

[54] **MACHINE AND METHOD FOR  
MANUFACTURING BROOMS FROM  
PLASTIC FIBERS**

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[51] Int. Cl.<sup>2</sup> .... **A46D 7/00**

[58] Field of Search .... **300/1, 2, 12, 19, 21**

[56] **References Cited**  
**UNITED STATES PATENTS**

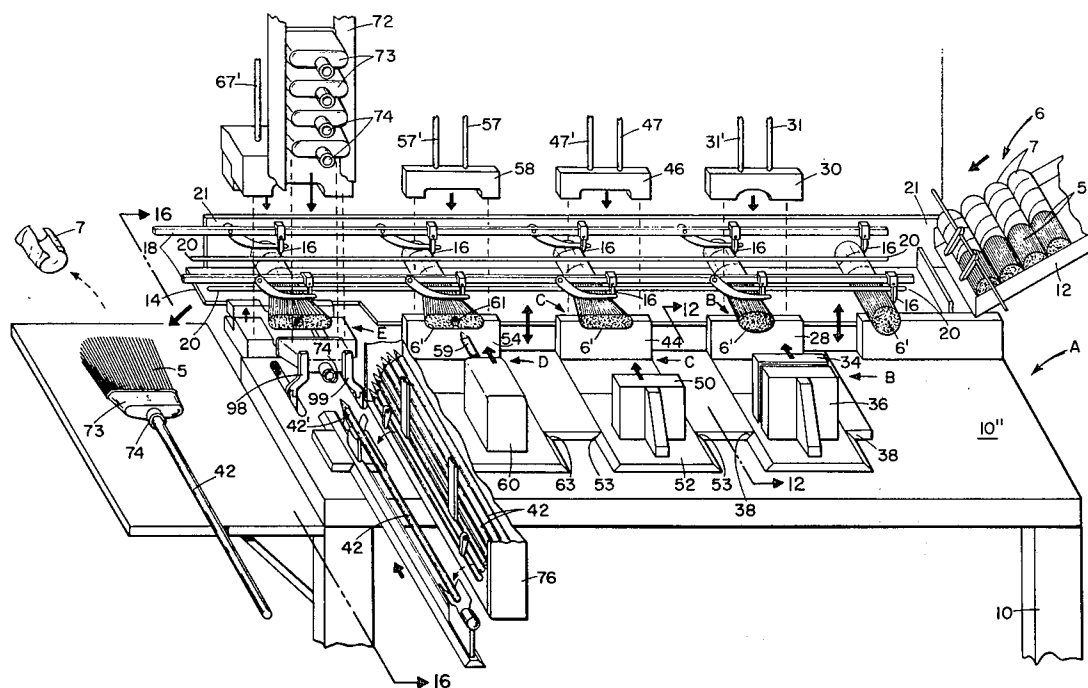
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|-----------|---------|-----------------|--------|
| 2,059,530 | 11/1936 | Lay .....       | 300/21 |
| 2,610,896 | 9/1952  | Marsh .....     | 300/21 |
| 3,596,999 | 8/1971  | Lewis, Jr. .... | 300/21 |

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Attorney, Agent, or Firm—J. Wesley Everett

[57] **ABSTRACT**

A broom making machine for manufacturing brooms from elongated flexible plastic fibers, such as polyester resin, which has a substantially low melting point. The fibers are first formed into bundles of a predetermined size wherein one end of the bundle is engaged by a heating element, preferably electrical, and melted in depth for uniting the ends of the fibers at one end of the bundle and to form a shoulder and a support for a handle, after which the free end portion of the fibers extending outwardly from the melted end are separated into a fan-like form, and held in this position by stitches or a band intermediate of the shoulder and the outward free ends of the fiber members including the method of making a broom of this type.

**10 Claims, 16 Drawing Figures**



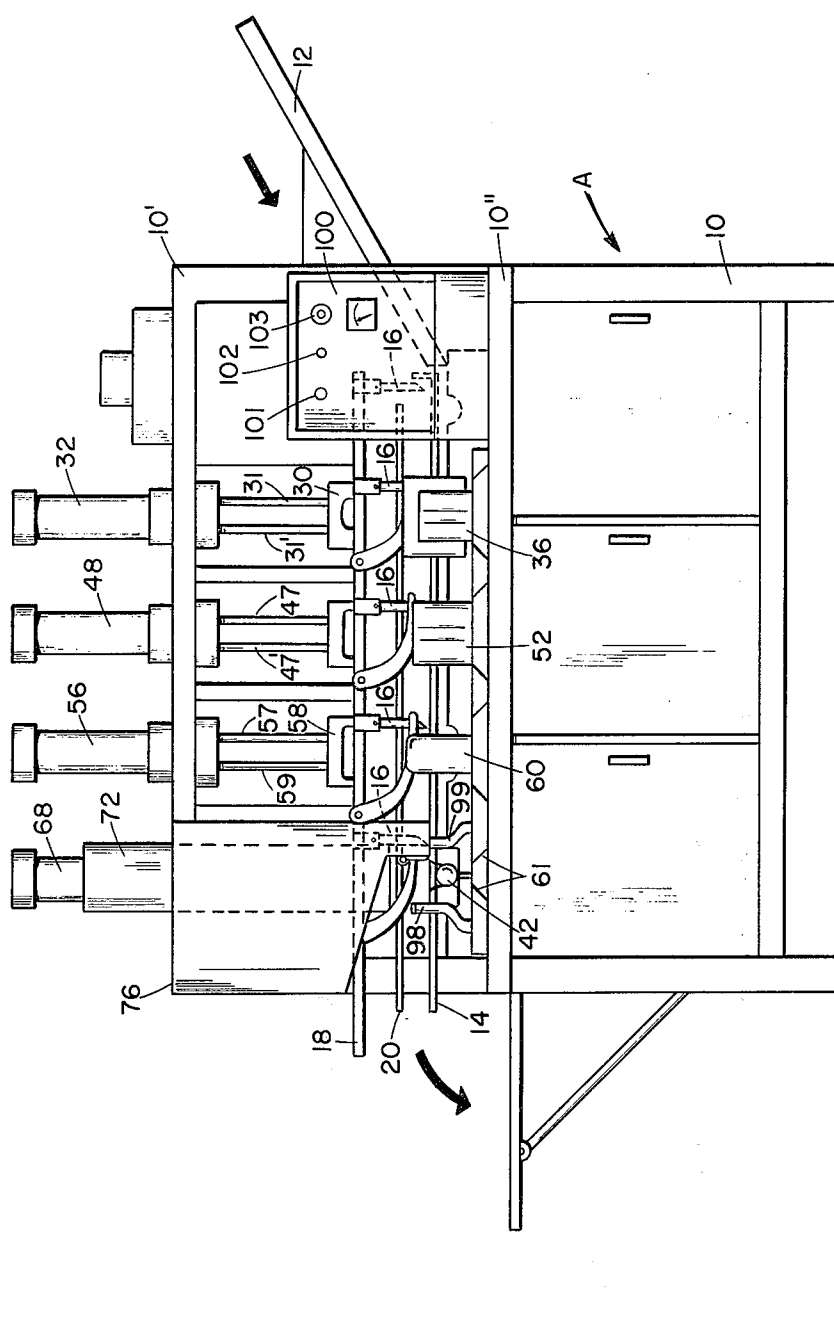


FIG. 1

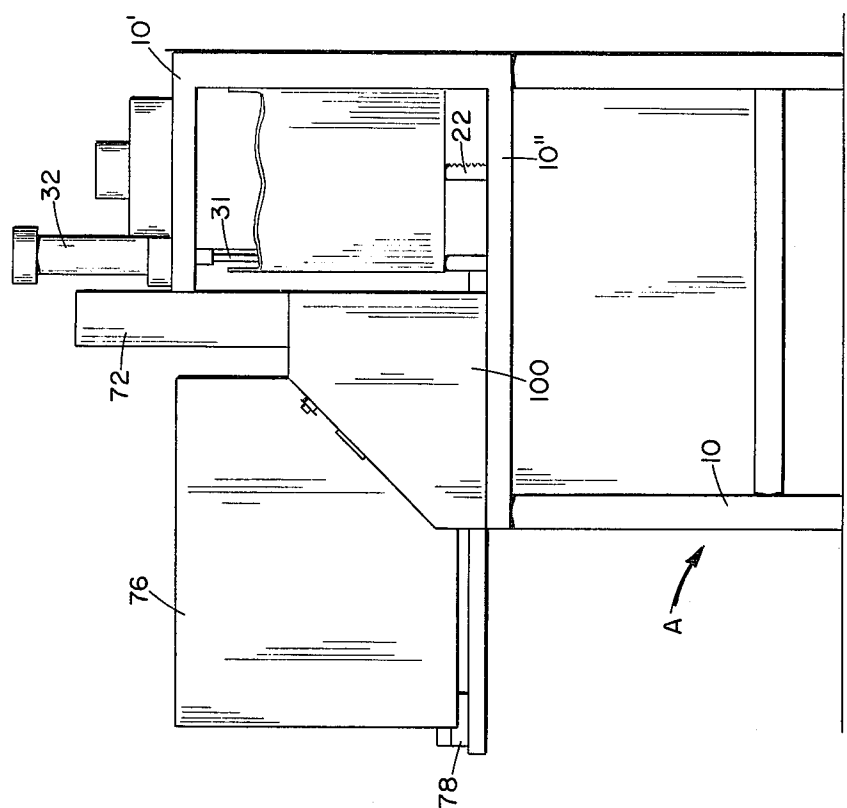


FIG. 3

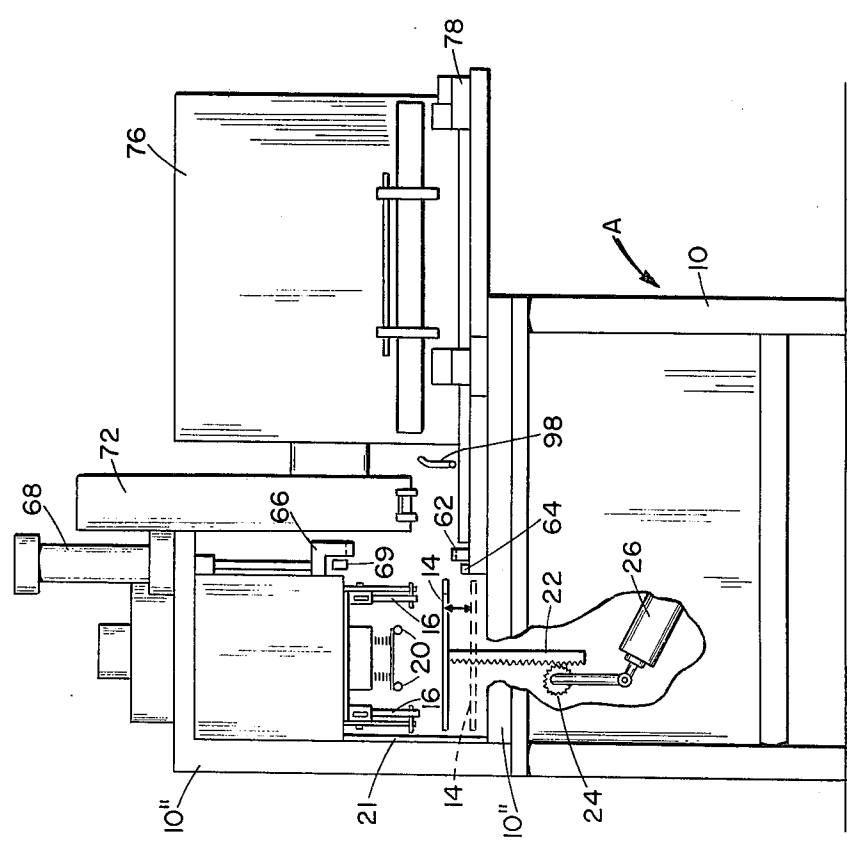


FIG. 2

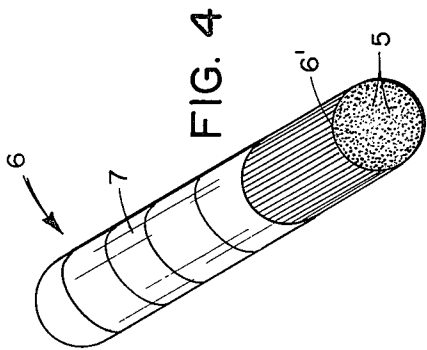


FIG. 4

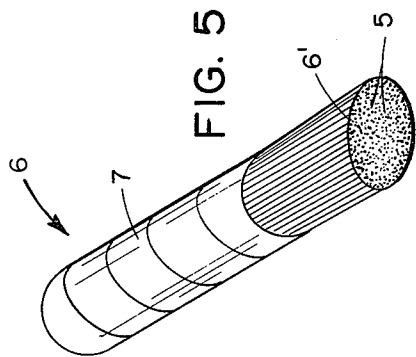


FIG. 5

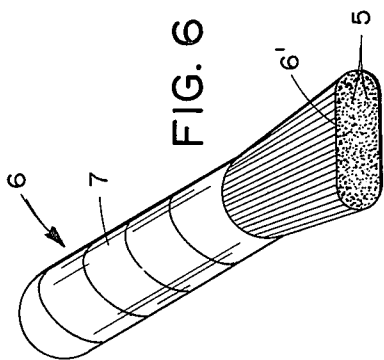


FIG. 6

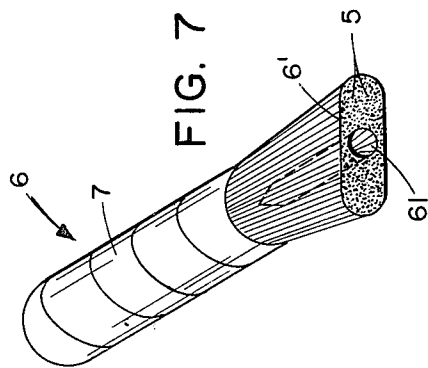


FIG. 7

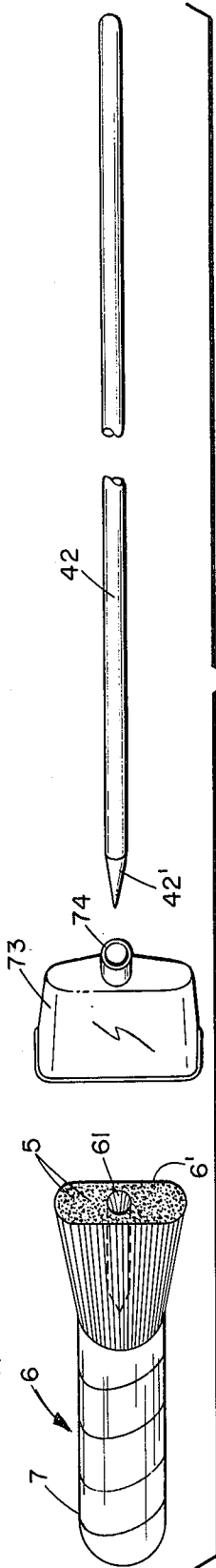


FIG. 8

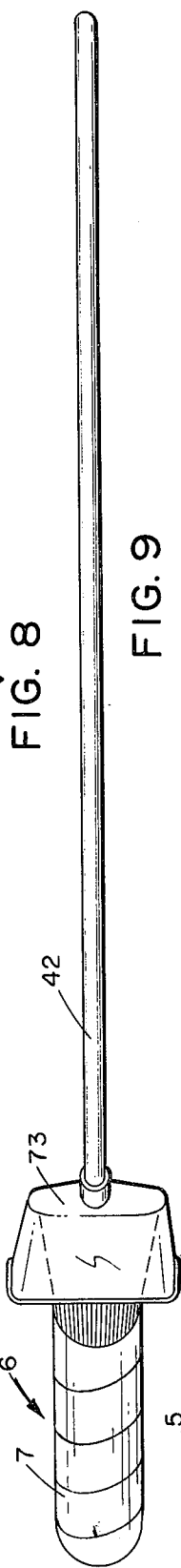


FIG. 9

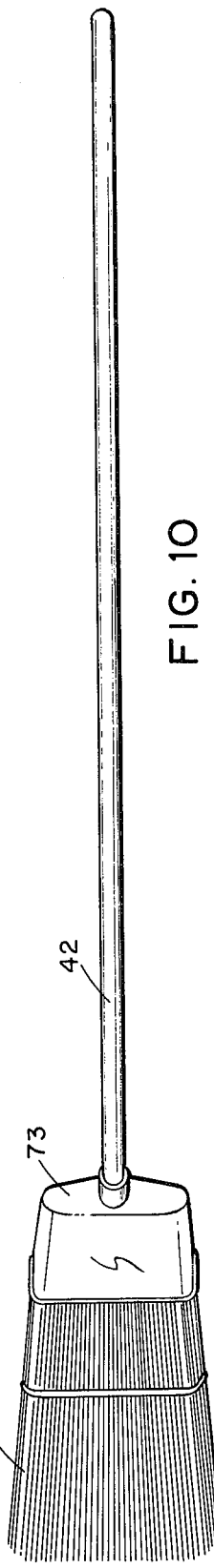
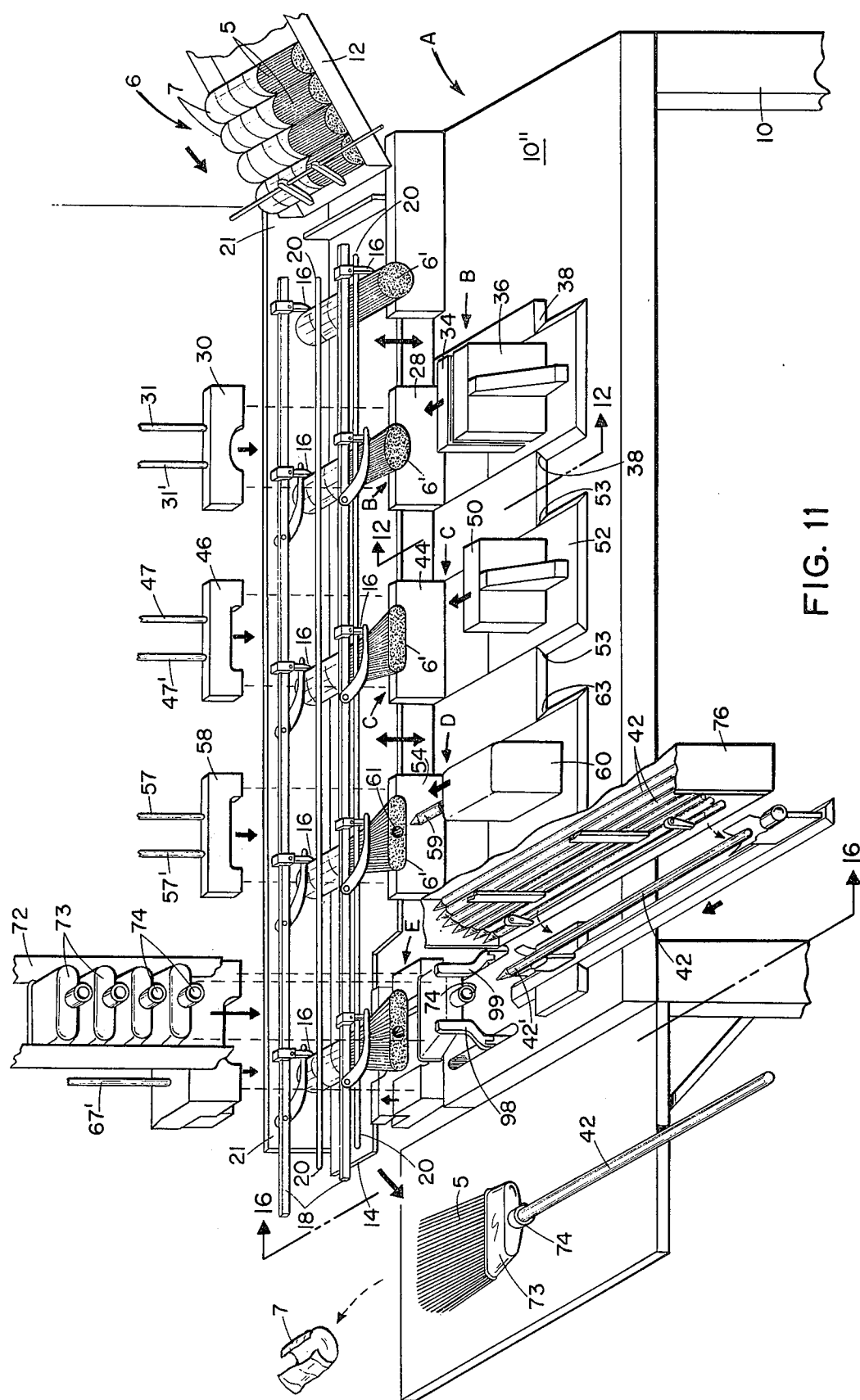
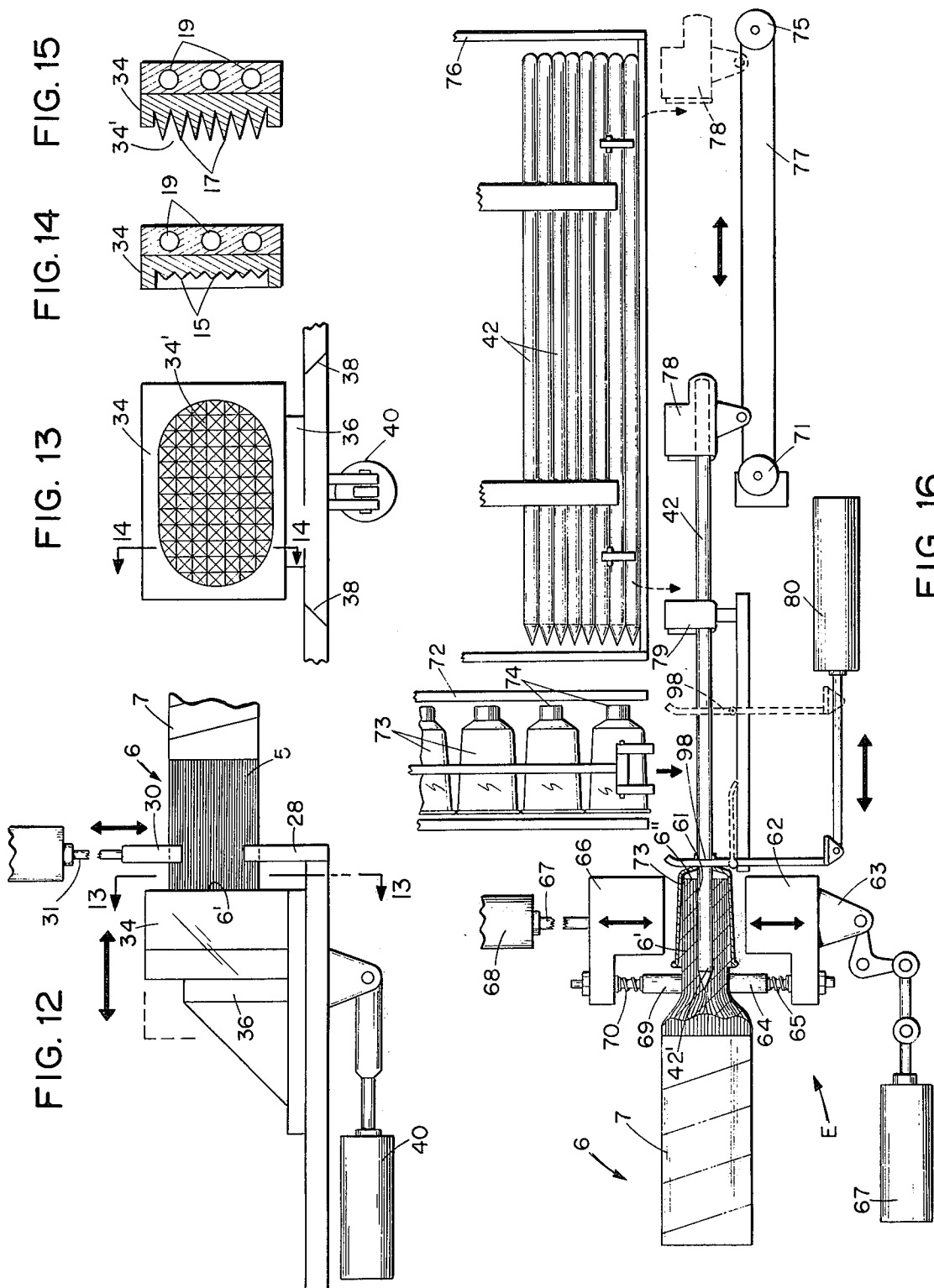


FIG. 10





## MACHINE AND METHOD FOR MANUFACTURING BROOMS FROM PLASTIC FIBERS

The present invention relates to a machine and a method of construction brooms, brushes and like articles made from elongated flexible plastic fibers, or strands. For convenience, later references to brooms alone will be intended to include brushes and any like articles that may be manufactured by the same or similar apparatus, and the method disclosed herein.

One object of the invention is to provide a new and novel machine for making brooms and brushes from elongated flexible plastic fibers whereby production may be substantially automatic.

Another object of the invention is to provide a method of producing brooms and the like in which a minimum number of operations are used.

A further object of the invention is to eliminate the necessity of using additional materials for securing the fibers to the end of the handle of the broom.

Another object of the invention is to provide a machine or apparatus that will reduce the requirement of specialized labor in the making of this type of broom.

Another object of the invention is to provide an apparatus that will greatly reduce the possibility of injury to persons in this type of work by reducing the number of present day single manual operations.

Still a further object of the invention is to provide a new method of making brooms of this type.

While several objects of the invention have been set forth, other objects, uses and advantages will become apparent as the nature of the invention is more fully disclosed as set forth in the following description with reference to the accompanying drawings.

FIG. 1 is a side elevation view of the machine.

FIG. 2 is an elevational view of the rear end of the machine.

FIG. 3 is an elevational view of the front end of the machine.

FIG. 4 is a perspective view of a bundle of bound broom fibers having at least one end free of said binding.

FIG. 5 is a perspective view of a bundle of broom fibers having the unbound end of the bundle of slightly oval shape.

FIG. 6 is a perspective view of a bundle of bound broom fibers having the oval end of the broom fibers shaped into substantially rectangular form.

FIG. 7 is a perspective view of a bundle of bound broom fibers showing a recess extending inwardly from the rectangular shaped end of the bundle.

FIG. 8 is an exploded view in elevation of a bundle of broom fibers, a cover for the rectangular end of the bundle and a handle in position to be inserted through the cover and into the recess formed in the rectangular portion of the bundle.

FIG. 9 is a view in elevation of the assembled bundle of the fibers, the cover and the handle.

FIG. 10 is a view in elevation of the assembly shown in FIG. 9 having the binding removed from the bundle of fibers and the free end of the fibers formed into rectangular shape to provide a broom.

FIG. 11 is a mechanical schematic perspective view of the machine.

FIG. 12 is an enlarged view in side elevation of a heating unit for heating the unbound end of the bundle of fibers showing its movable support and the means for operating the said support.

FIG. 13 is a sectional view taken on line 13—13 of FIG. 12.

FIG. 14 is a sectional view taken on line 14—14 of FIG. 13.

FIG. 15 is a sectional view of a modified form of heating unit.

FIG. 16 is a sectional view taken on line 16—16 of FIG. 11 illustrating the manner in which the cover and bundle are attached to the bundle of fibers.

In preparation of the elongated flexible plastic broom fibers 5, the fibers are cut to a predetermined length and bound in round bundles 6 of such size as to form a single brooms, as shown in FIGS. 4 to 10. In order to hold the fibers in a bundle, there is a binding 7 of any convenient type. It will be noted that the fibers are not bound adjacent one end of the bundle for the reason to be hereinafter referred to.

Referring in particular to the machine, there is a frame A having a lower section 10, an upper section 10' and an intermediate section 10''. The intermediate section 10'' is in the form of a horizontal bed on which is located a number of machine elements used in the making of the broom which will be referred to hereinafter in more detail.

The frame supports a hopper 12 located at the front end of the machine into which the bundles 6 of bound fibers are placed to be fed into the machine. The bundles 6 are fed onto a vertically movable bundle support 14 in spaced relationship and are moved along the support in a step-by-step movement, having a back plate 21 guiding the bound ends of the bundles.

While the bundle support 14 is shown in the form of a horizontal table, the bundles may be supported on a conveyor or other suitable means which may be operated in a step-by-step movement.

The bundles are moved by a plurality of pawls 16 hingedly supported on reciprocating bars 18. The pawls are hinged to move from a position perpendicular to the bundle support 14 to a point at least parallel with the bundle support in the direction of the rear of the machine, whereby they will engage the bundle of fibers when the bar 18 moves from the rear of the machine, and pass over the bundles when the bar 18 is moved towards the front of the machine.

The location of the pawls and the distance of the travel of the reciprocating bars 18 are so arranged that the pawls will place the bundle at a predetermined location along the bundle supporting table 14 which are designated as stations B, C, D and E.

Positioned above the bundle support 14 at a point substantially that of the diameter of the bundles 6 are elongated spring-loaded bars 20 adapted to bear against the upper side of the bundles as they are moved along the table 14 from one station to another.

At each of the stations there is a separate and particular type of operation performed on the unbound ends of the fibers 5.

The pawls 16 first move the bundle along the table 14 to station B. The table 14 is moved down to its lowest point by a rack 22 and a pinion 24 rotatable by an air cylinder 26 as shown in FIG. 2. The end 6' of the bundle is lowered into a lower half die 28. Positioned above the lower half die is an upper half die 30 supported upon members 31 and 31' carried upon an operating means associated with an air cylinder 32, which in turn is supported on the upper section of the frame. The bundles of fibers are so positioned in the dies as to allow a predetermined amount of the fiber ends to

extend beyond the face of the dies to be engaged by a heating unit 34.

Immediately after the dies 28 and 30 engage the ends of the fibers, the support 36 carrying the heating unit 34 is moved along a dovetail slot 38 by means connected to an air cylinder 40 (see FIG. 12) to cause the heating unit 34 to engage the extended ends of the fibers for a predetermined period, melting the end of the fibers into a continuous mass in depth which when cooled will form a rigid mass for the broom along the end 6' of the bundle. After the heating operation is completed, the air cylinder 40 moves the heating unit support 36 and the heating unit 34 out of contact with the ends of the fibers.

The heating unit 34 is shown best in FIGS. 13, 14 and 15. One form of the face 34 of the heating unit shown in FIG. 14 is provided with short extensions 15, and in FIG. 15 the die face 34' is shown with longer extensions 17. These extensions may be of any desired length for melting the ends of the fibers in depth. The heating unit is provided with means 19 for carrying heating elements for the heating unit.

After the heating unit has been moved out of contact with the end of the fibers, the air cylinder 32 will operate to raise the upper half die 30 from its contact position with the lower stationary half die 28 in order that the bundle, including its melted end 6', may be moved to the next station.

The bundle supporting table 14 being movable vertically for a predetermined distance by the apparatus mentioned hereinbefore, is moved vertically upward a sufficient distance to remove the melted end 6' of the fibers from the lower half die 28 whereby the bars 18 are set in reciprocal motion by an appropriate air cylinder (not shown), moving the bundle from its position at station B to station C.

At station C there is provided a stationary second lower half die 44 into which the previously melted end 6' of the bundle 6 is placed by operating the bundle supporting table again downwardly to its lowest position. A second upper half die 46 is supported on members 47 and 47' operated by an air cylinder 48. When the cylinder 48 is operated it will cause the second upper half die 46 to move downwardly and engage the lower stationary half die 44. These two half dies 44 and 46 are more elongated in shape to give a rectangular form to the shoulder of the broom with a predetermined thickness best shown in FIGS. 6 and 7. After the dies 44 and 46 have engaged the previously melted area 6', an outer end-forming die 50, carried by a movable support 52 within a dovetail slot 53 is moved by means associated within an air cylinder similar to that described for moving the heating unit support 36 whereby the support 52 and the end-forming die 50 are moved perpendicular to the previously melted end surface 6' of the bundle, which surface has by this time cooled to a point where the melted end has reached a semi-plastic state wherein the end-forming die 50 shapes and forms the outer surface of the semi-plastic mass in its final shape. At the end of the time period the air cylinder will operate to retract the surface forming member 50 to its holding position out of contact with the shoulder and into position for the next bundle, and the cylinder 48 will operate to raise the upper half die 46 upwardly and out of contact with the lower half die 44. Again the table 14 will be raised to its upper position and the reciprocating bars 18 will be operated whereby

the pawls 16 will engage the bundles on the table 14 moving them to their next respective station.

After the most advanced bundle has reached station D the bundle is lowered into the lower stationary half die 54 by the lowering of the table 14 as previously described. Immediately thereafter the air cylinder 56 having means 57 and 57' connecting the cylinder with the upper half die 58, will operate to move the upper half die 58 downwardly in contact with the lower stationary half die 54. The shape and size of these half dies 54 and 58 are substantially the same as the size and shape of the half dies 44 and 46.

Positioned outwardly from the outer face of the half dies 54 and 58 is an elongated electrically heated stem 59 fixedly secured to a support 60. The stem support 60 is slidably positioned in a dovetail slot 63 similar to that described for supports 36 and 52 and is movable by an appropriate air cylinder (not shown). This support moves the heated stem perpendicular to and centrally of the die opening and the stem is adapted to engage the molded end of the fibers when the die members 54 and 58 engage the molded end 6' forming a recess 61 of a predetermined size and depth therein for receiving the end 42' of the handle 42.

At this point the melted mass has begun to cool, particularly on its outer surface; therefore, the contours of the shoulder are well defined and the newly formed recess provides a more fluid inner surface about its side portions for receiving the end 42' of the handle 42.

After the shoulder has received the recess the table is again raised in the prescribed manner and the bundle is moved to station E.

The half dies at station E are of a slightly modified form. The lower half die 62 is provided with an associated holding member 64 and is spring loaded as shown at 65 in FIG. 16. The lower half die 62 is supported upon a vertically movable support 63.

The upper half die 66 is also provided with a holding member 69 which is also spring-loaded by the spring 70 shown in FIG. 16. The holding member 69 is positioned to extend below the lower surface of the upper half die 66 in order that the hold-down member will first contact the bundle 6' and aid in holding the shoulder parallel with the bundle supporting table 14. These hold-down members 64 and 69 are spaced inwardly from the outer surface 6' of the molded shoulder and will allow the lower and upper dies 62 and 66 to be spaced outwardly from the sides of the rectangular molded area 6' a predetermined distance for allowing room for applying the cover 73 over the outer surfaces of the molded shoulder. The spring 65 is arranged to normally hold the holding member 64 in its upper position relative to the lower half die member 62. The holding member is adapted to contact the bundle first when the molded end of the bundle is deposited over the lower half die for holding the rectangular shoulder parallel with the bundle supporting table 14. When the molded end 6' is in position over the lower half die 62 the upper half die 66 is moved downwardly by the air cylinder 68 to a point where the holding member 69, which is held downwardly by the compression spring 70, is firmly in contact with the upper side of the bundle. These holding members 64 and 69 hold the molded shoulders in position to receive the end of the handle into the recess 61.

Positioned on the frame at station E and leading to a point adjacent the molded shoulder is a chute 72 for

receiving a number of covers or caps 73 for placement over the molded shoulder. These cover members 73 are shown best in FIG. 11 and 16 and are adapted to fit snugly over the shoulder 6' of the broom having a central opening 74 therein for admitting the end 42' of the handle 42.

Positioned outwardly from the cover chute 72 is a hopper 76 for depositing a number of handles 42. The handles are fed one at a time to a means 78 and 79 for moving the inner end 42' of the handle through the opening 74 in the cover and into the recess 61 in the shoulder 6' of the broom. As soon as the handle has passed through the opening 74 in the cover, an air cylinder 80 will operate the members 98 and 99 engaging the cover 73 moving it over the shoulder of the broom. At this point the air cylinder 68 is further operated to cause the die 66 to engage the upper side of the cover in the area of the shoulder, and the cylinder 67 is operated to cause the lower half die 62 to engage the lower surface of the cover 73 finally pressing the shoulder to the desired rectangular form should it have been distorted in forming the recess and inserting the end of the handle therein. This final clamping of the dies 62 and 66 also presses the melted mass remaining around the sides of the recess formed by the stem element 59 and forms the recess tightly about the end of the handle, after which the air cylinder 68 raises the upper half die 66 and its associate hold down member 69 upwardly out of the way of the bundle and at the same time the air cylinder 67 operates to move the lower half die 62 and the hold-down member 64 out of contact with the lower side of the bundle, whereby the bundle is again raised and moved by the pawls to another station (not shown) or out of the machine.

The time element for each station is the same as that required for the melting operation at station B.

Practically all the operations of the machine are performed by compressed air in cooperation with an electronic timing system for operating the means for supplying the compressed air to the respective cylinders. This electronic timing system is carried in a cabinet 100 and is set by the dials 101, 102 and 103.

While a particular type of machine has been shown and described, it is not intended as a limitation as the scope of the invention is best defined in the appended claims:

I claim:

1. A machine for making brooms from predetermined size bundles of flexible elongated plastic fibers, comprising:

- a. a frame;
- b. means carried by said frame for supporting a plurality of fiber bundles in spaced relationship;
- c. a plurality of spaced stations positioned along the bundle supporting means having means for performing a predetermined operation on at least one end of the said bundle of fibers;
- d. means for intermittently moving the said bundles in a step-by-step movement over the bundle supporting means;
- e. means for gripping the fibers adjacent one end of the bundle for forming the end of the bundle and supporting the same in releasably fixed position at one of the said stations;
- f. an electrically heated unit positioned outwardly from the fixed end of the fibers and means for supporting and moving the heated unit parallel

with the said elongated fibers to engage the fixed end of the fibers for a predetermined period during one of the intervals between the step-by-step movement to form a unitary melted mass of a predetermined depth;

g. an elongated electrically heated element normally held outwardly and perpendicular to the outer surface of the cooling melting mass, means for supporting and moving the heated element into engagement with the cooling melted mass to form a recess of predetermined depth within the cooling melted mass for receiving one end of a handle member;

h. means for moving the end of the handle into the recess.

2. In a broom making machine as claimed in claim 1 wherein means are provided to further shape the cooling melted mass at a station between the melting of the ends of the fibers and the forming of the recess for receiving the end of the handle member.

3. In a broom making machine as claimed in claim 1 wherein automatic means are provided to apply a cover over the cooling melted end of the broom during one of the intervals at a preselected station.

4. In a broom making machine as claimed in claim 1 wherein the bundle supporting means is provided with means for raising the supporting means when the bundles are being moved along the support means and lowering the support means when the bundle is opposite one of the stations.

5. In a broom making machine as claimed in claim 1 wherein the bundle support is in the form of an elongated table.

6. In a broom making machine as claimed in claim 1 wherein resilient means are provided to hold the bundles downwardly in contact with the bundle support when the bundles are moved from station to station.

7. In a broom making machine as claimed in claim 1 wherein the heated unit is provided with a plurality of projections to penetrate the ends of the plastic fibers for heating and melting the ends of the fibers in depth.

8. In a broom making machine as claimed in claim 1 wherein the means for moving the bundles is in the form of a reciprocating bar having a plurality of pawls hinged thereto having a limited movement from a point substantially perpendicular to the bundle support to a point substantially parallel with the said bar in the direction toward the rear of the machine.

9. A method for automatically producing brooms from elongated plastic fibers, comprising the steps:

- a. forming the fibers in cylindrical bundles of a size to make a single broom;
- b. melting the end of the bundle of fibers to form a melted mass to support the free ends of the fibers;
- c. molding the melted mass into a predetermined rectangular form to provide a shoulder on the bundle of fibers;
- d. allowing the melted mass to partly cool at least on the outer surface and forming a recess extending through the outer surface of the melted mass to a predetermined depth therein.

10. In a method for automatically producing brooms from elongated plastic fibers as claimed in claim 9 by adding the steps of inserting the end of a handle member in said recess and pressing the melted mass about the end of the handle.

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