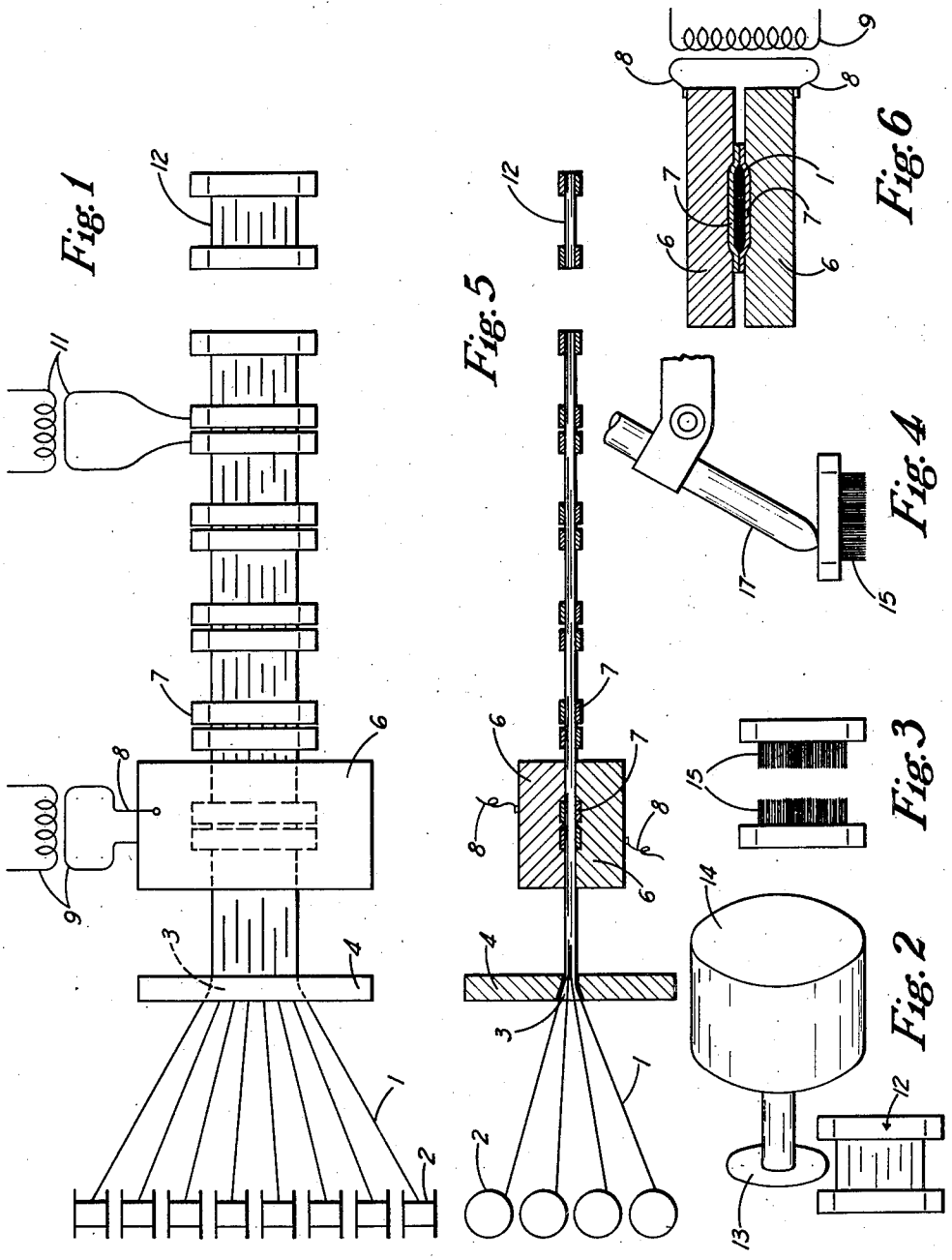
May 31, 1949. J. F. CUNNINGHAM, JR 2,472,003

METHOD OF MAKING WIRE BRUSHES

Filed May 10, 1945 2 Sheets-Sheet 1



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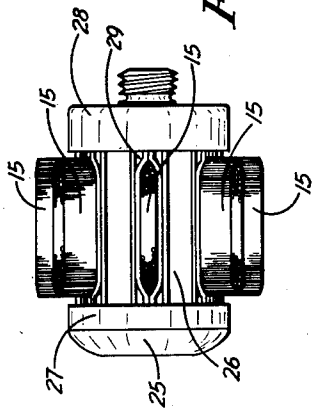


Fig. 8

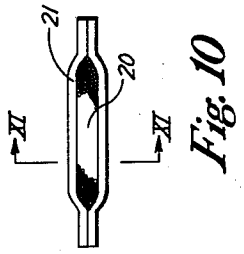


Fig. 10

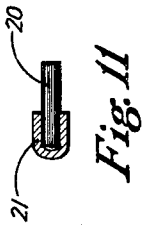


Fig. 11

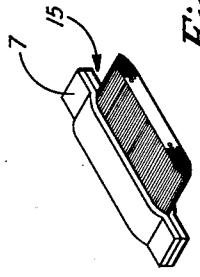


Fig. 7

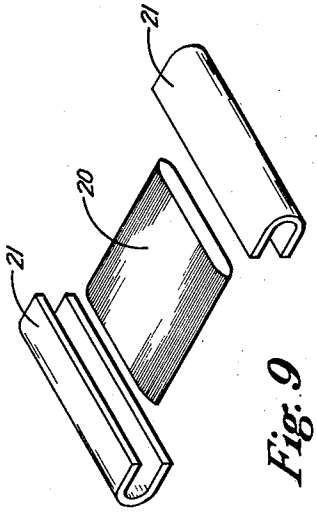


Fig. 9

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2,472,003

METHOD OF MAKING WIRE BRUSHES

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Application May 10, 1945, Serial No. 592,988

6 Claims. (Cl. 300—21)

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This invention relates to solid packed wire bristle brushes and to a method of making them.

It is among the objects of this invention to provide a brush in which a maximum number of wire bristles are packed in a given area, in which the bristles are welded together at their inner ends into a solid mass, in which the bristles are prevented from bending at the weld, and which includes an inexpensive and easily applied clamp for the welded ends of the bristles. Another object is to provide a method of making such a brush which is simple, rapid, and inexpensive.

In accordance with this invention a solid pack of wire bristles has all of the bristles welded together at one end. A clamp, for mounting the brush in a suitable holder, is mounted on the welded end of the pack along which it extends inwardly along the bristles with its inner edge tightly engaging the bundle so that flexing of the bristles can not occur at the weld where the bristles have been weakened, but must occur at a distance therefrom. The clamp may be welded to the welded ends of the bristles, and in such a case it preferably is formed from two clips the end portions of which project away from the bundle with their inner surfaces welded together. In another form the clamp is made in one piece and has a channel-shape body receiving the welded end of the bundle of bristles. The ends of the clamp project beyond the edges of the bundle with the opposite side walls of each end portion pressed together and welded. If desired, the clamp may be formed from a plastic molded on one end of the pack of bristles.

Preferably, my brushes are made by clamping a long compact bundle of wires at a pair of closely spaced points, and then applying a charge of electricity to the wires between the clamped points to burn the wire apart and simultaneously to weld together the burned ends of the wires in each of the two bundles thus formed. By severing the wires of a welded bundle at a predetermined distance from their welded ends, a solid pack of bristles welded together at one end is formed. The bristles are held together securely between their ends by means of a clamp so that bending of the bristles can not occur between the inner edge of the clamp and the weld. Preferably, these clamps are mounted on the bundle of wires before the latter are burned apart, and sufficient current is used to weld the bristles to the clamps as well as to one another. If the bristles are not welded to the clamps at the time the wires are burned apart, the operation may be performed later as a separate step. It is preferred to apply the clamps to the bundle of wires in the form of pairs of cooperating clips which are welded together at their ends before the current is applied that burns the wires apart.

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The preferred embodiment of the invention is illustrated in the accompanying drawings in which Fig. 1 is a diagrammatic view of apparatus for producing clamped bundles of wire; Fig. 2 shows a short bundle about to be cut in two; Fig. 3 shows two bundles formed from the preceding cutting operation; Fig. 4 shows the bristles of a brush being welded by an arc welder to their clamp; Fig. 5 is a longitudinal section through Fig. 1; Fig. 6 is an enlarged cross section of the clip-applying device; Fig. 7 is a perspective view of a finished brush; Fig. 8 is a side view of a brush holder with a plurality of my brushes mounted therein; Fig. 9 is a perspective view of the parts required to make a pair of modified brushes; Fig. 10 is an end view of one of the modified brushes; and Fig. 11 is a cross section taken on the line XI—XI of Fig. 10.

In making these brushes a long, compact bundle of wires is formed in any suitable manner. One way of doing this continuously is illustrated more or less diagrammatically in Figs. 1 and 5 of the drawings, wherein wires 1 from hundreds of spools 2 are led through a compacting opening 3 in a guide plate 4. This opening is the size and shape of the bundle of wires that is to be formed, preferably wide and flat, and enough wires extend through it to compel them to press tightly together and to completely fill the opening as a solid pack. For example, a bundle has been produced in accordance with this invention which is about one inch wide and $\frac{3}{32}$ inch thick, from about 1700 wires.

A short distance in front of the plate the compact bundle of wires passes through a clip-applying and welding device formed from spaced cooperating blocks 6 on opposite sides of the wire bundle. The blocks are movable toward and away from each other, and both are provided in their inner walls with a pair of closely spaced recesses for snugly receiving preformed metal clips 7 that are applied to the wire bundle when the blocks are pressed together, as shown in Fig. 6. The recesses in each block are only about $\frac{1}{32}$ inch apart. The blocks are connected by wires 8 to a transformer 9 for supplying welding current to the clips disposed in the recesses. When the blocks with the clips therein close on the temporarily stationary bundle of wires, the clips are pressed tightly around the bundle with their inwardly offset end portions projecting beyond the

opposite edges of the bundle. The inner surfaces of these end portions of each clip engage the end portions of the adjoining clip and are spot welded thereto by the current from transformer 9 to form a clamp which tightly engages the bundle of wires and holds it in the desired cross-sectional shape.

The blocks 6 then are separated, the bundle is fed forward again a distance roughly equivalent to twice the length of the bristles that are to be contained in the finished brushes, and another set of clips are applied to the bundle by blocks 6. Consequently, the bundle of wires leaving the clip-applying device has applied thereto closely spaced pairs of clamps disposed at predetermined intervals along its length. Any suitable means may be used to feed the bundle of wires forward intermittently.

Disposed at a location in front of the clip-applying device is apparatus 11 for electric resistance welding. This apparatus is connected to the pair of closely spaced clamps nearest to the front end of the continuous bundle of wires. The charge of electricity thus supplied to the clamps flows through the short length of wires between them and instantly burns the wires apart like a fuse and thereby produces a short bundle 12 of wires in addition to the long bundle from which the short bundle was separated. At the same time the melted ends of the wires in each of these bundles fuse together into a solid mass. Each short wire bundle 12 formed by this operation therefore has a clamp mounted on each of its ends. It is preferred to use sufficient current to cause the welded ends of the wires simultaneously to weld themselves to the outer end of the surrounding clamp.

The next operation is to cut the separated short bundle in two, substantially midway between its end clamps, in order to form two brushes. This cutting may be done in any suitable manner, such as by a shear or by an abrasive cutter 13 driven by an electric motor 14, as shown in Fig. 2. Each of the two wire brushes thus formed (Fig. 3) therefore includes a closely packed or solid bundle of wire bristles 15 welded together at one end where they also are welded to a surrounding clamp projecting from opposite edges of the pack. As the clamp tightly engages the pack of bristles, it confines their flexing in use to the portions thereof projecting from the clamp; that is, they can not bend at points any closer to their welded ends than the inner edge of the clamp. This is highly desirable because the welding heat weakens the bristles at their inner ends, so that they would break off if they were allowed to bend at that point.

If, for any reason, the wires are not welded to the clamps by welding apparatus 11, such welding can be accomplished later as a separate operation. For example, after the brushes have been formed, the welded ends of their bristles can be welded to the outer ends of the clamps by an arc welder 17, as shown in Fig. 4.

If desired, the clip-applying device can be eliminated, and the electric current of welder 11 can be applied to the continuous bundle of wires between temporarily clamped points close together in order to burn the wires apart between those points and simultaneously to weld together the burned ends of the wires in each of the two bundles thus formed. The short bundle separated from the long bundle of wires will not have clamps at its opposite ends at this time, but they are added before the bundle is cut in two to form two

packs of bristles in each of which the bristles are welded together at one end. One of these short bundles of bristles 20 is shown in Fig. 9, which also shows clips or clamps 21 ready to be applied to the welded ends of the bundle. As there illustrated, a desirable type of metal clamp for this purpose is U-shape in cross section and is slipped over one end of the short bundle of wires. The sides of the clip then are pressed inwardly against the pack to tightly engage the outer bristles, whereby the side walls of the clamp are made parallel, as shown in Fig. 11. The end portions of the clamp projecting beyond the edges of the bundle are compressed to bring their opposite side walls into engagement (Fig. 10) so that they can be welded together to keep the clamp from sliding lengthwise off the pack of bristles. The rough side edges of the pack at the welded end help prevent the pack from sliding forward out of the clamp. The wire bundle with clamps at both ends then is cut to form two brushes.

A plurality of finished brushes, like the one shown in Fig. 7 or in Fig. 10, are mounted in a cylindrical holder 25, illustrated in Fig. 8, adapted to be connected at one end to a driving motor (not shown) by which the brush assembly can be rotated in a tube to clean deposits from the inner surface thereof. The brush holder is provided with a plurality of circumferentially spaced radial slots 26 in which the brush clamps 7 are disposed. The projecting ends of the clamps extend under caps 27 and 28 mounted on the opposite ends of the holder, whereby the brushes are retained in the holder. As the projecting ends of the clamps are thinner than the body portions of the clamps, spaces 29 are formed between the sides of these ends and the walls of the slots. These spaces serve as vents that allow dirt to escape from inside the holder.

According to the provisions of the patent statutes, I have explained the principle and construction of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. In the method of making wire bristle brushes, the steps comprising clamping a long compact bundle of wires at a pair of closely spaced points, applying a charge of electricity to the wires between said clamped points to burn said wires apart and simultaneously to weld together the burned ends of the wires in each of the two bundles thus formed, and severing the wires of a welded-end bundle at a distance from their welded ends to provide a pack of bristles welded together at one end.

2. The method of making wire bristle brushes, comprising tightly surrounding a long compact bundle of wires by a pair of closely spaced clamps, connecting a great enough charge of electricity to said clamps to burn said wires apart between the clamps and simultaneously to weld the burned ends of the wires in each clamp together and to the surrounding clamp, and severing the wires on the opposite side of each clamp at a distance therefrom to provide bristles projecting from the clamp.

3. The method of making wire bristle brushes, comprising tightly surrounding a long compact bundle of wires by a pair of closely spaced clamps, connecting a charge of electricity to said clamps to burn said wires apart between the clamps and

simultaneously to weld together the burned ends of the wires in each clamp, severing the wires on the opposite side of each clamp at a distance therefrom to provide bristles projecting from the clamp, and then welding the welded ends of the bristles to the outer end of the clamp.

4. In the method of making wire bristle brushes, the steps comprising feeding a continuous compact bundle of wires forward, periodically clamping the bundle at a pair of closely spaced points and applying a charge of electricity to said wires between said clamped points to burn the wires apart and simultaneously to weld together the burned ends of the wires in each of the two bundles thus formed, whereby the wires in the forward short bundle have their ends welded together at both ends of the bundle, and then severing said short bundle of wires substantially midway between its ends to provide two packs of brush bristles.

5. In the method of making wire bristle brushes, the steps comprising feeding a continuous compact bundle of wires forward, periodically clamping the bundle at a pair of closely spaced points and applying a charge of electricity to said wires between said clamped points to burn the wires apart and simultaneously to weld together the burned ends of the wires in each of the two bundles thus formed, whereby the wires in the forward short bundle have their ends welded together at both ends of the bundle, mounting clamps on both ends of said short bundle, compressing each clamp on the short bundle and securing each end of the clamp together to hold

the clamp on the bundle, and then severing said short bundle of wires substantially midway between its ends to provide two packs of brush bristles mounted in clamps.

6. The method of making wire bristle brushes, comprising feeding a continuous compact bundle of wires forward, periodically applying two closely spaced pairs of clips to opposite sides of said bundle, welding together the ends of each pair of clips to form a clamp, then connecting a charge of electricity to said clamps to burn said wires apart between the clamps and simultaneously to weld the burned ends of the wires in each clamp together and to the surrounding clamp, whereby the forward short bundle of wires has a clamp welded on each end, and then severing said short bundle between its end clamps to produce two packs of bristles projecting from clamps.

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