Oct. 23, 1962 H. SCHMIDT 3,059,972

AUTOMATIC TOOL FOR SETTING BRISTLES INTO BRUSH BODIES

Filed Aug. 24, 1959 3 Sheets-Sheet 1

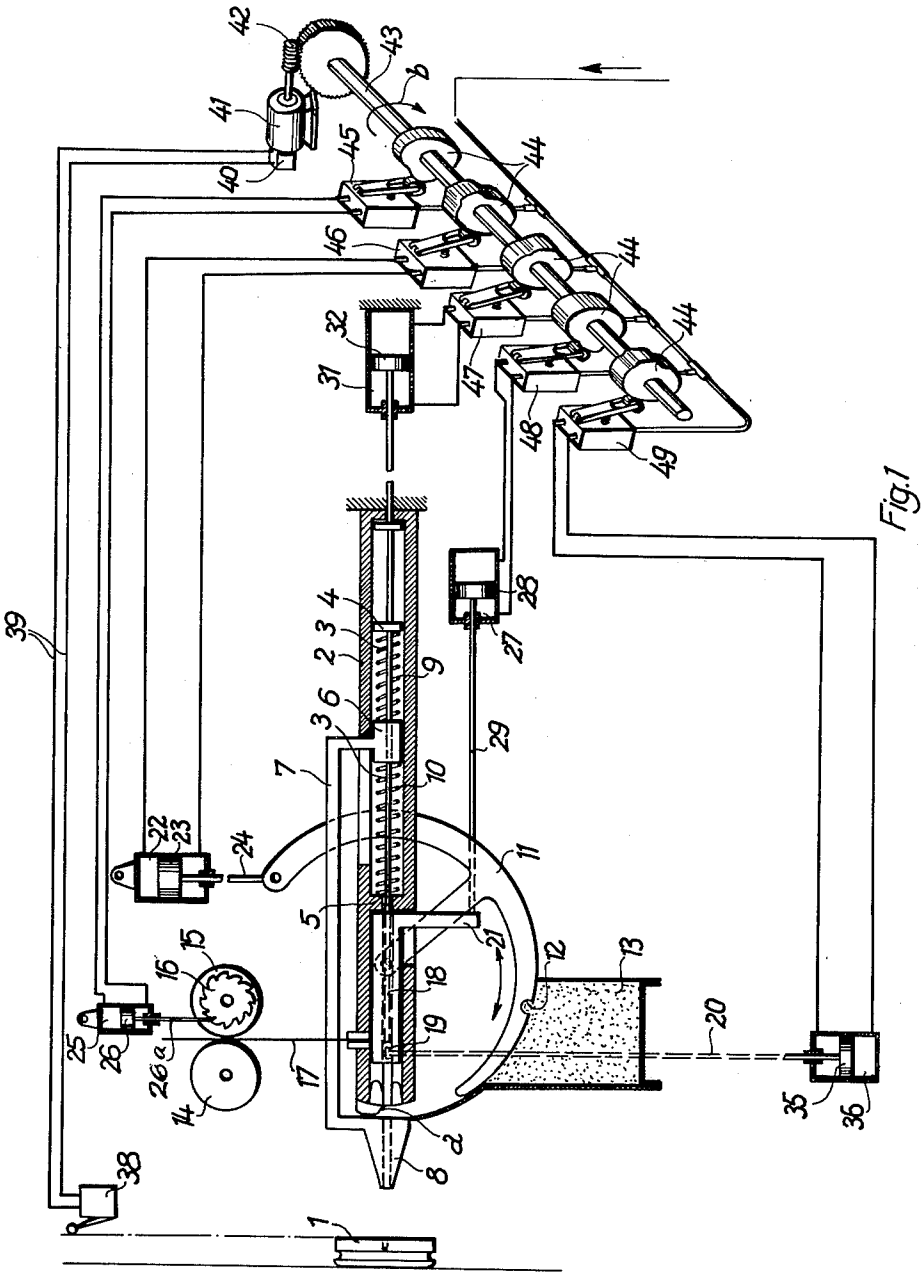

Fig.1

INVENTOR
Herbert Schmidt
By Walter Berlin
Patent Agent

Oct. 23, 1962 H. SCHMIDT 3,059,972

AUTOMATIC TOOL FOR SETTING BRISTLES INTO BRUSH BODIES

Filed Aug. 24, 1959 3 Sheets-Sheet 2

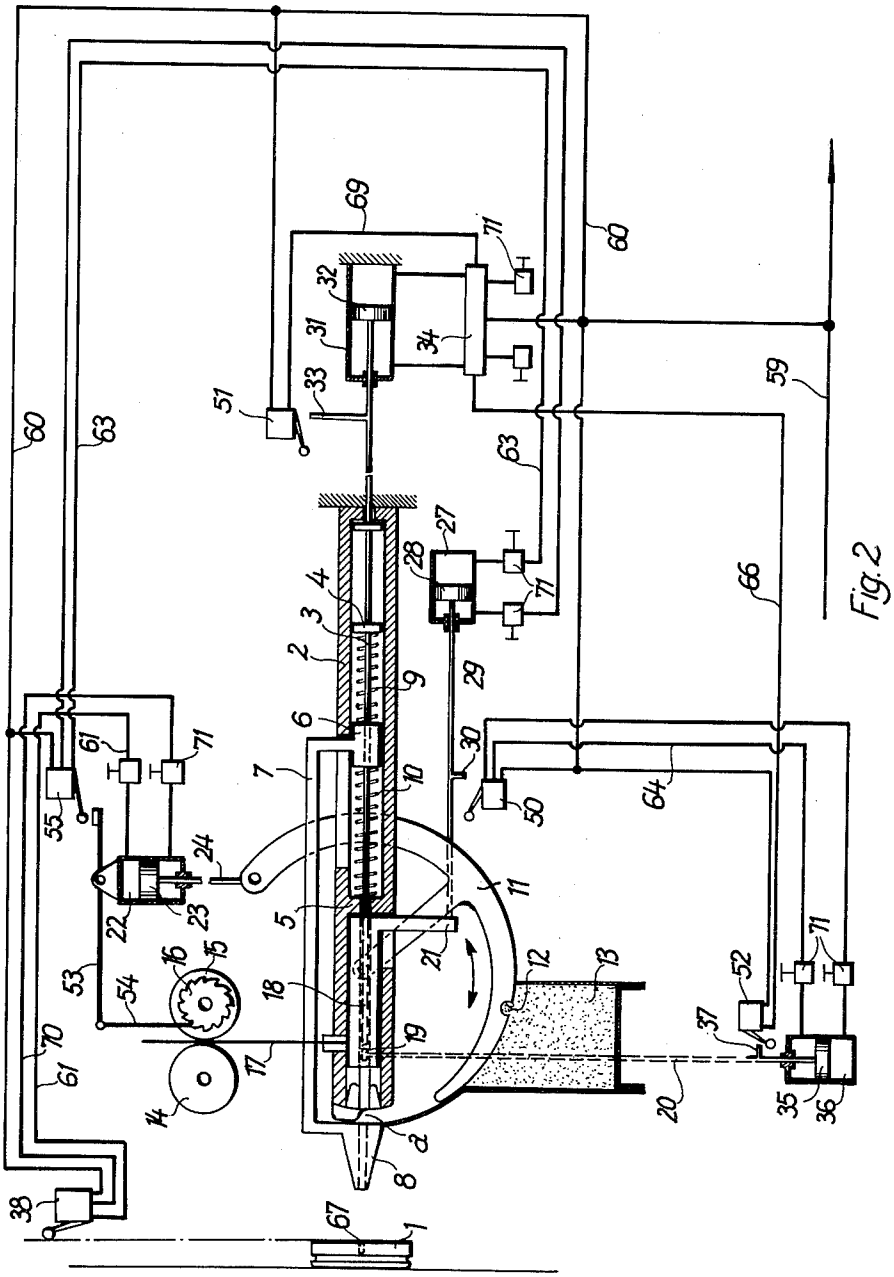

Fig. 2

INVENTOR
Herbert Schmidt
By Walter Becker
Patent Agent

Oct. 23, 1962 H. SCHMIDT 3,059,972

AUTOMATIC TOOL FOR SETTING BRISTLES INTO BRUSH BODIES

Filed Aug. 24, 1959 3 Sheets-Sheet 3

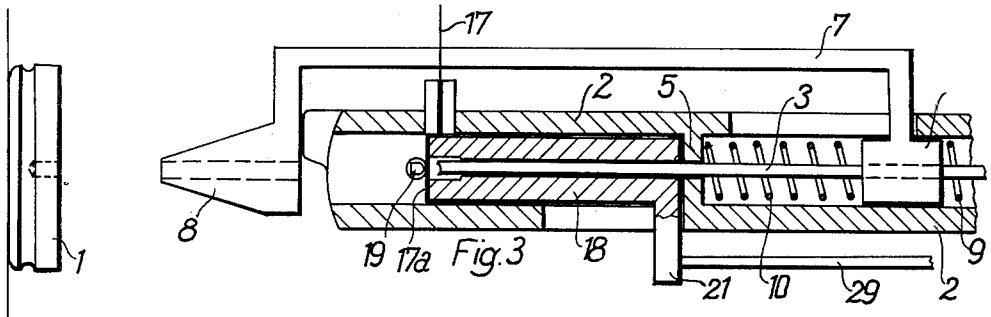

Fig.3

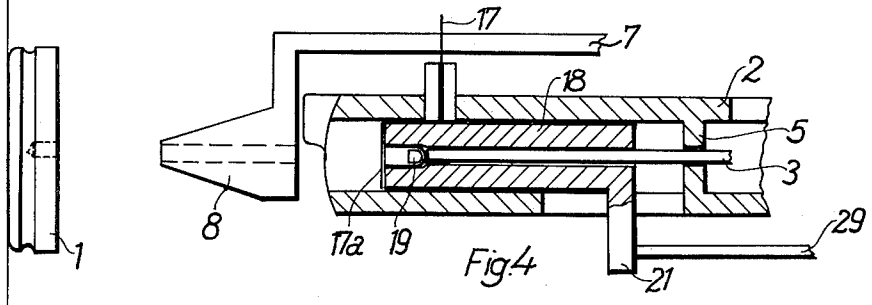

Fig.4

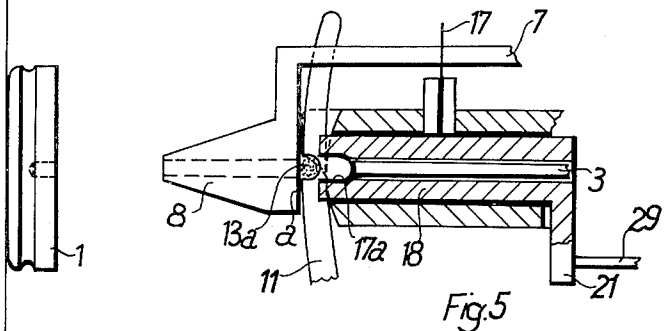

Fig.5

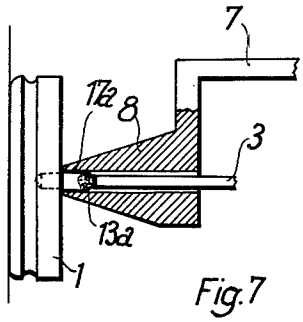

Fig.7

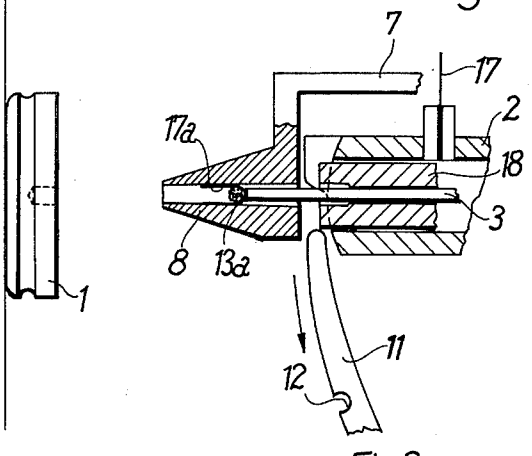

Fig.6

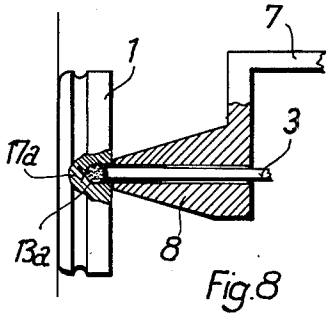

Fig.8

INVENTOR
Herbert Schmidt
By Walter Becker
Patent Agent

United States Patent Office 3,059,972
Patented Oct. 23, 1962

3,059,972

AUTOMATIC TOOL FOR SETTING BRISTLES INTO BRUSH BODIES

Herbert Schmidt, Hohenlockstedt, Holstein, Germany

Filed Aug. 24, 1959, Ser. No. 835,767
Claims priority, application Germany Aug. 26, 1958
9 Claims. (Cl. 300—5)

The present invention relates to the manufacture of brushes and, more particularly, is directed to an apparatus for automatically inserting tufts of bristles into a brush body. The invention is particularly concerned with an automatic control system for such apparatus.

The individual operational steps to be controlled of such apparatus comprise primarily

(*a*) The grasping of a number of tuft-forming bristles from a stock and feeding the same toward the tuft-setting means,

(*b*) Forming a wire loop and placing the same around a tuft or in the forming of anchoring means from a flat wire and feeding the same in front of the tuft material,

(*c*) Feeding the thus prepared tuft into the tuft-setting means proper,

(*d*) Moving the tuft-setting means into contact with the brush body to be provided with the respective tuft, and

(*e*) Inserting the respective tuft into the brush body so that the ends of the wire loop looped around the tuft will be driven into the material of the brush body so as to anchor the tuft therein.

With the heretofore known automatic tuft-setting devices, all of the above mentioned operational steps are controlled mechanically. Such mechanical control, however, requires a considerable number of elements and is rather complicated in construction, which is the reason that such heretofore known mechanical atuomatic control devices are rather frequently liable to disturbances and are very expensive as to manufacture. Both factors unfavorably affect the economy of mass production of brushes. Moreover, the tendency to increase the output as far as possible forces the manufacturer to increase the speeds of individual operational steps more and more which in turn brings about a fast wear and the necessity of prematurely replacing the tools in such heretofore known mechanical control. This fact in combination with the fact that the respective tools have to be manufactured with extreme high precision furnish the explanation for the high cost of manufacture and operation of said heretofore known automatic mechanically controlled tuft-setting devices.

Inasmuch as the heretofore known rather expensive mechanically controlled automatic tuft-setting devices, in which the tools have to carry out up to five operations per second, have thus reached the end of their development, it is an object of the present invention to provide an automatic tuft-setting apparatus of the general character set forth above, in which, however, the mechanical control system will be replaced by a different type of control system which will not have the drawbacks outlined above of the heretofore known mechanically controlled tuft-setting devices referred to above.

It is another object of this invention to provide a tuft-setting apparatus of the type set forth in the preceding paragraph, which will be relatively simple in construction and which can be produced relatively inexpensively.

It is still a further object of this invention to provide a tuft-setting apparatus as set forth in the preceding paragraphs, which will make it possible further to increase the output of the apparatus.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIG. 1 is a diagrammatic illustration of a tuft-setting apparatus with a control mechanism according to the present invention.

FIG. 2 is a modified tuft-setting apparatus according to the invention.

FIGS. 3 to 8 illustrate the tuft-setting tool in the subsequent working positions of its single parts.

General Arrangement

The tuft-setting apparatus of the present invention is characterized primarily by a fluid operable control mechanism as for instance a pneumatically operable control mechanism or a hydraulically operable control mechanism. The employment of fluid operable means for controlling the various control operations imparts upon the operation of the apparatus a heretofore non-obtainable smoothness, without affecting the precision of operation. In this way, the wear of the tools for carrying out the individual operational steps will be considerably reduced and thus the life of the apparatus will be increased while its liability to disturbances will be greatly decreased. Standard switch and control elements may be employed for the individual movements of the tools. The respective location of these switch and control elements may be selected in conformity with the particular requirements and the pneumatic or hydraulic connections may be effected in any convenient manner by hoses or the like. It is furthermore possible in view of the fluid pressure control of the present invention to combine a greater number of tools to an automatic brush-producing unit.

In conformity with the present invention, the control of the pneumatic or hydraulic tool drives may be effected by a single control member common thereto such as for instance a cam shaft the cams of which actuate control elements for the individual drives. By correspondingly off-setting the individual cams, the desired sequence of operation of the tools will be assured.

According to a modification of the present invention, the pressure fluid driving and controlling means for bringing about the individual working operations may also be arranged in series in such a way that each working step will control or initiate the next working step. Such an arrangement will assure the proper sequence of operation of the various operational steps and will further reduce the possibility of any disorders.

The course of the movements associated with each working operation may, according to the invention, be controlled in conformity with the movement of the work piece. In other words, the start of the working operations may be controlled by the stepwise effected feed of the brush body to be provided with tufts of bristles.

While the working speed of the tools in an apparatus according to the invention is less than that of a mechanically controlled apparatus of the type involved, this can be more than compensated for in a fluid pressure operated device according to the present invention by providing a sufficient number of pressure actuated tools, and above all in corresponding arrangement along the path of the brush body, preferably so that with each feed step of the work piece conveyor, the machine will deliver a completed brush at its discharge end.

Structural Arrangement

Referring now to the drawings in detail and FIG. 1 and FIGS. 3 to 8 thereof in particular, the arrangement shown therein comprises primarily a first portion with the actual tools and a second portion representing the control mechanism according to the invention. Said first portion, which comprises to a great extent a mechanism known per se, is designed as follows. In a stationary

housing 2 there is longitudinally displaceably mounted a setting needle 3 which is actuated and guided by the piston 4 and is furthermore guided in a transverse wall 5. Also longitudinally displaceably mounted in housing 2 is a slide 6 which is connected to a setting head 8 by means of an arm 7 firmly connected to said head and extending through the wall of said housing. The said tool head 8 is coaxially connected to the setting needle 3 and is provided with a longitudinal bore for the latter. The head 8 is located in front of one end face of housing 2 and is displaceable so as to be able to be brought into engagement with a work piece 1. Between the needle piston 4 and slide 6 in housing 2 there is mounted a spring 9, whereas between said slide 6 and the transverse wall 5 there is interposed a spring 10. However, if desired, the feed of the tool head 8 may also be effected by a separate fluid compressed actuating drive.

The apparatus or working tools thereof include a device 11 for grasping and feeding a certain quantity of bristles. This device, which has the shape of a sickle, is provided with a recess 12 and is adapted to oscillate. When said sickle 11 is oscillated outwardly (FIG. 1), it will from the stock container 13 grasp a certain quantity of bristles, hairs or the like and will convey the same to the station *a* between the end face of housing 2 and the setting head 8 (FIG. 5). For purposes of forming the anchoring loop from wire or in order to apply the anchoring loop to the withdrawn tufts of bristles to be set, the following means are employed. By means of a pair of rollers 14, 15 one of which is firmly connected to a drive gear ring 16, a wire 17 is fed to the front portion of housing (FIG. 1). A cutting or bending tool 18 longitudinally displaceably journalled in housing 2 and provided with a passage for the setting needle 3, is adapted to separate a section 17*a* from wire 17 (FIG. 3) and to bend the cut-off section into U-shape. This is effected through the intervention of a mandrel 19 which is transversely displaceable with regard to housing 2 on a bar 20. The mandrel 19 is displaceable on rod or bar 20 and in a direction transverse to the housing 2, which direction is in fact (as shown in FIGS. 3 and 4) rectangular to the plane of FIG 1, and is adapted to be moved into the longitudinal central axis of the housing 2 and thus into the path of tool 18 and setting needle 3. The bending tool 18 protrudes by means of transverse bar 21 from a slot of housing 2, the said transverse bar 21 being connected to a feed drive. After withdrawal of mandrel 19, the tool 3 will introduce the U-shaped wire loop 17*a* and the tuft 13*a* of bristles grasped at (*a*) into the bore of the setting head 8 (FIGS. 5 and 6). After the setting head 8 has been advanced until it engages the brush body 1 (FIG. 7), the needle 3 pushes the wire loop 17*a* with the tuft 13*a* of bristles into a bore of the brush body 1 thereby carrying out the tuft-setting operation (FIG. 8).

The fluid pressure operated mechanism of the tuft-setting apparatus according to the invention comprises the following elements (FIGS. 1 and 2). For purposes of actuating the sickle 11 there is provided a fluid pressure cylinder 22 with double acting piston 23, said cylinder 22 being journalled so as to be adapted to oscillate. The piston rod 24 of piston 23 is pivotally connected to sickle 11. The stepwise feed of wire 17, in the form shown in FIG. 1, is effected by a piston rod 26*a* connected to the piston 26 which is reciprocably mounted in a pressure fluid cylinder 25 which is journalled so as to be able to oscillate. The drive of the cutting and bending tool 18 is effected by a cylinder 27 having a double acting piston 28 reciprocably mounted thereon, while piston rod 29 connected to piston 28 is connected to bar or arm 21. The setting needle 3 extends outwardly through the rear end of housing 2 and is connected to a double acting piston 32 reciprocably mounted in a cylinder 31. The rod 20 is driven by a piston 35 which is reciprocably mounted in cylinder 36.

The above described elements and mechanisms are the same for the arrangement of FIG. 1 and for the arrangement of FIG. 2, except as noted below, and therefore have been designated with the same reference numerals.

There will now be described in detail the embodiment shown in FIG. 1.

As will be evident from FIG. 1, in the path of the stepwise advanced brush body 1 there is arranged an electric control switch 38 which is actuated by each of the work pieces when passing by said switch 38. The switch 38 is by means of lines 39 leading to a switch 40 electrically connected with an electric motor 41. Motor 41 through a worm wheel gear system 42 drives a control shaft 43 which has mounted thereon in certain offset arrangement five cam discs 44, each cam or disc 44 being offset to the next one in a certain manner. Each of the cams is adapted to actuate a pressure fluid controlling switch 45 to 49. These switches form the control means for the working cylinders 25, 22, 31, 27 and 36 to which said switches are connected by the lines shown in FIG. 1.

During the feed of the work pieces which is effected in successive steps, a brush body 1 taking part in said work piece feeding movement closes switch 38 thereby closing the energizing circuit for the electric motor 41 so as to start the same. The switch 40 in line 39 represents a time switch determining the time for which the motor 41 thus started will remain in operation. This period controlled by switch 40 is so selected that the cam shaft 43 will carry out precisely one complete revolution in the direction of the arrow *b*. During this revolution, the cam surfaces of the cam discs 44 respectively control the switches 45 to 49 associated therewith in the direction of advance and return of the pistons of the respective cylinder piston systems controlled thereby. This is effected in the sequence determined by the offset arrangement of the cams. Inasmuch as said sequence is determined in conformity with the sequence of the movement of the individual parts of the apparatus, it will be evident that with each complete rotation of cam shaft 43 a complete series of setting operations or a complete setting cycle will be effected.

If desired, the arrangement may be modified so that each switch 45 to 49 has connected thereto a number of tool drives, for instance for as many tools as are required for the simultaneous setting of a brush body. In addition thereto, the common control range may be broadened by a correspondingly extending shaft 43 and mounting thereon a number of groups of cam discs 44 and associating therewith a corresponding number of switches 45 to 49. If a larger tuft-setting machine is to be produced, the entire control mechanism from motor 41 on up to switches 45 to 49 may be multiplied and all control means may be controlled parallel to each other by a work piece switch 38 common thereto.

The embodiment illustrated in FIG. 2 differs from that of FIG. 1 with regard to the control of the individual working operations which in this instance are controlled in series. In connection therewith, the fluid pressure operable drives of the parts of the apparatus are supplemented in such a way that the piston rod 29 is provided with a dog or nose 30, while the piston rod 3 is equipped with a finger 33, and rod 20 is provided with a nose 37. In addition thereto, switches 50, 51 and 52 are respectively arranged in the path of said noses and finger. Cylinder 31 is preceded by an impulse valve 34. Cylinder 22 is journalled so as to be able to oscillate. A double lever 53 is adapted to take part in the oscillating movement of cylinder 22. To this end, the said double lever 53 is adapted by means of a push rod 54 engaging the gear ring 16 to actuate stepwise the pair of rollers 14, 15 in such a way that each time a wire piece of the length of the desired loop is fed into the housing 2. Switch 55 is arranged in the path of the oscillating lever 53.

If in the continuous work piece feed, the control member 38, which in this instance operates pneumatically, is actuated by a brush body passing by switch 38, the said switch 38 will in its switched-on position pass compressed air received from a main conduit 59 and conduit 60, through a conduit 61 to the cylinder piston system 22, 23 operatively connected to the sickle 11. As a result thereof, said sickle 11 will convey a certain quantity of bristles from container 13 to station *a*. At the same time, the pair of rollers 14, 15 will, through the intervention of the lever system 53, 54, move a piece of wire 17 into housing 2. During this operation, the oscillating lever 53 will by means of its free end actuate switch 55 so that the latter will through conduit 63 actuate the cylinder piston system 27, 28 for the cutting or bending tool 18 so as to cause the same to bend the wire loop 17*a* around mandrel 19. During this movement, the control nose 30 of piston rod 29 closes a switch 50 as a result of which pressure fluid passes through conduit 54 to cylinder 36 and actuates piston 35 so as to withdraw or return bar 20 to its starting position. During this operation, nose 37 of bar 20 actuates switch 52 designed as valve with idle return and adapted to release the compressed air through a conduit 66 to the impulse valve 34. Valve 34 controls a cylinder piston system 31, 32 in such a way that the setting needle 3 is instantaneously advanced whereby due to the follower effect of spring 9 first the tool set 8 containing the wire-looped tuft 13*a* of bristles is in a shock-like manner pressed against the brush body 1 while during the further stroke of piston 32, the setting needle 3 pushes or drives the tuft 14*a* of bristles into the receptive bore 67 of the brush body 1. At the end of this movement, arm 33 actuates the valve or switch 51 so that by compressed air passing through conduit 69 the impulse valve 34 is reversed and the return stroke of piston 2 and thereby of setting needle 3 is initiated. At the same time, during the stepwise advance of the work piece, the brush body controlling the respective operation releases the control switch 38. As a result thereof, switch 38 brings about an actuation of the cylinder piston system 22, 23 through conduit 70 in such a way that sickle 11, which may also be called the tuft-feeding means, will carry out a return stroke, i.e. will return the recess 12 to the bristle storage container 13. Due to the thus freed or released switch 55, the cylinder piston system 27, 28 returns the tool 18 to its starting position, whereas the cylinder piston system 35, 36 after releasing valve or switch 52 lifts bar 20 so that the latter again moves mandrel 19 into the path of the tool 18. In this way, all elements of the tool-setting apparatus have been returned to their starting positions and are now ready for the next following automatic cycle which will be initiated by the next feeding step of the work piece actuating switch 38.

It will be appreciated that instead of the automatically controlled switch 38, also a manually operable switch may be provided.

Each of the cylinder piston systems of the above described two embodiments is preceded by two control valves 71 (illustrated in FIG. 2 only), by means of which the stroke and speed of the driving pistons may be precisely adjusted. As medium values for the working speed of the tool according to the invention, the speed of from 1 to 2 seconds per cycle, and a further second for the feed of the work piece by one step may be mentioned.

It is, of course, to be understood that the present invention is, by no means, limited to the particular constructions shown in the drawings but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. In an automatic tuft-setting apparatus comprising a plurality of tools for grasping bristles, binding said bristles up to tufts, and setting the same into brush bodies: individual fluid operable actuating means for said tools operatively connected to said tools, and control means operatively connected to said fluid operable actuating means for automatically controlling the said actuating means in a predetermined sequence, said tools including feed means operable for delivering a bristle bundle directly from a supply of bristles to a tuft setting station, and a setting tool means operable for moving said bristle bundle directly from said tuft setting station to a brush body.

2. In an automatic tuft-setting apparatus comprising a plurality of tools for grasping bristles, binding said bristles up to tufts, and setting the same into brush bodies: individual fluid operable actuating means for said tools operatively connected to said tools, and control means operatively connected to said fluid operable actuating means operable for automatically controlling the said actuating means in a predetermined sequence, said control means including a plurality of fluid control valves respectively associated with said fluid operable actuating means, said tools including feed means operable for delivering a bristle bundle directly from a supply of bristles to a tuft setting station, and a setting tool means operable for moving said bristle bundle directly from said tuft setting station to a brush body.

3. In an automatic tuft-setting apparatus comprising a plurality of tools for grasping bristles, binding said bristles up to tufts, and setting the same into brush bodies: individual fluid operable actuating means for said tools operatively connected to said tools, motor means, a cam shaft operatively connected to said motor means and provided with a plurality of cam means corresponding to the number of tools to be controlled, said cam means being offset with regard to each other in conformity with the sequence according to which said tools have to be actuated, and means interposed between said fluid operable actuating means and said cam means and operable by the latter for controlling the flow of fluid to and from said fluid operable actuating means, said tools including feed means operable for delivering a bristle bundle directly from a supply of bristles to a tuft setting station, and a setting tool means operable for moving said bristle bundle directly from said tuft setting station to a brush body.

4. In an automatic tuft-setting apparatus comprising a plurality of tools for grasping bristles, binding said bristles up to tufts, and setting the same into brush bodies: individual fluid operable actuating means for said tools operatively connected to said tools, motor means, a cam shaft operatively connected to said motor means and provided with a plurality of cam means corresponding to the number of tools to be controlled, said cam means being offset with regard to each other in conformity with the sequence according to which said tools have to be actuated, valve means hydraulically connected to said fluid operable actuating means and under the control of said cam means so as to be operable by the latter for controlling the flow of fluid to and from said fluid operable actuating means, feeding means for feeding a work piece to said apparatus, and switch means extending into the feeding path of the work piece and operable thereby for controlling said motor means to cause the motor means to drive the cam shaft one revolution each time said switch is actuated.

5. In an automatic tuft-setting apparatus comprising a plurality of tools for grasping bristles, binding said bristles up to tufts, and setting the same into brush bodies: individual fluid operable actuating means for said tools operatively connected to said tools, and control means operatively connected to said fluid operable actuating means for automatically controlling the same, said control means including a plurality of fluid control valve means respectively hydraulically associated with said fluid operable actuating means, and means operated by movement of each said tool, with the exception of the tool of the last control means, to operate for controlling the initiation of operation of the others of the tools.

6. In an automatic tuft-setting apparatus comprising a plurality of tools for respectively feeding bristles to a tuft-forming station, binding said bristles up to tufts, and setting the same into brush bodies; individual fluid operable actuating means operatively connected to said tools for actuating the same, a storage container for storing bristles, a tuft-binding station, said tool for feeding bristles comprising a feeding member operatively connected to one of said fluid operable actuating means and operable thereby for withdrawing bristles from said container and feeding the same directly to said tuft-binding station, and for supporting the bristles in said station, wire feeding means for feeding a wire to said tuft-binding station, means for actuating said wire feeding means, a wire cutting and bending tool for cutting off a section of wire fed by said wire feeding means, control means operable for controlling the operation of said wire cutting and bending tool, a mandrel operable for cooperation with said wire cutting and bending tool for forming a loop of wire around the bristles to be bound to a tuft while the bristles are supported by said feeding member, additional fluid operable actuating means for controlling said mandrel, and means for conveying the bristle bundle and wire loop directly from said feeding member to a brush body while setting the bristles and wire loop therein.

7. In an automatic tuft-setting apparatus comprising a plurality of tools for respectively feeding bristles to a tuft-forming station, binding said bristles up to tufts, and setting the same into brush bodies: a storage container for storing bristles, feeding means, a tuft binding station, first fluid operable actuating means operatively connected to said feeding means for causing the same to withdraw bristles from said container and to feed the same directly to said tuft-binding station and support the bristles in said station, wire cutting and bending means, second fluid operable actuating means for actuating said wire cutting and bending means, wire feeding means for feeding wire into the path of said wire cutting and bending means, means for actuating said wire feeding means, mandrel means, third fluid operable actuating means operatively connected to said mandrel means for controlling the movement thereof to said tuft-forming station to permit said wire cutting and bending means to bend a wire loop around the bristles at said tuft-forming station while the bristles are supported therein by said feeding means, tuft-setting means for engaging the wire loop and bristles and the wire loop and bristles directly from the said feed means to a brush body to set the bristles into a brush body, fourth fluid operable actuating means operatively connected to said tuft-setting means, control means operable by said third fluid operable actuating means in response to a movement of said mandrel means from said tuft-forming station, and impulse valve means operable by said control means for controlling said tuft-setting means.

8. In a machine for setting tufts in brush bodies: a setting head movable into engagement with the brush body, a setting needle reciprocable in a straight line through the setting head for pushing a tuft therethrough into the brush body, a bristle container, a bristle feed member associated with the container operable for conveying bundles of bristles from the container directly to the tuft forming station located between the setting head and the setting needle and for holding the bundle of bristles therein, means for feeding a wire into the space between the setting needle and the tuft in the tuft forming station and for bending the wire, and means for advancing said setting needle toward the brush body, resilient means between said needle and said setting head whereby in one continuous movement the said needle advances the wire to the tuft forming station and then advances the tuft and wire to the setting head and then advances the setting head and the tuft and wire into position where the setting head engages the brush body, and then drives the tuft and wire through the setting head into the brush body.

9. In a machine for setting tufts in brush bodies: means to support a brush body, a setting head movable axially into engagement with said body, a setting needle co-axial with said setting head, resilient means between the setting head and setting needle so that movement of the needle toward the brush body will advance the setting head into engagement with the brush body, a bristle container, a feeding member movable in one continuous movement to convey a predetermined quantity of bristles from said container into the space between the setting head and the setting needle and operable to support the bristles therein, means for feeding a wire and for cutting off the wire and forming it into a loop in the space between a tuft of bristles and the setting needle, and fluid operable means connected with said setting needle and operable after the tuft of bristles and the wire loop are in the aforementioned positions to advance the setting needle toward the brush whereby in one continuous and uninterrupted movement the wire loop is brought into engagement with the tuft of bristles and the wire loop and thereafter the tuft of bristles and wire loop together with the setting head are advanced toward the brush body until the setting head engages the brush body and whereupon the setting needle and wire loop and tuft of bristles are pushed through the setting head and the tuft of bristles is set into the brush body.

References Cited in the file of this patent

UNITED STATES PATENTS

2,097,296	Lipps	Oct. 26, 1937
2,433,191	Baumgartner	Dec. 23, 1947

FOREIGN PATENTS

E8425 III/9a	Germany	Dec. 13, 1956