W. C. READ.

BRUSH MACHINE.

APPLICATION FILED MAY 25, 1917.

1,433,151.

Patented Oct. 24, 1922.

6 SHEETS—SHEET 1.

FIG. 1.

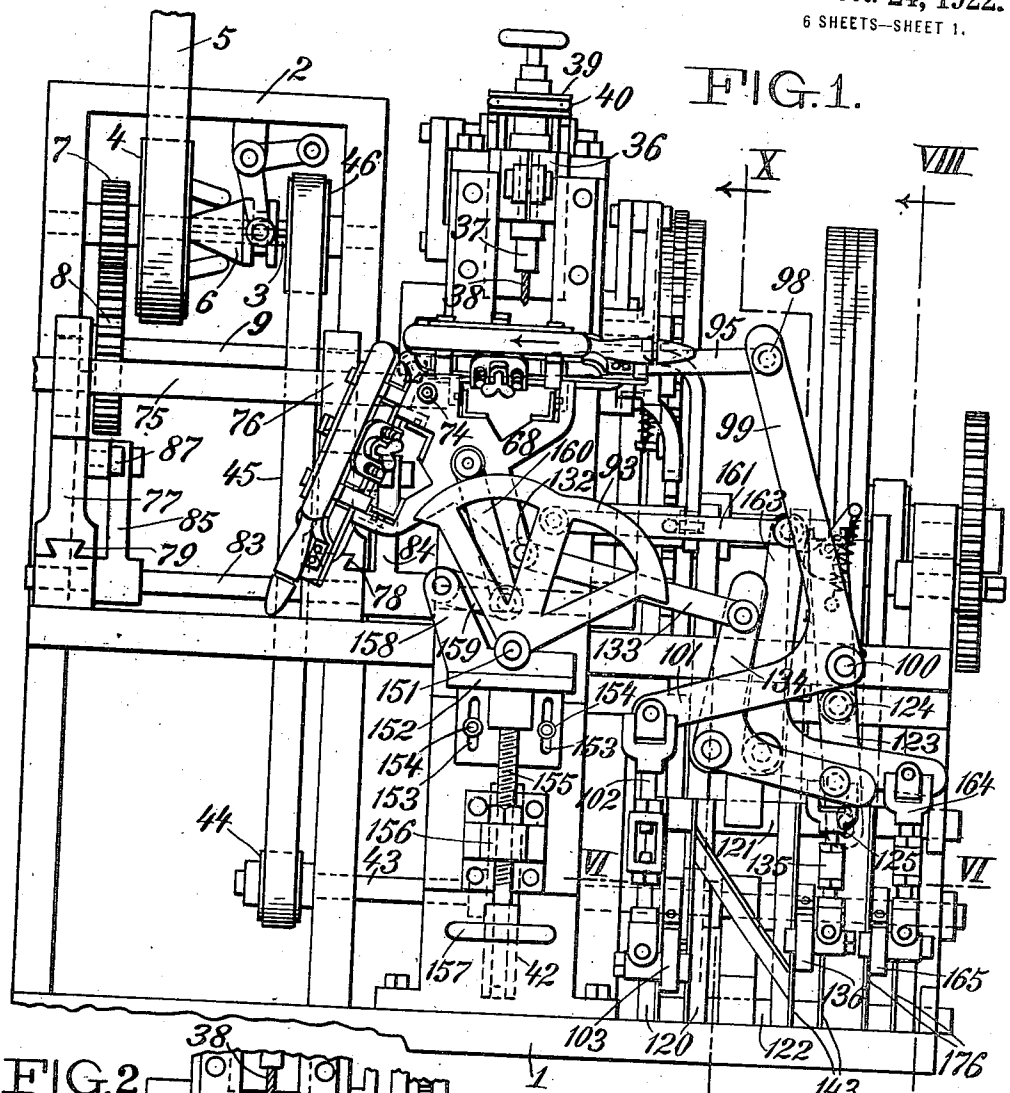


FIG. 2.

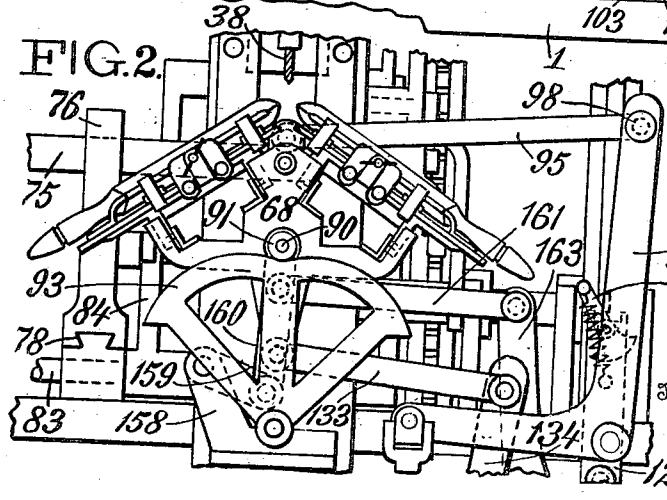
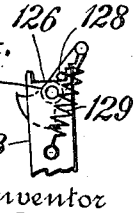


FIG. 2A.



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By his Attorney

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6 SHEETS—SHEET 2.

FIG. 3.

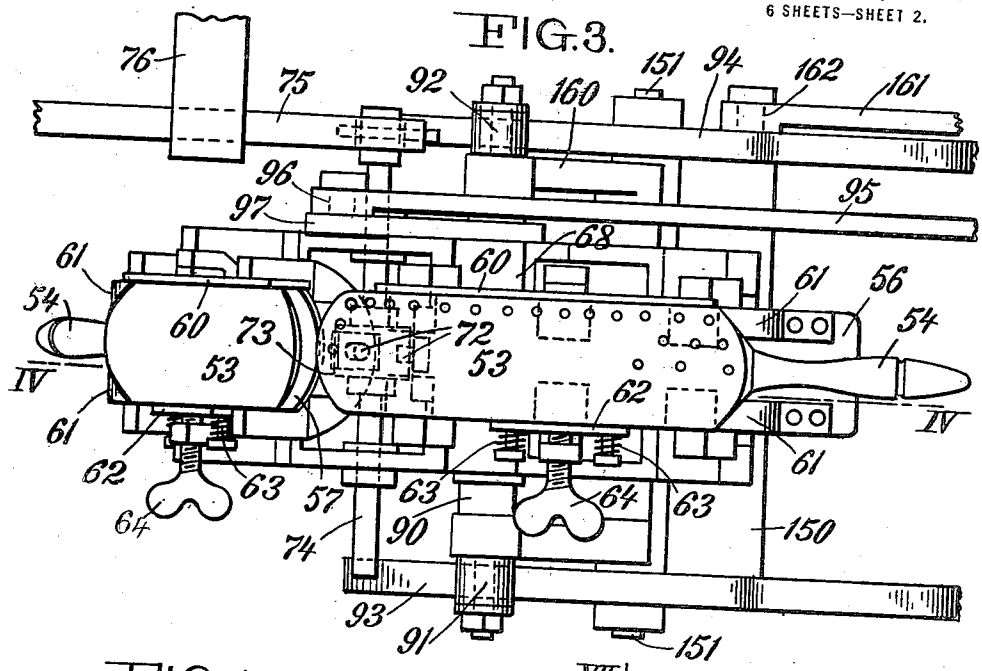
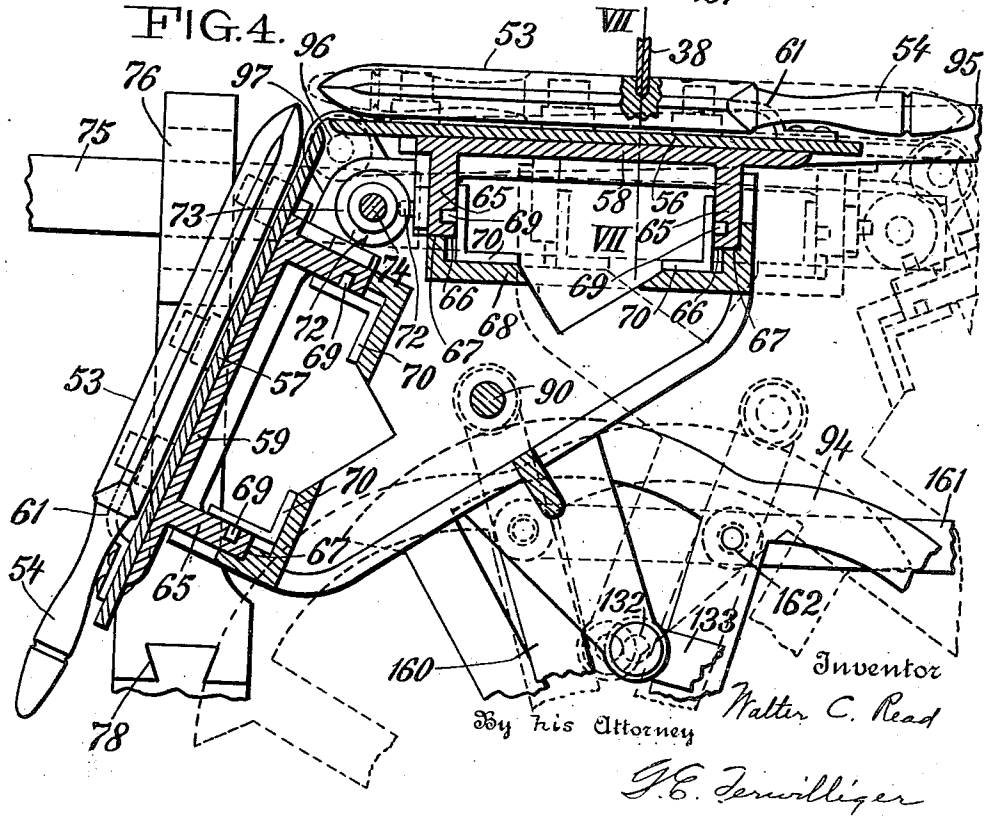


FIG. 4.



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6 SHEETS—SHEET 3.

FIG. 5.

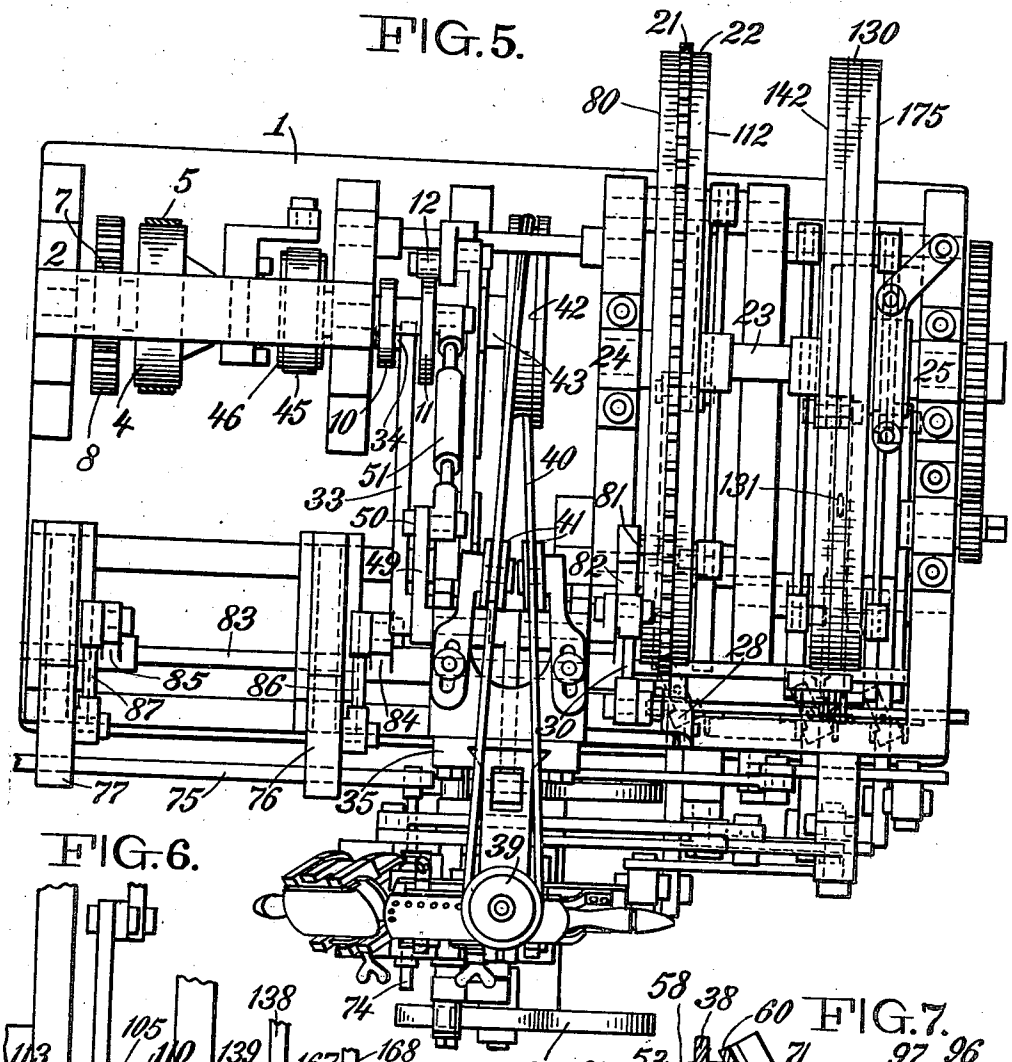


FIG. 6.

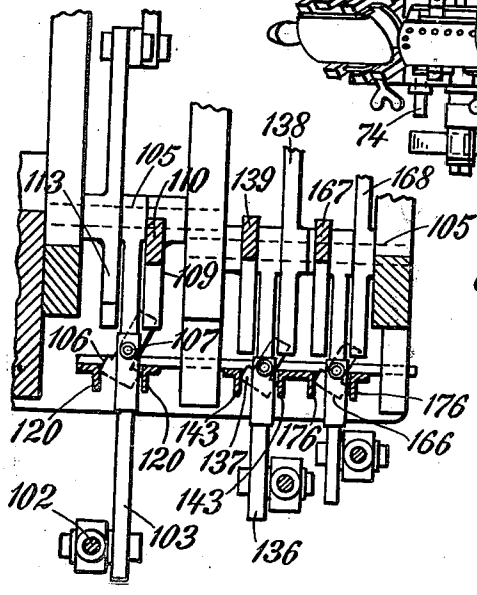
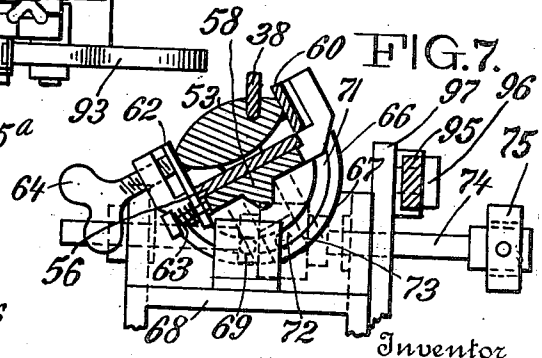


FIG. 7.



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6 SHEETS—SHEET 4.

FIG. 8.

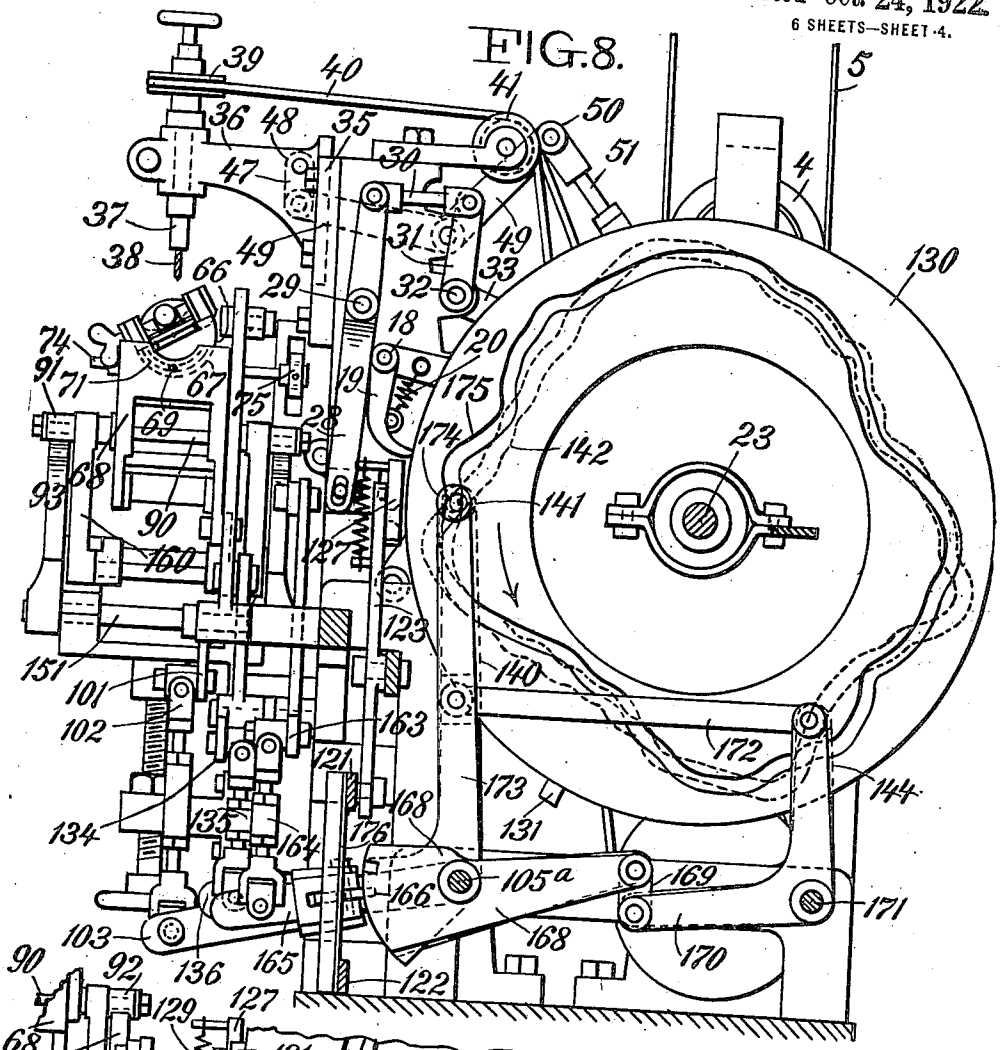

FIG. 9.

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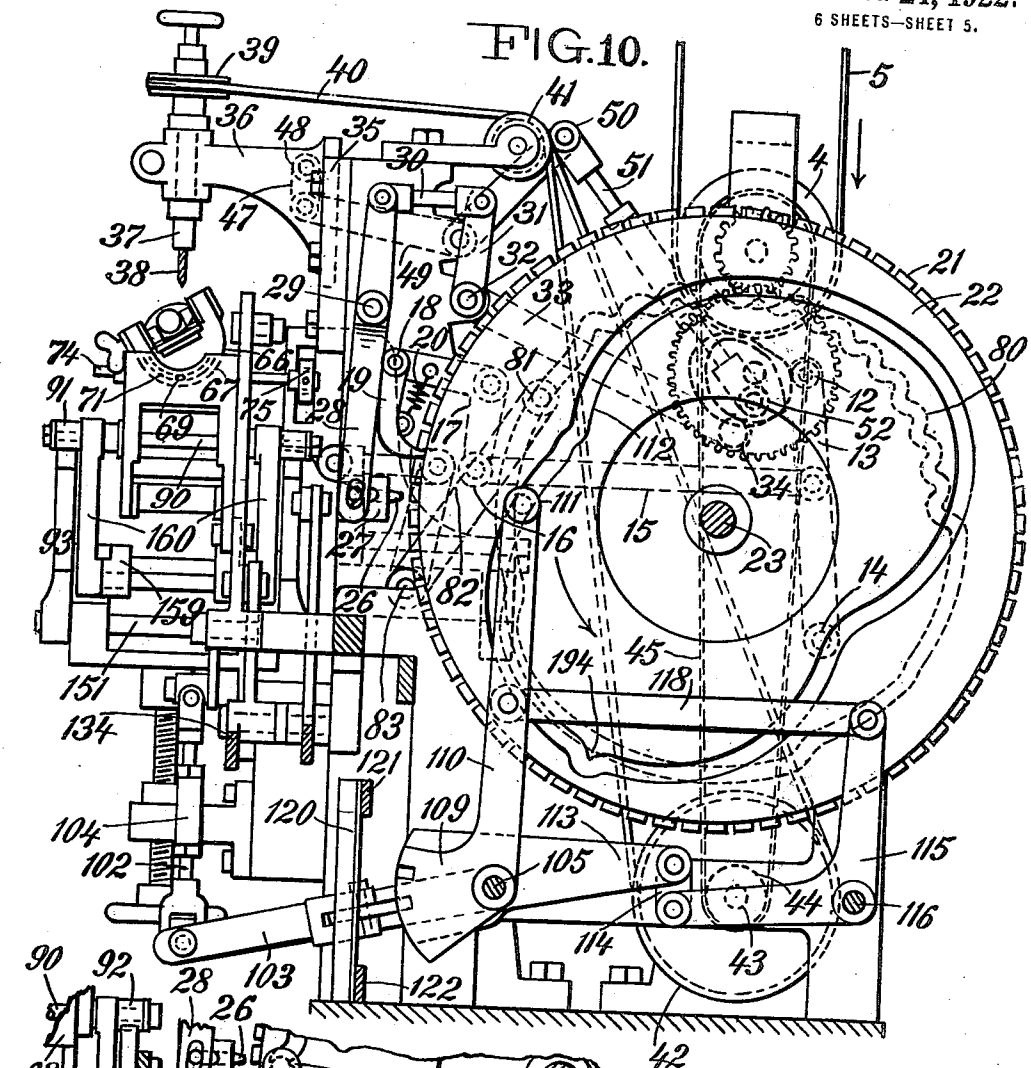
6 SHEETS—SHEET 5.

FIG. 10.



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6 SHEETS—SHEET 6.

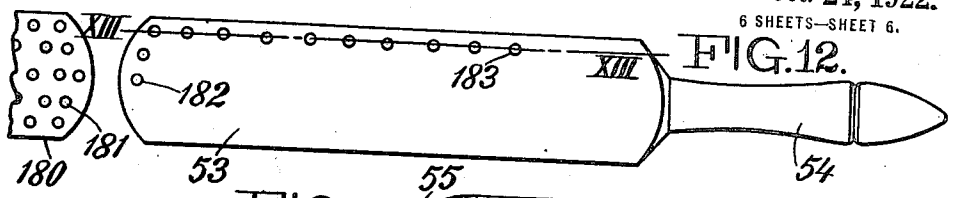


FIG. 12.

FIG. 13.

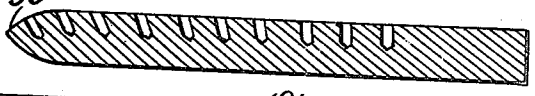
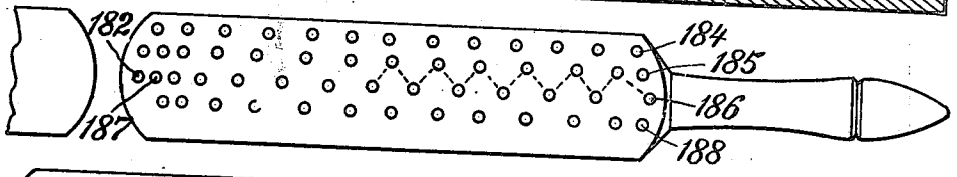


FIG. 14.



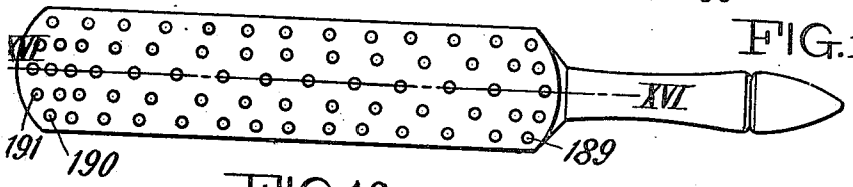


FIG. 15.

FIG. 16.

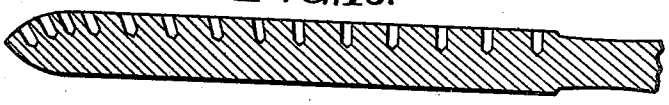


FIG. 17.

FIG. 18.

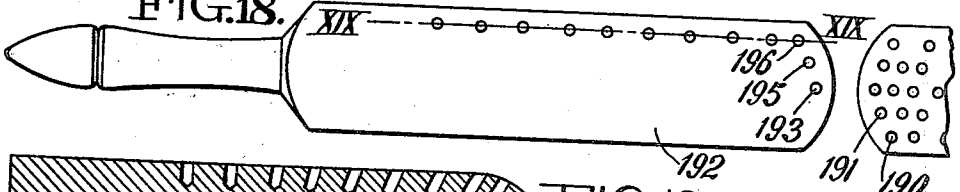


FIG. 19.

FIG. 20.

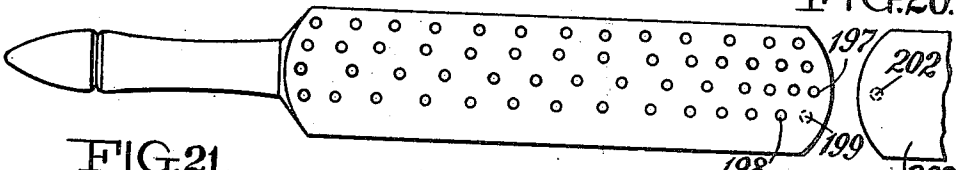


FIG. 21.

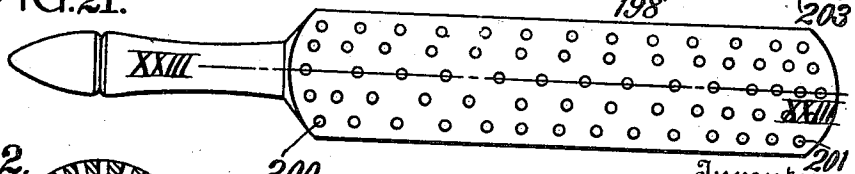


FIG. 22.

FIG. 23.

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UNITED STATES PATENT OFFICE.

WALTER C. READ, OF BLOOMFIELD, NEW JERSEY.

BRUSH MACHINE.

Application filed May 25, 1917. Serial No. 170,825.

To all whom it may concern:

Be it known that I, WALTER C. READ, a citizen of the United States, residing in the town of Bloomfield, county of Essex, and State of New Jersey, have invented certain new and useful Improvements in Brush Machines, of which the following is a specification.

My invention relates to a device designed to hold a wooden blank which is to become the back of a brush, and firmly to position this blank while it is undergoing certain operations in the course of brush manufacture, such as drilling the blank with the holes which are to receive the tufts and subsequently tufting the brush, that is, inserting the tufts or bristles in the previously drilled holes and securing them in place.

My invention aims to perform the various functions attendant upon positioning and holding the blank in predetermined successive positions without manual effort or attention on the part of the operator, all the various operations being accomplished automatically by suitable mechanism. While thus doing away with hand labor and thus reducing the cost of manufacture, my invention also makes possible the further advance of absolute uniformity in the product, that is, every back will be drilled with the same number of holes, positioned exactly the same and of uniform depth, so that if a drilling machine and tufting machine are coupled together, the blanks after being drilled may be removed from the holder or carrier of the drilling machine and placed in a similar carrier of the tufting machine with the definite certainty that the tufts will centrally enter the holes previously drilled. Many other advantages will become apparent from the following specification.

In the accompanying drawings, which form a part of this specification, Figure 1 is a front elevation of one embodiment of my invention mounted in connection with a drilling machine of the usual type. Figure 2 is a fragmentary view, also in front elevation, of the blank carriers and part of their operating mechanism at the phase in the operation of the machine when the drill has finished operating on one blank and is about to drill a companion blank. Figure 3 is a top view on an enlarged scale of the carrier mechanism in the position of Figure 1. Figure 4 is a longitudinal sectional view on line IV—IV of Figure 3. Figure 5 is a plan view of the machine in the same phase as Figure 1. Figure 6 is a horizontal sectional view on line VI—VI of Figure 1. Figure 7 is a vertical sectional view on line VII—VII of Figure 4. Figure 8 is a vertical sectional view on line VIII—VIII of Figure 1. Figure 9 is a view of a portion of the mechanism of Figure 8 at a different phase. Figure 10 is a vertical sectional view on line X—X of Figure 1. Figure 11 is a fragmentary view of a portion of the mechanism of Figure 10, corresponding in its phase to Figure 9. Figure 12 is a diagrammatic view of a brush blank partially drilled and a portion of another blank completely drilled. Figure 13 is a longitudinal sectional view on line XIII—XIII of Figure 12. Figure 14 is a view similar to Figure 12 at a later phase in the operation of the machine. Figure 15 shows a blank completely drilled. Figure 16 is a longitudinal sectional view on line XVI—XVI of Figure 15. Figure 17 is a transverse sectional view of the drilled blank. Figure 18 is a view similar to Figure 12 but showing the left-hand blank partly drilled. Figure 19 is a longitudinal sectional view on line XIX—XIX of Figure 18. Figure 20 is a view similar to Figure 18 but showing a later phase in the operation. Figure 21 shows the left-hand blank completely drilled. Figure 22 is a transverse sectional view of such blank. Figure 23 is a longitudinal sectional view on line XXIII—XXIII of Figure 21. Figure 24 is a fragmentary view of a portion of the mechanism for accomplishing the reversal of certain of the controlling mechanism.

Referring to the drawings in detail, the numeral 1 designates a base upon which is mounted a frame 2, in which is journaled a shaft 3 upon which is loosely mounted a pulley 4 driven by belt 5. The clutch 6 splined to the shaft 3 is adapted to lock the pulley 4 on the shaft and cause the simultaneous rotation thereof. Upon the shaft 3 is mounted a gear 7 meshing with gear 8 on the shaft 9, likewise mounted in the frame 2 and carrying upon its inner end the cams 10 and 11. The cam 11 is provided with a follower 12 (see Figures 5 and 10) mounted upon an arm 13 pivoted at 14 to a fixed part of the

framework of the machine and pivotally connected at an intermediate point to an arm 15, which is pivoted at 16 to a bell crank lever 17. Upon the extending end 18 of this bell crank lever is pivoted a pawl 19, which is constantly urged toward the lever by means of a spring 20. This pawl is adapted to engage teeth 21 on the periphery of a wheel 22 fixed to the shaft 23, which is suitably mounted in bearings 24, 25. Each revolution of the cam 11 in the direction of the arrow in Figure 10 causes the pawl 19 to advance the wheel 22 a step equal to the length of a tooth and a space between two teeth and then returns the pawl to its initial position, where it will enter the space between the next two teeth. It will be seen that the shape of the pawl is such that in moving downward in Figure 10, it will be locked with the teeth of the wheel 22 and will cause the wheel to move with it, while in moving upward the pawl will ride over the teeth. The cams 10 and 11 are so designed and bear such an angular relationship to each other that at the instant the pawl 19 ends its downward travel, that is, when it has advanced the wheel 22 a complete step, the wheel will be locked in that position by means of a dog 26 carried by a block 27, which has a pin-and-slot connection with a lever 28 pivoted to the frame at 29 and having its upper end pivoted to a link 30, which in turn is pivoted to an arm 31 mounted upon a rock shaft 32 to which is also secured the arm 33 carrying the follower 34 of the cam 10. It will thus be seen that by the mechanism thus far described the continuous revolution of the shaft 3 gives the wheel 22 and the shaft 23 a step-by-step movement equal to the length of a tooth and the distance between two teeth.

Mounted in guideways 35 in front of the machine is a vertically sliding arm 36 in which is journaled a chuck 37 of any suitable construction for holding the drill 38. The upper end of the shaft to which the chuck is secured is provided with a pulley 39 over which passes a belt 40 running over the guide pulleys 41 and pulley 42 on shaft 43. This shaft carries another pulley 44, which is continuously driven by the belt 45 passing over a pulley 46 on the shaft 3. By this mechanism the drill 38 is continuously rotated as long as the shaft 3 revolves. The arm 36 and consequently the drill are reciprocated vertically by mechanism including an arm 47 pivoted to the arm 36 at 48 and at its other end to a bell-crank lever 49 centrally mounted upon the frame of the machine. The other end of this bellcrank lever is pivoted at 50 to the connecting rod 51, which in turn is pivoted at 52 to the side of cam 11.

The blank which is to be drilled or otherwise operated upon by the machine, may consist of a body portion 53 and a handle 54. The face of the body portion is customarily curved transversely, as shown in Figure 17, and the tip 55 is curved or beveled off as shown in Figure 13.

In the manufacture of a brush of this type, the tufts are usually placed radially with respect to the transverse curvature and while they are perpendicular to the axis of the brush near the handle, as shown in Figures 13 and 16, they are inclined at an increasing angle as the tip is reached. Furthermore, in order to make the bristles appear uniform, it is necessary to have the tufts closer together at the tip, where they are inclined sharply away from each other, than near the handle where they are more or less parallel. It will thus be seen that a complex motion of the blank holder or carrier is necessary, if the drill is to have a simple vertical reciprocating movement. Not only must the holder be capable of a transverse tilting movement about the center of curvature of the face of the blank, but it must also be tiltable longitudinally to accomplish the inclining of the tufts required by the mutual inclination of the holes in Figure 16, and must also be capable of a movement toward and away from the drill, since the holes are bored to a substantially uniform depth. The carrier must also move back and forth so as to cover the area of the body of the blank with the desired number of holes, and their spacing must be constant and predetermined. The carrier and the mechanism for giving it these complex movements will now be described.

The blank holders consist of plates 56 and 57 mounted upon the frames 58 and 59, respectively, (see Figures 3, 4 and 7). Each plate is provided at one side with a stop or guide 60, against which one side of the blank is adapted to be seated, and at one end with stops 61 having beveled faces adapted to engage the narrowing part of the blank. A movable clip 62 forced inwardly by means of springs 63, is adapted to be clamped against the other side of the blank by the wing bolt 64. It will be understood that in placing a blank in the machine, the wing bolt 64 is retracted sufficiently to permit the blank to be placed by the operator in contact with the stops 60 and 61. A turn of the wing bolt 64 will then be sufficient to clamp the blank between the clip 62 and the stops, its longitudinal position being determined by the engagement of the stops 61 with the receding ends of the blank adjacent to the handle. It will be seen that the plates and the frames to which they are secured are angularly disposed with reference to each other and that the stops are so arranged that the carrier is capable of holding two blanks with the tips close together. Each

of the frames 58 and 59 is provided with depending ends 65 having the lower edges 66 formed on an arc and seating upon similarly curved surfaces 67 in a sub-frame 68. The surfaces 66 and 67 are held in continuous but slidable engagement by means of pins 69 mounted upon supports 70 secured to the sub-frame and entering grooves 71 in the members 65, these grooves being formed about the same axis as the surfaces 66 and 67. By this construction, the carriers and the blanks are capable of transverse tilting movement about the axis of the curved surfaces 66. The machine is so designed that this axis is also the axis of the transverse curvature of the blank when it is in position in the carrier. The device for communicating tilting motion to the carriers includes pins 72 projecting from blocks slidably mounted in the adjacent end members 65 of the two carriers and entering holes in a spool 73 mounted upon rod 74. This rod is adapted to reciprocate freely in bearings formed in an upward extension of the sub-frame and is secured at its inner end to an arm 75 mounted in and connecting uprights 76 and 77, the lower ends having a dove-tail connection at 78 and 79, respectively, with a fixed portion of the main frame of the machine. This construction provides a frame which is adapted to slide horizontally in a direction forwardly and rearwardly of the machine. The position of this frame and consequently the transverse tilting motion of the carrier are controlled by a cam 80 on one face of the wheel 22. This cam is provided with a follower 81 mounted on and arm 82 secured at its other end to a shaft 83, which is provided with arms 84 and 85 pivoted to links 86 and 87, respectively, which are in turn pivoted to the uprights 76 and 77. It will be seen that the cam groove 80 causes the oscillation of the arm 82 and through its linkage produces a reciprocation of the members 76 and 77 connected by the arm 75, which in turn reciprocates the rod 74 and thus tilts the carriers transversely.

The sub-frame 68 has the general form of a cross, the top carrying the rod 74 and the arms supporting the outer ends of the carriers. This cross is provided centrally with a transverse shaft 90 extending laterally beyond the sub-frame on each side and provided with the rollers 91 and 92 resting on the arcuate rails 93 and 94, respectively. The position of the sub-frame, and consequently of the carriers and the blanks is determined by the following mechanism:

Link 95 is pivoted at 96 to an arm 97 secured to the upper part of one side of the sub-frame. The other end of this link is pivoted at 98 to one arm 99 of a bell-crank lever, which is pivoted to the frame at 100. The other arm 101 of this lever is pivoted to the upper end of the link 102, the bottom of which is pivoted to an arm 103. The link 102 may be provided with the turn-buckle 104 for purposes of adjustment. The inner end of the lever 103 is pivotedly mounted upon the shaft 105. Centrally mounted upon the lever 103 is a T-shaped dog 106, which is free to move about the point 107 as an axis (see Figure 6). With the parts in the position shown in Figure 6, the extending end of this dog is thrown to the right into a slot 108 in one arm 109 of a bell-crank lever mounted upon the shaft 105 (see Figure 11). The other arm 110 of this lever is provided with a cam roller or follower 111 entering a cam groove 112 in the face of the wheel 22 opposite to the cam 80. As the wheel 22 revolves, it will cause an oscillation of the bell-crank arm 110, and when the dog 106 is in the position shown in Figure 6, the other arm 109 and the lever 103 are locked together by the dog, and consequently this oscillation of the arm 109 will be communicated to the arm 95 through the linkage previously described, and this will control the position of the arm 97 and thereby the upper end of the cross forming the sub-frame for the carriers. When, however, the dog 106 is thrown to the left with relation to Figure 6, direct connection between the bell-crank arm 109 and the lever 103 will be broken. The dog will then enter a slot in a lever 113, which is freely mounted upon the shaft 105 and which has its rear end connected by a link 114 to a bell-crank lever 115 pivoted to the frame at 116. The upper end of this bell-crank lever is pivoted at 117 to a link 118, which is pivoted at 119 to the arm 110. When such a connection is established between the arm 103 and the lever 113, any movement of the bell-crank arm 110 toward the rear of the machine, instead of lifting the arm 103 will depress it, since the connection between the bell-crank arm 109 and the arm 103 has been broken and motion is now communicated from the arm 110 to the arm 103 through link 118, bell-crank lever 115, link 114, lever 113 and the dog 106. This mechanism thus affords an effective means for causing a reverse movement of the arm 103 with reference to the motion of the bell-crank arm 110 merely by shifting the dog 106 through a small angle.

The mechanism which controls the action of the dog consists of a frame including the uprights 120, which span the T-shaped head of the dog 106, and the horizontal connecting members 121, 122, the entire frame being slidable laterally in the main frame of the machine. The position of the frame is controlled by a lever 123 pivoted to the main frame at 124 and having its lower end connected to the member 121 by a pin-and-slot connection 125 (see Figure 1). The upper end of the lever 123 is provided with a wide

notch 126, adjacent to which is pivoted a latch 127 (see Figure 24). Projecting rearwardly from the latch is a pin 128 adapted to move in the notch 126. The upper end of the latch is connected to the lever 123 by a spring 129. It will be seen that the latch has two positions of rest; one in which the pin 128 is in contact with the right-hand side of the notch 126 as shown in Figures 1 and 24, and another in which the latch is swung to the left with the pin bearing against the left-hand side of the notch as in Figure 2. Once in every revolution of the wheel 130 mounted upon the shaft 23 the latch is engaged by a pin 131. If the parts are in the position shown in Figures 1 and 24, the pin 131 will strike the upper portion of the latch and will swing the upper end of the lever 123 to the right. This will throw the lower end of the lever 123 and consequently the frame to which it is connected to the left with reference to Figure 1 and will shift the dog 106 into the position of Figure 6. Further travel of the pin 131 will cause it to encounter the lower curved portion of the latch 127, and will throw the latch into its other position, namely, with the pin 128 resting against the left-hand end of the notch 126, but this is accomplished without any further movement of the lever 123. This is the position shown in Figure 2. The next revolution of the wheel 130 will bring the pin 131 against the other face of the latch, first swinging the upper end of the lever 123 to the left, with respect to Figures 1 and 24, and then moving the latch about its pivot into the position shown in these figures. At each complete revolution of the wheel 130 when the pin 131 strikes the latch, there will be a movement of the frame to which the lever 123 is connected, either to the right or to the left, as the case may be, and consequently a reversal of the motion of the arm 103 with reference to the bell-crank arm 110 and therefore with reference to the cam 112 and its follower 111.

The lower end of the arm of the cross which forms the sub-frame for the carriers is pivoted at 132 to a link 133, the other end of which is pivoted to a bell-crank lever 134 having its opposite arm pivoted to a link 135 connected at its lower end to an arm 136 loosely mounted upon the shaft 105^a, which carries a dog 137 adapted to engage either the lever 138 or the arm 139 of a bell-crank lever 140 provided at its upper end with a roller or cam follower 141 entering a cam groove 142 in one face of the wheel 130.

The mechanism for operating the dog 137 consists of uprights 143 forming a part of the same frame as the uprights 120 and moving with them, so that a similar and synchronous reversal of motion is afforded. The lever 138 is connected by suitable linkage including a bell-crank lever 144 (see Figure 8) to the upper arm of the bell-crank lever 140, this back gearing being the same as in the case of the mechanism actuated by the cam 112, and providing the same reversing action.

The rails 93 and 94 are connected by a bar 150 (see Figure 3) and each is mounted upon a V-shaped frame pivoted at 151 to a cross-head 152 provided with slots 153 in which are mounted bolts 154 secured to the main frame of the machine. This cross head is vertically adjustable by means of a screw 155 passing through the internally threaded block 156 mounted upon the main frame and provided with a hand wheel 157. The cross-head is also provided with an upwardly extending arm 158 (see Figure 1) which is connected by the pivotally mounted links 159, 160 to the rod 90 forming the axis of the rollers 91 and 92.

The position of the rails and their supporting frame with reference to the axis of their pivotal mounting 151 is controlled by mechanism precisely similar to that connected to the lower end of the cross forming the sub-frame. This consists of a link 161 pivoted to the rail 94 at 162 and at its other end to a bell-crank lever 163, the lower end of which is connected by the link 164 to an arm 165 carrying the dog 166, similar in its construction and functions to the dogs 106 and 137. This dog is adapted to cooperate either with one end of the bell-crank lever 167 mounted on shaft 105^a or with the lever 168 which is connected by the link 169 to the bell-crank lever 170 pivoted to the main frame at 171 (see Figures 6, 8 and 9). The upper arm of this lever is connected by a link 172 to the upwardly extending arm 173 of bell-crank lever 168. The arm 173 carries at its upper end a roller 174 which enters and forms the follower of the cam groove 175 on the face of the wheel 130 opposite from the cam 142. The position of the dog 166 is controlled by uprights 176 which are secured to the uprights 120 and 143 by the connecting members 121, 122.

In the operation of the device, assuming that the pulley 4 is continuously rotated by the belt 5 and the clutch 6 is engaged, the drill will be rotated continuously by belts 40 and 45 and pulleys and shafts with which they cooperate. Each time the cam 11 makes one complete rotation, the drill will be given a complete vertical reciprocation through the bell-crank levers and links which connect them, since the cams 10 and 11 are mounted on the same shaft and revolve with it. For each reciprocation of the drill, the wheels 22 and 130 will be advanced one step through the action of the mechanism actuated by cams 10 and 11 and this interval will consist of a relatively short period during which the wheels are being advanced one step by the pawl 19 and a relatively long

period during which they are locked in stationary position by the dog 26. The relation of the cams to the point 52 at which the arm 51 is pivoted to the cam 11 is such that it will be during this period of rest that the drill makes its downward travel or operative stroke. Consequently, when the drill is making its downward stroke, the carriers and the blanks held by them are stationary. The step-by-step movement of the wheels 22 and 130 results in a variety of motions being imparted to the carriers through the agency of the four cams 80, 112, 142 and 175 and the mechanism which connects them to the carriers. The cam 80 acting through the arm 82 controls the position of the rod 74 in the manner already described and thus causes the transverse tilting of the carriers, oscillating the blanks about the center of the curvature of the faces which are being drilled. The cam 112 acting either directly through the bell-crank lever 110 or indirectly through the back gearing including the bell-crank lever 115, moves the arm 103, which in turn imparts motion to the link 95, which controls the position of the upper part of the cross forming part of the sub-frame of the carrier. Coincidently the position of the lower end of this cross is controlled by the link 133 actuated either directly or indirectly through its back gearing by the cam 142. With the top and bottom of the cross thus controlled, the rollers 91 and 92 are free to move along the rails 93 and 94 except as their motion may be limited by the links 159 and 160 pivoted to the arm 158 of the cross head 152. Simultaneously, however, the positions of the rails and consequently the vertical elevation of the center of the cross is controlled by the cam 175 acting through its linkage. The compound motion of the carriers may be briefly described as consisting of a transverse tilting and a tilting about an axis through the center of the cross accomplished by the links 95 and 133 (which may also produce a movement of the rollers along the rails) and finally a movement of the rails themselves.

In the position of the parts in Figures 1, 5, 7, 8, 10 and 12, the machine is shown operating upon the first row of the right-hand blank. Referring to Figure 12, it will be seen that the machine has finished operating on the blank 180, the last hole having been drilled at 181. The carriers were then moved by an operation which will later be described, into the position for drilling hole 182, and then the other holes drilled in order, the machine being in the act of drilling 183 at the phase shown in these figures. Upon the completion of the first row with hole 184, the blank is tilted to drill 185 and 186 and then the next two rows, of which these form the end holes, are drilled, the order of drilling being indicated by dotted lines in Figure 14. From hole 187 the operation is continued and completed in a direct line to finish the fourth row, as shown in Figure 14, this row ending with hole 188, after which hole 189 (see Figure 15) and the last row is drilled ending with hole 190. The carrier then moves the blank into position to drill hole 191. It is to be noted that because the last hole drilled in the blank is actually the first hole of the fourth row, this brings the machine into proper position to jump a minimum distance from the blank 53 to the new blank 192 (see Figure 18), with which the attendant has replaced the blank 180 at the completion of the latter. By having the machine complete drilling the blank 53 with the hole 191 instead of the hole 190, only a comparatively short jump is necessary to the next hole 193 in the new blank. This jump is accomplished at the phase of the machine shown in Figure 11, with the point 194 of the cam 112 acting to move the carrier the required distance. Figure 2 shows the parts in the neutral position just as the shift is being made from one blank to the other. Figure 9 corresponds to Figure 11 and shows that the tooth 131 is just engaging the latch 137 so as to swing the upper end of the arm 123 into the left-hand position, thereby shifting the frame including the uprights 120, 143 and 176 to the right. This will reverse the various motions which have previously been imparted to the carriers by the three cams 112, 142 and 175 through the shifting of the engagement of the dogs 105, 137 and 166 with the various members of their actuating mechanism. Consequently, whereas the carrier has been turning in Figure 18 in such a direction as to bore the holes 190 and 191 consecutively, it will continue its motion in the same direction and will bore holes 193, 195 and 196 in the blank in spite of the fact that the cam 112, immediately recedes toward the center of the wheel 22 after the high point 194 is passed. This reversal of action at the critical instant of passing from one blank to the other makes it possible to use cams only half as long as would otherwise be necessary, since the movement of the follower 111 rearwardly (toward the axis of the shaft 23) as the wheel 22 continues to revolve produces the same effect upon the motion of the arm 103 by virtue of the reversing mechanism as though the cam 112 continued to increase its radius—that is its distance away from the axis of the shaft 23 after the critical point 194 was passed. The same thing is true of the other cams 142 and 175 and their associated mechanism. Consequently, the holes of blank 180 are bored in a sequence reversed from that of the blank 53. In other words, the line of which the hole 196 is the first, is completed and then the next two lines are drilled by a zigzag motion, as shown in Fig-

ure 20, until the hole 197 is reached, from which the machine jumps to the hole 198, completes that row (except for the final hole 199 indicated in dotted lines, which corresponds to the hole 191). The last row, beginning with the hole 200, is drilled in a straight line until the hole 201 is reached from which point the machine goes into position to drill hole 199. Before this time, the operator has replaced the blank 53, which has been completed, with a fresh blank and at the instant the hole 199 is bored, the machine comes back to the position shown in Figure 11; that is, with the critical point 194 of the cam 112 acting to throw the carriers a sufficient distance to swing them to the hole 202 about to be bored in the new blank 203 (see Figure 20). Then, the pin 131 actuates the reversing mechanism and as the hole 202 is bored, reverses the machine into the position in which it initially was, thus completing a full cycle of operations. The dotted lines in Figure 4 show the corresponding position for drilling the left-hand blank.

While I have illustrated my invention as applied to a machine for boring or drilling holes in brush backs, it will be obvious that it may be applied to other uses, as for instance, by replacing the drill with any desired form of tufting mechanism for inserting the tufts or bristles into holes previously bored, and as a matter of fact in practice, I have found it feasible to use such drilling and tufting mechanism interchangeably or there may be a plurality of sets of carriers precisely similar in all respects and all actuated from a single set of cams merely by connecting their various pivot points to each other with links, so that when any point, for instance 132, of one carrier is moved, all will move simultaneously. Where such sets of carriers are provided, the blank which has just been drilled in one carrier may be removed and placed in a corresponding carrier of an adjacent set, which is operated upon by a tufting machine instead of a drill, and the brush automatically tufted by that machine.

While I have illustrated and described only one specific embodiment of my invention, I realize that it is susceptible of wide adaptation, and I do not desire to be limited to the precise mechanism shown and described.

What I claim is:

1. In a brush machine, means for operating upon a brush blank, a plurality of blank carriers, means for producing tilting movements of each of said carriers in a plurality of directions, and automatic means for causing blanks carried by said carriers to be successively presented in position to be operated upon by said operating means.

2. In a brush machine, means for operating upon a brush blank, a plurality of blank carriers mounted for tilting movements about longitudinal and transverse axes, means for imparting to each of said carriers a step by step movement to bring successive portions of the blank thereon into position to be operated upon by said operating means when such blank is in the zone of operation, and automatic means for shifting the carriers so as to alternately place them in position to present the blanks thereon in the zone of operation of the operating means.

3. In a brush machine, means for operating upon a brush blank, a plurality of blank carriers mounted for tilting movement about longitudinal and transverse axes, means for imparting to each of said carriers a step by step longitudinal tilting movement, means for imparting to each of said carriers a step by step transverse tilting movement, and automatic means for shifting the carriers so as to alternately place them in position to present the blanks thereon in the zone of operation of the operating means.

4. In a brush machine, means for operating upon a brush blank, a plurality of blank carriers disposed in angular relation to each other, automatic means for tilting said carriers about longitudinal axes, automatic means of tilting the carrier about transverse axes, and automatic means for effecting a change in the angular positions of the planes of said blank carriers to successively bring the brush blanks thereon into the zone of operation of said operating means.

5. In a brush machine, means for operating upon a brush blank, a plurality of blank carriers, and continuously operating step-by-step movement imparting means for tilting said carriers in a plurality of directions and for successively presenting said carriers in the zone of operation of said operating means.

6. In a brush machine, means for operating upon a brush blank, a frame mounted to oscillate adjacent thereto, a plurality of blank carriers mounted on said frame and arranged to hold brush blanks in angular relation to each other in the direction of movement of the frame, and means for imparting to the frame step-by-step longitudinal and tilting movements while the carriers are respectively in the zone of operation of said operating means and for moving the frame to bring the brush blanks carried by the respective carriers alternately into the zone of operation of said operating means.

7. In a brush machine, means for operating upon a brush blank, a movable frame, a plurality of blank carriers carried by the frame, means for tilting the carriers with respect to the frame, and means for effecting a movement of the frame to change the position of a single carrier with respect to the operation performing means and for

effecting a different movement of the frame to shift one carrier out of the operating zone and another carrier into said zone.

8. In a brush machine, means for operating upon a brush blank, a pair of blank carriers disposed in angular relation to each other, means for imparting to each of said carriers a step-by-step movement to bring successive portions of the blank carried thereby into position to be operated upon by said operating means, and means for tilting said carriers to substitute the second of said carriers in place of the first carrier in the operating zone, the sequence of steps in the movement of said second carrier being the reverse of the sequence of steps in the movement of the first carrier.

9. In a brush machine, means for operating upon a brush blank, an oscillating frame, a plurality of blank carriers mounted on said frame and disposed in angular relation to each other in the plane of oscillation of said frame, and automatic means for oscillating said frame and for giving to said frame and carriers a bodily movement in the plane of oscillation of said frame.

10. In a brush machine, a plurality of blank carriers disposed in angular relation to each other, means for operating upon blanks carried thereby, means for tilting the carriers about a longitudinal axis, and means for tilting the carriers about a transverse axis and for moving said carriers bodily in a direction longitudinally of the blanks carried thereby, said last mentioned means acting to move the carriers alternately into operative position with relation to said operating means.

11. In a brush machine, means for operating upon a brush blank, a pair of carriers disposed in angular relation to each other for holding a pair of blanks with ends adjacent, means for imparting to each carrier a transverse tilting motion about a longitudinal axis, and means for tipping each carrier longitudinally about a movable transverse axis and for controlling the position of said transverse axis, said last three mentioned means serving to move the carriers alternately into operative position with relation to said operating means.

12. In a brush machine, a blank carrier, a cam, means connecting said carrier and cam for controlling the position of the carrier including reversing means for reversing the direction of movement of said carrier with reference to the throw of said cam.

13. In a brush machine, means for operating upon a brush blank, a pair of blank carriers adapted to be shifted to present alternate brush blanks in position to be operated upon by said operation performing means, a cam, and means for connecting said carriers and cam for controlling the position of the carriers including reversing means for reversing the direction of movement of said carriers with reference to the throw of said cam every time the carriers are shifted to present a different blank for operation.

14. In a brush machine, a pair of blank carriers, a cam, means for connecting said carriers and cam for controlling the position of the carriers including reversing means for reversing the direction of movement of said carriers with reference to the throw of said cam, and automatic means for actuating said reversing mechanism at a definite point in the cycle of operation of the machine.

15. In a brush machine, a plurality of blank carriers, a cam, and means for connecting said carriers and cam for controlling the position of the carriers, said connecting means including a lever which may be rendered either operative or inoperative so as to cause said cam to actuate said carriers either in a direct or reverse manner.

16. In a brush machine, means for operating upon a brush blank, a pair of blank carriers disposed in angular relation to each other and adapted to be alternately shifted into operative relationship with said operation performing means, a cam, means for connecting said carriers and cam for controlling the position of the carriers including reversing means for reversing the direction of movement of said carriers with reference to the throw of said cam, and automatic means for actuating said reversing mechanism when one of the carriers is moved out of and the other carrier is moved into operative relationship to said operation performing means.

17. In a brush machine, a plurality of blank carriers, a cam, means for intermittently moving said cam, means for connecting said carriers and cam for controlling the position of said carriers, said means acting progressively to bring the blanks carried thereby successively into position to be operated upon and including reversing means for reversing the motion of said carriers with reference to the throw of said cam, and means for actuating said reversing means before the carrier first enters its operative position.

18. In a brush machine, a plurality of angularly disposed carriers, means for operating upon blanks held thereby, a member for supporting said carriers, said carriers being capable of laterally tilting with reference to said supporting member, a roller mounted on said supporting member, an arcuate rail for supporting said roller, means for controlling the transverse tilting of said carriers, means for controlling the position of said rail and means for controlling the position of said supporting member.

19. In a brush machine, a plurality of angularly disposed carriers, means for op-

erating upon blanks held thereby, a member for supporting said carriers, said carriers being capable of laterally tilting with reference to said supporting member, a roller mounted on said supporting member, an arcuate rail for supporting said roller, means for controlling the transverse tilting of said carriers, means for controlling the position of said rail and means connected to said supporting member at two points for controlling the position thereof.

20. In a brush machine, a blank carrier, means for operating upon a blank held thereby, a support for said carrier mounted for oscillating movement and for bodily movement towards and from the means for operating upon said blank, said support having a bearing element movable therewith, means for oscillating said support, and means for causing said bodily movement of said support, said last named means including a movable curved rail engaging the bearing element on said support and means for causing cyclic movements of said rail.

21. In a brush machine, a blank carrier, means for operating upon a blank held thereby, a member for supporting said carrier, said carrier being capable of laterally tilting with reference to said supporting member, a roller mounted on said supporting member, an arcuate rail for supporting said roller, means for controlling the transverse tilting of said carrier, means for producing cyclic movements of said rail and means for producing cyclic movements of said supporting member.

22. In a brush machine, a tilting frame and a plurality of blank carriers mounted on said frame for tilting movement about axes disposed in the plane of tilting movement of said frame, said axes being angularly disposed with relation to each other.

W. C. READ.

Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,433,151, granted October 24, 1922, upon the application of Walter C. Read, of Bloomfield, New Jersey, for an improvement in "Brush Machines," an error appears in the printed specification requiring correction as follows: Page 6, line 95, claim 4, for the words "of tilting the carrier" read *for tilting the carriers;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 17th day of April, A. D., 1923.

[SEAL.]

KARL FENNING,
Acting Commissioner of Patents.