April 26, 1938. E. P. KRANZFELDER 2,115,026

METHOD OF MAKING AND BRUSH FOR CLEANING BOILER AND OTHER TUBES

Filed March 16, 1933

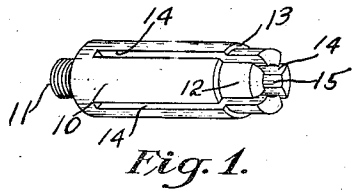


Fig. 1.

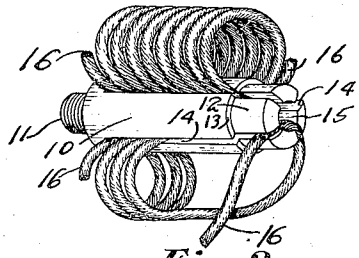


Fig. 2.

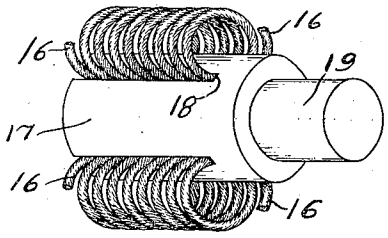


Fig. 3.

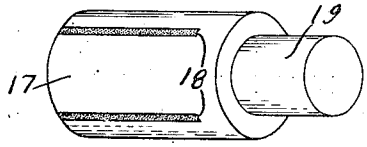


Fig. 4.

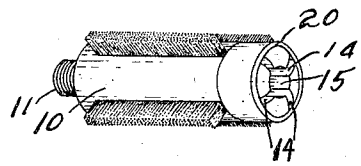


Fig. 5.

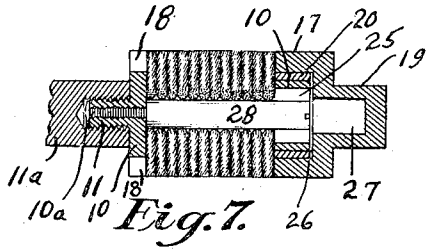


Fig. 7.

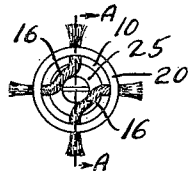


Fig. 6.

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UNITED STATES PATENT OFFICE

2,115,026

METHOD OF MAKING AND BRUSH FOR CLEANING BOILER AND OTHER TUBES

Edgar P. Kranzfelder, United States Navy

Application March 16, 1933, Serial No. 661,116

23 Claims. (Cl. 300—21)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

My invention is an improvement on the invention of Guysbert B. Vroom, a commander in the United States Navy who, in the practice of his invention, provided a hole through his round brush body for each bristle unit; inserted such body in a fixture; laced a length of wire or other rope through openings in said fixture and body, the length of the rope portion on the outer surface of said fixture being determined by the fixture; severed flush with the outer surface of said fixture the projecting portions of the laced rope; and removed the thus formed and constructed brush from the fixture. This severing permitted the unlaying of the strands of each rope portion only at its ends which formed bristle units, projecting the desired distance from the opposite ends of the holes. I have found that this lacing is tedious and leaves each bristle unit separately spaced from those in its row and leaves the free ends without lateral support from its fellows.

My invention provides the method and means for relieving such tediousness, laterally supporting by contact with its fellows each projecting bristle portion, and produces a less expensive, more durable and efficient brush adapted for all uses of which a tubular brush is capable, including cleaning boiler, condenser and other tubes.

This invention consists of the method of making a brush and the resulting brush, as the same will hereinafter more clearly appear in connection with the description of the brush.

My improved method and brush economically produces a very efficient brush which is readily refillable when the bristle units have become worn.

The invention is characterized by a brush body having a plurality of pairs of slots extending longitudinally thereof from one end and connecting the outer surface thereof with a central longitudinal opening therein.

My invention is further characterized by wire or other rope adapted to form bristles and which rope is forcibly coiled into the open end of each pair of slots, a coil at a time, or the coils may be formed of the desired number and then inserted into each pair of slots. Each coil is of a definite diameter such that the portion of the coils projecting without the brush body may be trimmed to form continuous rows of bristle units of the requisite length extending throughout a desirable length of such slots.

This invention is further characterized by said bristle units being clamped and held in firm lateral engagement with their fellows in and with the walls of their respective slots.

In the drawing, illustrating two optional forms of my invention, and in which like characters of reference indicate the same parts:

Fig. 1 represents a perspective view of a brush body constructed in accordance with my invention;

Fig. 2 is a similar view thereof illustrating the coiling of the rope thereon;

Fig. 3 is a perspective view of a brush body inserted in its sizing holder and having its rope bristles coiled therein;

Fig. 4 is a perspective view of the sizing holder after the external coiled rope portions have been severed flush with the surface of the holder;

Fig. 5 illustrates the finished brush removed from the holder shown in Fig. 4 and of the type shown in Figs. 1 and 2;

Fig. 6 is an end view of a slightly modified form of the brush;

Fig. 7 is a longitudinal central vertical sectional view of the brush shown in Fig. 6, inserted in its sizing holder which is shown in like section.

With reference to Figs. 1 to 5, inclusive, the brush body 10 comprises a relatively long cylindrical body having projecting centrally from one end a threaded cylindrical portion 11 of reduced diameter. The opposite end of the body 10 is provided with a shoulder 12 of reduced diameter and relatively narrow, terminating in a shoulder 13. Centrally in the shouldered end of the body 10 is formed a cylindrical opening 15 extending substantially the length of the body 10.

In the shouldered end of brush body 10 are formed a plurality of pairs of relatively narrow radial open slots 14 extending through the central opening 15, through the outer surface and longitudinally of the brush body 10 to a point near the opposite end of said body. The relative diameters of opening 15 and of the brush body 10 afford relatively thick walls for brush body 10 and relatively wide faces for the walls of slots 14. The width of the slots 14 is substantially the diameter of the wire or other rope 16 adapted to form the bristle units. The depth of these slots 14 from the shoulder 13 to the bottom of slots 14 is a multiple of the diameter of rope 16 when its coils are tightly pressed together.

The portions of body 10 intermediate slots 14 are key-stone shaped. About the alternate key-stone shaped portions of body 10 are respective coiled portions of the rope 16. These coiled portions may be formed, one coil at a time, as shown in the lower portion of Fig. 2, by a portion of rope 16 being forced into the open end of adjacent portions of opening 15 and slots 14 and drawing

the rope therethrough until its outer portion forms a coil of the desired diameter. The requisite number of said coils are likewise formed about alternate key-stone shaped portions of brush body 10 and severed from the length of rope 16.

However, the requisite number of coils may be preformed and severed from rope 16 and a portion of the thus formed coil forced into the open end of a pair of slots 14 and the intervening portion of opening 15, the component coils being held together until they all are in position about the key-stone shaped portion of brush body 10.

When each alternate key-stone shaped portion of brush body 10 is surrounded by a coil of rope 16, formed in accordance with either of these methods, collar 20 is forced over the shoulder 12 of body 10 and against shoulder 13 thereof. In such position, collar 20 presses the coils tightly together in their respective slots 14.

The coils of rope 16 are of sufficient diameter to admit of the severance of the surplus portion of such coils to form bristle units of the required length projecting from each slot 14. This severance is then accomplished and the bristle unit trimmed into a substantially uniform brushing surface.

The bristle units are securely held in their brushing positions by the tightness with which the side walls of slots 14 engage the portions of rope 16 therein, and by the force with which ring 20 clamps the rope portions longitudinally in slots 14, as well as by the sharp bends of the rope portion at the interior corners of the key-stone-shaped portion of body 10.

The length of brush body 10 and the depth of slots 14 afford some outward spring to the key-stone-shaped portions of body 10 when the coils are inserted or formed thereabout, and the collar 20, when in position, prevents such spring and insures the rigid holding of the rope portion between the walls of slots 14.

In the instance shown in Figs. 3, 4 and 7, a sizing holder is provided. This holder is provided with a cylindrical body 17 of a diameter coincident with the desired uniform cleaning surface of the bristle unit. Centrally in one end of the holder 17 is formed a cylindrical opening 26 of the length and diameter of the brush body 10. In said open end of said holder 17 and through the walls thereof is formed a longitudinal slot 18 adapted to accommodate each row of bristle units. The opposite end of holder 17 is provided with a central cylindrical projection 19. In the bottom of opening 26 is a cylindrical central opening 27 extending within the projection 19 and adapted to freely receive the threaded projection 11 of the brush body which is inserted into opening 27 with its projection 11 occupying opening 27, with its slots 14 registering with slots 18 of the holder 17. The coils of rope 16 may then be formed or inserted in each of registering slots 14, 18 in either of the ways heretofore stated. The collar 20 is then forced into its position heretofore explained. Projection 19 of holder 17 is then secured in the jaws of a grinder or other rotatable cutting machine and the surplus portions of the coils of rope 16 are trimmed to a cleaning surface substantially uniform with the outer surface of sizing holder 17. The completed brush of Fig. 5 may then be withdrawn from holder 17 for use when a suitable operating member 11a is screwed upon threaded projection 11.

In the instance shown in Fig. 7, the slots 18 in holder 17 are of a width readily receiving the coils of rope 16 formed and associated with the brush body as described in connection with Fig. 2. The brush body containing such coils may then be inserted, with the collar 20 end first, into opening 26 of holder 17 with its coils of rope 16 occupying slots 18 of holder 17. The surplus portions of the coils may then be removed as previously described, and the finished brush removed from the holder.

The relatively small structural differences of the brush of Figs. 6 and 7 will now be described.

With the same diameter and other construction features of brush body 10 heretofore described, the present illustrated form of my invention is provided with a central longitudinal opening 25 which differs from opening 15 only in being of substantially larger diameter, and the bottom of said opening 25 is provided with a central longitudinal screw threaded opening 10a. The wall of this brush body is relatively thinner, as are also the walls of slots 14.

The coils of rope 16 may be formed and associated with the brush body of Figs. 6 and 7 in either of the manners heretofore stated. A stud screw 28 is then forced between the portions of the coils of rope 16 within opening 25 and its threaded portion engaged in opening 10a. Such insertion of screw 28 forms an outward crimp in the portion of each component turn of each of the coils of rope 16 between the sharp bends at the inner corners of the keystone-shaped portion of body 10 embraced by its respective coil of rope 16. This affords a very firm securement of the bristle portions of the coils to the brush body.

The surplus portions of the thus secured and crimped coils of rope 16 may be removed and a substantially uniform cleaning surface afforded the resulting bristle units in either of the manners heretofore explained.

The bristle units projecting from each slot 17 of the brush body, in each of these methods and structures, thus have their component strands very tightly compressed together and form a very rigid cleaning ridge of high cleaning efficiency and durability. When the bristle units or ridges have worn by long continued hard service, the worn bristle units may be readily removed and the brush body refilled with bristle units by either of the methods herein described.

It will be appreciated by those skilled in the art that the bristle units provided in accordance with my invention are exceptionally rugged, efficient and durable even when subjected to the hardest kind of commercial service; that the same may be easily refilled whenever worn below the point of efficiency; and that a brush body is produced of such cheapness, simplicity and durability under even the most severe conditions, and that the same will retain its high efficiency throughout the useful period of many refills of bristle units.

It will be understood that the above description and accompanying drawing comprehend only the general and preferred embodiment of my invention, and that various changes in construction, proportion and arrangement of parts may be made within the scope of the appended claims without sacrificing any of the advantages of this invention.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalty thereon.

Having so fully shown and described my invention that others may therefrom make and use

the same, what I claim and pray to secure by Letters Patent is:—

1. The method of making a brush, comprising the steps of taking a brush body having at least one pair of open slots extending from one end of the body and connecting at a point adjacent one surface of the body, inserting a coiled rope at a point intermediate its ends into the open end of the pair of slots with a portion of the coiled rope extending beyond the adjacent exterior surface of the body, and severing a part of said extending coil to form bristles of the coil portions projecting from the body.

2. The method of rebristling a brush body having at least one pair of open slots extending from one end of the body and connecting at a point adjacent one surface of the body, comprising the steps of inserting a coiled rope at a point intermediate its ends into the open end of the pair of slots with a portion of the coiled rope extending beyond the adjacent exterior surface of the body, and severing a part of said extending coil to form bristles of the coil portions projecting from the body.

3. The method of claim one characterized by the steps of associating a guide with the extending portion of the coiled rope, and guiding the execution of the severing step by said guide.

4. The method of claim two characterized by the steps of associating a guide with the extending portion of the coiled rope and the exterior surface of the body, and guiding the execution of the severing step by said guide.

5. The method of making a brush, comprising the steps of introducing bristle material in coils into the open ends of a pair of slots intersecting in the interior of the brush body and extending into the end of the brush body with a portion of the coils extending beyond the outer edge of said slots, and severing a part of the extending portion of the coils while maintaining the positions of the coil portions in the slots to form rows of bristles projecting from the body.

6. The method of rebristling a cylindrical brush body having a plurality of pairs of diagonal slots extending longitudinally through and open at the periphery and one end of the body and connecting at a point within the body, comprising the steps of laterally thrusting a portion of a rope at a point between its ends into a pair of said slots, drawing a portion of the rope through to the bottom of said slots, laterally thrusting a portion of a rope at a point intermediate its ends into the same pair of slots, drawing said inserted portion of the rope through such slots and against the side of the previous portion of the rope in such slots until a loop of the rope extends between the outer lateral edges of such slots, repeating the two last stated steps until such pair of slots is substantially filled with such coils of rope, likewise filling the remaining pair of slots, and severing a part of each extending coil to form rows of bristles of the coil portions projecting from the body.

7. The method of claim 5 characterized by the step of maintaining portions of the coils in contact with the portions of the body forming the opposite walls of said slots and with an inner portion of the body intermediate the pair of slots.

8. As a new article of manufacture for brushes, an integral member formed into a circular brush body having a plurality of pairs of slots extending diagonally therethrough from the periphery and one end of the body and adapted to intersect at a point near the center of the body, and a projection of lesser diameter than the body integral with and projecting from one end of the body and through which projection said slots extend through its periphery end.

9. As a new article of manufacture for brushes, an integral member formed into a cylindrical brush body having an integral projection of lesser diameter than and projecting centrally from one end of the body and a circular opening extending from the outer end of said projection and substantially through the body centrally and longitudinally thereof, and provided with a plurality of pairs of longitudinal slots extending diagonally therethrough from the end of said projection and the periphery of the body and into and to the bottom of said opening, said opening and slots extending substantially the length of said body, an angular longitudinal projection extending centrally from the other end of said body and of lesser diameter than said body, said body being provided with a recess at the bottom of said opening and extending into said last stated projection.

10. A brush including an angular member formed into a cylindrical body provided with longitudinal slots angular and transverse relative to and communicating with one another in the interior of and extending substantially throughout the length of the body, said slots leaving sector-like portions of the body between said slots, said portions having sharp corners at their inner edges, wire bristles doubled upon themselves to provide pairs of angularly arranged tufts, said pairs of tufts being seated in the slots with the tufts of each pair extending outwardly through adjacent slots and the connecting portions between said tufts pressed against said sharp corners on the sector-like portions, and means for holding the tufts against said corners.

11. A brush including an angular member formed into a cylindrical body provided with longitudinal slots angular and transverse relative to and communicating with one another in the interior of and extending substantially throughout the length of the body, said slots leaving sector-like portions of the body between said slots, said portions having sharp corners at their inner edges, wire bristles doubled upon themselves to provide pairs of angularly arranged tufts, said pairs of tufts being seated in the slots with the tufts of each pair extending outwardly through adjacent slots and the connecting portions between said tufts pressed against said sharp corners on the sector-like portions, and means intermediate the tufts on opposite sides of the brush body for holding the tufts against said corners.

12. A brush including an angular member formed into a hollow cylindrical body provided with longitudinal slots angular and transverse to and communicating with one another in the interior of and extending substantially throughout the length of the body, the portions of the body between the transverse slots being sector-like in cross section with sharp corners at their inner edges, wire bristles doubled upon themselves to provide a pair of tufts seated in the slots with one tuft projecting outwardly through each slot and the connecting portions between the tufts being adapted to be pressed against said sharp corners of the body, and means for holding the tufts against said corners.

13. A brush including an angular member formed into a hollow cylindrical body provided

with longitudinal slots angular and transverse to and communicating with one another in the interior of and extending substantially throughout the length of the body, the portions of the body between the transverse slots being sector-like in cross section with sharp corners at their inner edges, wire bristles doubled upon themselves to provide a pair of tufts seated in the slots with one tuft projecting outwardly through each slot and the connecting portions between the tufts being adapted to be pressed against said sharp corners of the body, and means intermediate the tufts on opposite sides of the brush body for holding the tufts against said corners.

14. A brush including a cylindrical body provided with longitudinal slots extending through one end of the body and terminating adjacent the other end of the body, said slots being at an angle to and communicating with one another, there being sector-like portions of the body between each pair of slots and defined corners at the edges of said portions, bristle units each having its central portion extending intermediate an adjacent pair of slots and impinging the inner corners of one of said portions and passing outwardly through and terminating a distance beyond said pair of slots; each bristle unit being supported by engagement with the walls of the slots through which the unit extends, which, with said corner impingement, is adapted to secure each bristle unit longitudinally in place, and means secured to the slotted end of the body portion for laterally retaining the bristles in place.

15. A brush including a hollow cylindrical body provided with means for attachment thereto of an operating member and longitudinal slots extending through one end of the body and terminating adjacent the other end of the body, said slots being at an angle to and communicating with each other and of a width and length adapted each to snugly receive a row of bristle units, there being sector-like portions of the body between each pair of slots and defined corners at the edges of said portions, bristle units each having its central portion extending intermediate an adjacent pair of slots and impinging the inner corners of said portion and passing outwardly through and terminating a distance beyond said pair of slots; the bristle units being in rows laterally supported by engagement with the walls of their respective slots through which the units extend, which support, with said corner impingement, is adapted to secure each bristle unit longitudinally in place, and means secured to the slotted end of the body portion for laterally retaining the bristles in place.

16. The brush of claim 15 characterized by means holding said bristle units into said impingement with said inner corners.

17. In a brush, the combination of a cylindrical body having a longitudinal opening extending centrally therein from one end of the body, a plurality of longitudinal slots extending through the periphery and said end of said body and into said opening, a plurality of bristles each having its two ends extending out through two of said slots to points above the periphery of the body and having a portion intermediate its ends occupying a portion of said opening, said bristles forming rows filling the major portion of said slots, means abutting the ends of said rows of bristles at the open ends of said slots to prevent axial movement of the bristles, and a cylindrical member removably secured in the center of said opening and engaging the intermediate portions of the bristles to prevent radial movement thereof.

18. In a brush, the combination of a cylindrical body having a longitudinal opening extending centrally therein from one end of and substantially throughout the length of the body, a central projection on the remaining outer end of the body and provided with means for the attachment thereto of another member, a plurality of longitudinal slots extending through the periphery and the open end of said body and into said opening to its bottom, a plurality of bristle units each having its two ends extending out through two of said slots to points above the periphery of the body and having a portion intermediate its ends occupying a portion of said opening with lateral surfaces of a portion of said bristles directly impinging against at least a portion of the walls of said slots and opening, said bristle units forming rows filling the major portion of said slots, means abutting the ends of the rows of bristles near the open ends of said slots to prevent lateral movement of the bristles relative to the brush body, and a cylindrical member removably secured to the unslotted end of the body and extending centrally through said opening with portions of whose periphery impinging directly upon portions of the lateral of the intermediate portion of each of the bristle units to prevent movement resulting in a variation in the length of the bristle units extending from the brush body.

19. In a brush, the combination of a cylindrical body having a longitudinal opening extending centrally therein from one end of the body, a plurality of longitudinal slots extending through the periphery and said end of said body into said opening, a portion of the periphery of said opening extending between the inner ends of adjacent ones of said slots with sharp corners extending along the inner edges of said slots, a plurality of bristles each having its two ends extending out through two of said slots to points above the periphery of the body and having a portion intermediate its ends occupying a portion of said opening with lateral portions of said bristle directly impinging against said corners, said bristles forming rows occupying a portion of said slots, means for preventing movement of the bristles longitudinally of the slots, and a member secured in the center of said opening and directly impinging against a portion of the inner surface of the intermediate portions of the bristles and maintaining said impingement for preventing radial movement of the bristles.

20. A brush including a cylindrical body, said body provided with a plurality of pairs of transverse communicating spaced apart slots with the slots forming each pair being of a depth substantially the length of said body, the portions of the body between the transverse pairs of slots being adapted to be sprung outwardly by the hereinafter stated tufts and cylindrical member, wire bristles whose intermediate portion is bent with their extremities toward each other to provide a pair of tufts, and seated in and filling the width of said slots with one tuft projecting outwardly at opposite ends through each pair of slots with said bent portions forming an open center within said body, and a cylindrical member thrust through the open center of said body provided by the communicating slots and bent portions for holding said tufts in seated relation to said sectors.

21. The brush of claim 20 characterized by

means for moving the portions of the body intermediate said pairs of slots inwardly at least to the extent of said outward spring for gripping the tufts between the walls of their slots and against a portion of the outer surface of said cylindrical member.

22. A brush including a cylindrical body, said body provided with longitudinal slots transverse to and communicating with one another, and leaving sector-like portions of the body between the transverse slots having sharp corners at their inner edges, wire bristles doubled upon themselves to provide pairs of angularly arranged tufts, said pairs of tufts being seated in the slots with the tufts of each pair extending outwardly through adjacent slots and the connecting portions between said tufts being held against said sharp corners on the sector-like portions, and means secured to the end of the body portion for securing the bristles in place.

23. A brush including a hollow cylindrical body, said body provided with longitudinal slots transverse to and communicating with one another, the portions of the body between the transverse slots being sector-like in cross section, with sharp corners at their inner edges, wire bristles doubled upon themselves to provide a pair of tufts, and seated in the slots with one tuft projecting outwardly through each slot and the connecting portions between the tufts being held against said sharp corners of the body.

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