing two key slots for the hub of each mounting member, as shown in Figs. 1 and 2. In the case of the mounting member 21, the first such key slot 36 is utilized for the key 25, the second key slot 37 not being utilized; in the case of the adjacent plate member 22, the first key slot 36 is not utilized, and the key 25 is received in the second key slot 37. The spacing between the first and second key slots 36-37 may be of angular extent slightly less than or slightly greater than an integer multiple of the uniform angular spacing of slots 30, and the extent of departure of spacing slots 36-37 from such integer multiple preferably exceeds twice the greatest expected lateral clearance or tolerance between an inserted brush binder and its slot opening 30.

With the described construction, as assembled in Fig. 6, brush binders may be freely longitudinally inserted in the first two retaining plates 21-22 and thereafter fed

through slot openings 30 in remaining supporting plates 22-21 upon gentle bending of the strip and upon light hammer-tapping at the end of the brush strip. The resultant assembly will have a wavy appearance, as shown very much exaggerated in Fig. 6, but the inherent resiliency and stiffness of the brush binders will securely retain the assembly against rattling and against undue looseness at the intermediate support stations 22.

In the arrangement of Fig. 7, the brush binders 20 are held against undue looseness and rattling at the central stations 22' by a suitably indexed location of adjacent slotted openings 30 in the various supporting members 21'-22'. In accordance with the arrangement of Fig. 7, the slotted peripheries of all plates 21-22 may be essential duplicates of one another, but the spacing is deliberately non-uniform. Such spacing may be characterized by a relatively wide angular interval between a first two adjacent slot openings 30, by a relatively narrow angular space between the next two adjacent slot openings 30; and so on, alternating between narrow and wide spacings. The difference between the narrow and wide spacings between slot openings 30 preferably exceeds twice the maximum lateral clearance to be expected between a brush binder 29 and a slot opening 30.

Assembly of the Fig. 7 arrangement is effected upon threading any two adjacent brush strips 20 alternately through narrow and wide spacings of slots 30 in successive mounting plates 21'-22'. For example, in the fragment shown in Fig. 7, proceeding from left to right, at left-end plate 21', the two strips 20 pass first through slots 30 that are narrowly spaced; at the left intermediate plate 22', the spacing between slots 30 is relatively wide; at the right intermediate plate 22', the spacing between slots 30 is relatively narrow; and at the right-end plate 21', the spacing is relatively wide. The assembly of Fig. 7 will be appreciated as effecting the desired anti-rattling stressing of the brush strips 20 without resorting to special keying means, for the keys 25 need only be applied to widely spaced hubs, as at the end hubs 24' shown. The clip means 32 need only be applied at the end mounting members 21' for retention against longitudinal displacement and loss of strips 20; and I have shown the clips 32 to be applied at the narrow spacings between slots 30.

In Figs. 8 and 9, I show an alternative clip construction in which there need be no use of screw means or other retaining means to hold the clip in place. The clip 40 of Figs. 8 and 9 may have the same planform when flat as the clip 32 previously described, but the clip 40 is preferably of resilient material initially formed with an arch as shown in Fig. 8. When thus formed, the total span of clip 40 may permit free insertion between adjacent brush strips 20. Assembly of the clip 40 may proceed upon insertion of a suitable tool such as a fork having spaced tynes 41 or abutments to space the ends of clip 40 slightly from the plate 21. Upon compressing the span of the clip 40 toward the plate 21 by the same or another tool, the outer limits will be extended so as to cram the brush binders 29 outwardly against the remote walls of their respective slots 30. At the same time, adjacent binders 29 may become indented, as at 42. Once past the "dead center" position, in which the clip 40 is flat, further compression of the arch toward plate 21 will snap clip 40 into a negative arch, as shown in Fig. 9. In this position, the legs of the clip 40 will have been dug into the binders 29, and the clip will be braced against the plate 21. The tool projections or tynes 41 may be retracted at any time after the clip legs have sufficiently dug into the binders 29, as will be understood.

In Figs. 10 to 13, I show another clip construction in which no screw means or other anchorage is required. In this arrangement, the inserted clip 45 may also be arched and of resilient material, but the arch in the un-

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stressed condition is preferably in the reverse direction with respect to the direction shown for the clip 40 of Fig. 8. Insertion of the clip 45 against the mounting plate 21 involves use of a special tool having outboard members 46 and a central member 47 to develop a stressed negative arch in the clip 45, as shown in Fig. 11. When thus grasped, the clip 45 may be fully inserted between adjacent brush binders 29 until the legs of the clip 45 strike the mounting plate 21. The grip on the tool 46—47 may then be relaxed, and the inherent resiliency in the clip 45 will tend to draw the main body of the clip 45 against the plate 21.

If the brush binders 29 happen to be at a point of minimum width, then the inherent resiliency of the clip 45 may drive the clip 45 flat against the plate 41, producing anchoring indentations 48 in adjacent sides of adjacent brush binders 29, in the manner shown in Fig. 13. On the other hand, if the local sections of the brush binders 29 happen to be of greater than the minimum width, the inherent resiliency of clip 45 may be insufficient to drive itself flat against plate 21, and the parts may look as they do in Fig. 12. For appearance's sake, a light hammer blow against the arched clip in Fig. 12 may flatten the assembly, but it will be understood that, whether the clips are left in the position shown in Fig. 12 or in the position shown in Fig. 13, they may be equally effective in securing an assembly.

Figs. 11 and 13 may be considered illustrative of a further embodiment wherein the clip 45 is of relatively non-resilient material. The clip 45 may thus be formed initially with the curvature shown in Fig. 11 and driven to the home position shown in Fig. 13 in a simple squeezing operation so as to compress the arch of the clip 45 flat against the plate 21. If desired, the arch of clip 45 may be positively held against plate 21 by integrally forming the clip (see clip 45' in Fig. 13a) with an outwardly projecting tab 49, which may be initially formed in the laterally bent position shown in Fig. 13a, and which may be subsequently further bent around the other face of plate 21, as suggested by the dotted outline 49'.

It will be understood that the described anchoring means may be applied to a number of known brush-strip configurations. Several such configurations are shown in Figs. 14 to 17. In Fig. 14, the clip 40 of Figs. 8 and 9 is shown in solid outlines when in its arched condition, and the dotted outlines 40' represent the extended planform when snapped into home position of Fig. 9. In Fig. 15 I show a clip 50 suitably contoured to embrace adjacent sides of adjacent binders of pear-shaped configuration, as received in slotted openings 51 on a mounting plate 52. In Fig. 16, I show a clip 55 suitably contoured at its ends to embrace adjacent sides of adjacent brush binders of channel-shape configuration, such binders being received in slotted openings 56 of a mounting plate 57. In Fig. 17, a clip 60 is suitably contoured at its ends to embrace adjacent sides of adjacent brush binders of generally hexagonal configuration, as received in correspondingly shaped oversize slotted openings 61 in a mounting plate 62. It will be appreciated that the characteristic feature of all clips 40—45—50—55—60, whatever the brush binder shape, is such as to provide a recessed end contour defined (at each leg or end) by inner and outer projecting limits, as at 63—64 in the case of clip 40 in Fig. 14, the recess being intermediate these limits for the purpose of receiving a bulbous part of the brush binder.

It will be seen that I have provided extremely simple means for securely anchoring brush-strips in multiple-strip assemblies. The anchoring means is easy to apply, with a minimum of operations, and positive locking is assured at all points of support. The fully assembled article is of smooth and clean appearance, without presenting any snagging projections. Retaining clips of many proportions and natures have been shown, principally for the case of a differentially applied securing

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stress, but it will be understood that the various described actions are equally applicable to the case of unilaterally applied securing stress (i. e., between one brush binder and a fixed reference point on the mounting means 21—22).

While I have described my invention in considerable detail for the preferred forms shown, it will be understood that modifications may be made within the scope of the invention as defined in the appended claims.

I claim:

1. Brush-mounting means, including plate means with a brush-receiving slot opening on a part of the periphery thereof, an elongated brush binder of non-circular contour inserted in said slot, the slot opening being characterized by side walls converging toward the mouth of the opening and the opening having a cross-section of greater area than the inserted cross-sectional area of said brush binder received therein, said slot opening being characterized by walls conforming generally to the contour of said binder and by a mouth of lesser span than the maximum inserted width of said binder, whereby said brush binder may be loosely received in such slot opening in a first assembly operation, and deformable clip means between the slot opening and a reference point supported by said plate means, said clip means being deformable from a first shape characterized by a span between said reference point and in clearance relation with an adjacent part of said binder in the slot opening to a second shape characterized by a span greater than the spacing between said reference point and said adjacent side of the binder, whereby when deformed into said second shape said clip means may force the inserted binder against a wall of the slot opening for secure retention and orientation of the binder on said plate means.

2. Brush-mounting means according to claim 1, in which said plate means has a plurality of brush-receiving slot openings along the periphery thereof, and in which said clip means utilizes part of an adjacent binder in an adjacent slot opening as said reference point.

3. Brush-mounting means according to claim 1, in which said reference point is a fixed abutment on said plate means.

4. Brush-mounting means according to claim 1, in which said clip means comprises a metallic strip arched over its span, and means coacting between said strip and said plate means for compressing the arch, whereby said clip means may be effectively elongated.

5. Brush-mounting means according to claim 4, in which said clip means is relatively resilient and initially formed in arched shape.

6. Brush-mounting means according to claim 4, in which said clip means is relatively non-resilient, whereby after compression of said span there may be relatively little inherent tendency to open said span.

7. Brush-mounting means, including plate means having a brush-receiving slot opening along a part of the periphery thereof, the slot opening being characterized by lateral walls converging toward the mouth of the slot opening, the slot opening having a cross-section of greater area than the inserted cross-sectional area of a brush binder to be received therein, whereby a brush binder may be longitudinally received in such slot opening in a first assembly operation, fixed-abutment means on said plate means generally beneath the slot opening, and deformable clip means between said fixed-abutment means and the bottom of the slot opening, said clip means being deformable from a first shape characterized by a span between said abutment means and in clearance relation with the bottom of a binder inserted in the slot opening to a second shape characterized by a span between said abutment means and projecting further than the undeformed bottom of the inserted brush binder, whereby when deformed into said second shape said clip means may outwardly force said binder against the con-

verging sides of the slot opening for secure retention of the binder on said plate means.

8. Brush-mounting means, including plate means with a brush-receiving slot opening on a part of the periphery thereof; the slot opening having a cross-section of greater area than the inserted cross-sectional area of the brush binder to be received therein, whereby a brush binder may be longitudinally received in said slot opening in a first assembly operation, and a deformable clip comprising an arched span of resilient material, said clip being readily insertable between a reference point carried by said plate means and an adjacent part of the inserted brush binder when in said arched shape; whereby, in a compression of said span toward a "dead-center" position, said clip means may be elongated to a maximum extent in which said binder is locked in the slot opening with maximum force; and whereby, with further compression of said span beyond the "dead-center" position, said clip means may snap into a negatively arched shape for resilient retention of the inserted brush binder in the slot opening.

9. Brush-mounting means, including plate means with a brush-receiving slot opening on a part of the periphery thereof, the slot opening having a cross-section of greater area than the inserted cross-sectional area of the brush binder to be received therein, whereby a brush binder may be longitudinally received in said slot opening in a first assembly operation, and a clip of inherently resilient material having an effective span when flat in excess of the span between a reference point carried by said plate means and a near side of the inserted brush binder, whereby said clip may be deformed for ready insertion between the reference point and the brush binder and may resiliently tend to assume its elongated flat position to forcibly hold the brush binder in the slot.

10. Brush-mounting means, including plate means with a brush-receiving slot opening on a part of the periphery thereof, the slot opening having a cross-section of greater area than the inserted cross-sectional area of the brush binder to be received therein, whereby a brush binder may be longitudinally received in said slot opening in a first assembly operation, and a clip of inherently non-resilient material having an effective span when flat in excess of the span between a reference point carried by said plate means and a near side of the inserted brush binder, whereby said clip may be deformed for ready insertion between the reference point and the brush binder and may be subsequently bent back to assume its elongated flat position to forcibly hold the brush binder in the slot.

11. In a brush assembly of the character indicated, a plurality of longitudinally spaced circular mounting members having circumferentially spaced slotted openings on the peripheries thereof; brush binders of non-circular contour in said slotted openings, said slot openings having cross-sections of contour conforming generally with the inserted-binder contour and of greater area than the inserted cross-sectional area of the brush binders received therein, whereby said brush binders may be longitudinally received in such slot openings in a first assembly operation, and deformable retaining clips between each pair of adjacent brush binders in the end circular mounting members, said clips being deformable to squeeze adjacent binders apart and against the adjacent retaining slot walls for secure orientation of said binders.

12. In a brush assembly, a plurality of spaced mounting members having corresponding spaced brush-receiving slotted openings in the peripheries thereof, longitudinally extending brush binders in corresponding longitudinal openings of said mounting members, each said brush binder having a maximum cross-sectional area within the slotted openings in which it is inserted less than the cross-sectional area of the slots receiving each said brush binder, there being a deliberate misalignment

of slots for each inserted brush binder as between successive mounting members, said misalignment being deliberately in excess of the normal loose-fitting clearance of the inserted brush binder in said slots, whereby said binders must be forcibly bent for insertion in three or more adjacent mounting members, and deformable clip means carried by end mounting members for securely retaining the ends of inserted brush binders, said clip means being deformable from a first shape in clearance relation with an adjacent binder to a second shape in retaining relation with said adjacent binder.

13. A brush assembly according to claim 12, in which all said mounting members are circular and are keyed to a common shaft, whereby the deliberate misalignment may be effected by keyed orientation of slots of one circular mounting member in angularly displaced relation with respect to an adjacent mounting member.

14. A brush assembly according to claim 12, in which said mounting members are circular and are substantial duplicates of each other, the slot spacing between a first pair of adjacent slots being less than the slot spacing of an adjacent pair of adjacent slots, whereby upon assembly with a plurality of longitudinally spaced mounting members the wide slot spacing of one mounting member may be aligned with the narrow slot spacing of the adjacent mounting member and the next adjacent mounting member may be aligned with the first said mounting member, whereby a first inserted brush binder may be stressed in a first warp and the adjacent brush binder may be stressed in an opposite warp.

15. As an article of manufacture, brush-mounting means, comprising a circular plate with a plurality of brush-receiving, slotted openings on the periphery thereof, there being a greater space between two adjacent slot openings than between one of said two openings and the next adjacent opening, the difference between said spacings being at least as great as twice the anticipated maximum clearance characterizing the looseness of fit of a brush binder in one of said openings, and deformable clip means carried by said plate adjacent one of said openings for engagement with a brush binder inserted therein, said clip means being deformable from a first shape permitting slidable insertion of the brush binder in said one opening to a second shape in retaining relation with the inserted binder.

16. As an article of manufacture, brush-mounting means, comprising a circular plate with a plurality of uniformly angularly spaced brush-receiving slotted openings on the periphery thereof, central means for supporting said mounting means on a shaft, and two angularly spaced key means for keying said central means to a shaft, the angular spacing between said key means differing from an integer multiple of the uniform angular slot spacing by an amount at least as great as twice the anticipated maximum clearance characterizing the looseness of fit of a brush binder in one of said openings, and deformable clip means carried by said plate adjacent one of said openings for engagement with a brush binder inserted therein, said clip means being deformable from a first shape permitting slidable insertion of the brush binder in said one opening to a second shape in retaining relation with the inserted binder.

17. Brush-mounting means, comprising a plate with a brush-receiving opening in the periphery thereof; a brush binder in the opening, and a deformable securing clip on one side of said plate and coacting between said binder and a reference point supported by said plate, said clip integrally including tab means extending around a part of said plate and anchored against the other side of said plate.

18. In combination, a cylindrical brush assembly comprising a plurality of axially spaced circular plates each having a plurality of radially outwardly open brush-binder retaining slots spaced about the periphery thereof, two

elongated brush binders of non-circular cross-sectional contour loosely retained in corresponding adjacent slots of adjacent plates, the remote walls of said adjacent slots in one plate conforming substantially with the adjacent contours of said brush binders, and a deformable clip 5 between said binders at said one plate, said clip being deformable from a first shape characterized by a span in clearance relation with adjacent sides of said binders at said one plate to a second shape characterized by a span greater than the spacing between adjacent sides of said binders, whereby when deformed into said second shape said clip may laterally force said adjacent binders against said remote walls for secure retention and orientation of both said binders at said one plate.

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