This invention relates to machines for making mattress tufts, and more particularly to a machine for forming a tuft characterized by an elongated loop of thread having a tufting button correlated thereto as a part thereof.

The objects will appear more fully in the accompanying specification, and include the following:

(1) To provide a mechanism the action of which is reliable and entirely automatic;
(2) To provide mechanism by means of which the length of the finished product may be predetermined to meet given requirements;
(3) To provide means for synchronizing the operation of respective mechanisms and insure rapid fabrication of a merchantable product;
(4) To provide a mechanism which, in spite of its automatic features, will be of simple construction, hence more reliable in action over long periods of time;
(5) To provide means by which thread can be pulled through a needle and quickly converted into a closed loop in which will be contained a tufting button;
(6) To provide improved means for co-ordinating knotting and severing mechanisms to complete formation of the loop and enable the thread to be cut in a manner to insure retention of a surplus or predetermined length of thread at the needle after each loop forming operation, which surplus will be available for use in the next loop-forming operation;
(7) To provide a machine, the operation of which will insure against waste of the raw material used in fabricating the product;
(8) To provide improved means for accurately feeding buttons to positions where the eyes thereof will be always aligned with the needle as the latter is in continuous operation;
(9) To provide a hopper of novel form and construction that will insure free passage therefrom of buttons and which has embodied therein means for controlling delivery of the buttons to a mechanism for acting upon or handling same singly and translating them to the needle;
(10) To provide novel co-ordinated automatic mechanisms, all of which can be driven from a common power plant;
(11) To provide an organization of mechanisms which is compact, relatively light of weight and freely portable;
(12) To provide a machine for manufacturing tufts which will be complete in every respect except for a single button, wad of cotton, leather or the like which can be readily applied to the loop after the latter has been threaded through the mattress in a manner common in the art of mattress making;
(13) To provide novel means for holding a button while the loop is being formed and for releasing the button in operative time with movement of the needle and pulling the thread to form the loop;
(14) To provide novel means for securely holding the aforementioned surplus length of thread while pulling the thread to form the loop;
(15) To provide improved means for uniformly supporting the loops as they are made; for preventing entanglement of one with another and gradually feeding them from the machine.

My invention is illustrated in the accompanying drawings forming a part of this application, in which—

Figure 1 is a front elevation of the device;
Figure 2 is a top plan view;
Figure 3 is a section along the line 3—3 of Figure 1;
Figure 4 is a section along the line 4—4 of Figure 3;
Figure 5 is a horizontal section along the line 5—5 of Figure 3;
Figure 6 is a front elevation of the button feeding mechanism similar to Figure 3, but showing the parts in a different position;
Figure 7 is a section along the line 7—7 of Figure 1;
Figure 8 is an isometric illustration of the loop-forming mechanism;
Figure 9 is a section along the line 9—9 of Figure 1;
Figure 10 is a section along the line 10—10 of Figure 11 is a front elevation of Figure 10 showing the parts in different position;
Figure 12 is a plan view of the knotter;
Figure 13 is an end view of Figure 12;
Figure 14 is a view similar to Figure 12, but showing the jaws of the knotter open;
Figures 15, 16 and 17 are isometric views showing the loop-forming, threading and knotting mechanisms;
Figures 18 to 22 inclusive are schematic side views of the threading operation;
Figures 23 to 25 inclusive are schematic plan views of the threading operation; and
Figure 26 is a view of the complete product.

In carrying out my invention I will first describe the diagrammatic Figures 18 to 25 inclusive since these figures will show the steps in succession of threading the button eyelet, form-
ing the loop, tying the knot in the ends of the loop, and in finally cutting the closed loop from the remaining string or thread.

In Figure 18 a button 1 is shown with its eyelet 2 disposed in line with a needle 3. The mechanism for moving the button into this position will be described hereinafter. A button holder 4 prevents movement of the button during the threading operation.

The needle 3 is carried by a needle arm 5 and the thread or string 6 is fed through an opening 1', see Figure 15, in the foot 8 of the arm, and the thread is then passed through the tubular needle 3. A thread arrests 9 clamps the thread down upon the foot 8 during the downward movement of the arm 5.

Figure 19 shows loop-forming hooks 10 moved into a position to be in alignment with the needle 3, and the eyelet 2. Figure 20 shows the arm 5 lowered, and shows the needle 3 passing through the eyelet 2, and the hooks 10. The figure further shows the portion of the thread extending below the needle as being clamped between a gripper 11 and a plate 12.

During the retracting of the needle 3 from the eyelet 2 the gripper 11 still holds the end of the thread 6. The button holder 4 is lifted free of the foot 8, and the thread arrests 9 is lifted free of the foot 8. This permits the needle 3 to move with respect to the thread 6.

An open loop 13 is now formed, and this is accomplished by the hooks 10 moving to the right in Figure 22 by means hereinafter described. The button 1 is carried with the hooks, and it will be noted that the thread 6 passes through the eyelet 2 of the button. The thread is pulled from the needle 3 to form the loop 13. The hooks 10 are moved a predetermined distance, and this determines the length of the loop 13.

In Figure 23 a thread tightening 14 is shown pulling the two portions of the loop 13 over a knotter 15. The hooks 10 are shown in plan view, and so is likewise the gripper 11. The knotter 15 is now actuated for tying a knot in the loop 13, and thus closes the loop. Figure 24 shows a diagrammatic plan view of this operation, and it will be noted that the thread tightener 14 is moved clear of the loop 13.

In the final operation the knotter 15 grasps the loop ends and the thread tightening 14 is again moved against the loop 13 for removing a portion of the string from the knotter 15, this portion forming the knot 16. A cutting knife 17 is now moved for severing the closed member 13 from the string 6. The loop is now fed to the exit end of the machine as will be hereinafter described, and the gripper 11 is moved away from the plate 12 ready for the next operation.

At the start of the next operation the various parts will assume the position shown in Figure 18.

**Button feeding mechanism**

It is now best to describe the button feeding mechanism. This mechanism is shown in Figures 1 to 6 inclusive. A button receptacle 18, see Figure 4, is supported by a bracket 19, which in turn is secured to the frame 20 of the machine. The receptacle 18 has a tubular portion 21 for rotatably receiving a rod 22. Figures 2 and 4 show the rod 22 as carrying a disc 23 and an agitator 24. The receptacle 18 has an exit opening 25 for buttons and an inwardly extending flange 26 for permitting only those buttons resting on their heads to pass beneath the flange.

The flange has openings 27 through which the eyelets of the buttons pass. The rod 22 is rocked by means hereinafter described and the agitator 24 will agitate the buttons in the receptacle 18, and those buttons that are turned on their backs 30 or heads will gravitate toward the exit opening of the receptacle due to the inclination of the disc 23. These buttons will be fed one at a time into a gravity chute 28 toward the button positioning mechanism.

Before describing this mechanism it is best to briefly set forth the mechanism for rocking the rod 22. In Figure 1 I show the frame 20 as carrying a motor 25. This motor, through speed reducing belts and pulleys indicated generally at 30, rotates a cam shaft 31. A number of cams are mounted on the shaft, and each will be described in turn. On the cam shaft 31 I mount an eccentric 32, see Figure 3, and this eccentric through a rod 33 oscillates an arm 34. The swinging of the arm 34 can be varied by adjusting the end 35 of the rod 33 in a slot 36. The arm 34 has a link 37 connected to its free end, and this link in turn is pivotally connected to a bracket 38. The bracket 38 is attached to a 23 slide 39, and this slide carries an upright 40. A link 41 has one end attached to the upright 40, and has its other end connected to an arm 42 which is integral with a collar 43 that is rigidly secured to the rod 22. It will be seen that a rotation of the camshaft 31 will operate the eccentric 32 and, through the mechanism just described, will rock the rod 22. In this way the buttons in the receptacle are kept agitated, and there will be a continuous flow of buttons arranged in the proper position to the gravity chute 28.

In Figures 4 and 5 I show the chute 28 in detail. In Figure 4 the underplate 44 is shown provided with a hump 44a which will prevent the feeding of the buttons thereby. The chute 28 is in the form of a channel with inwardly extending top flanges and the eyelets of the buttons project through the space between the two flanges. The lowest position of the button in the chute is held against movement by the hump 44a bearing thereagainst. A rearwardly projecting extension 45, see Figure 4, has a pin 46 and a spring 47 exerts a force on the pin 46 tending to move the hump 44 of the rear plate to the left in the figure. At the proper moment the extension 45 is moved to the right for freeing the button.

This mechanism is shown in Figures 3 and 6. An upright 48 pivotally carries at 49 an arm 50. This arm has a cam member 51 for engaging a pin 52, see Figure 4. The arm also has a hook 53 for engaging with the next to the bottom button, and this hook will prevent the feeding of the buttons through the chute when the extension 45 is retracted. Figure 4 shows the cam 51 as moving in back of the chute 28 and the hook 53 as moving in front of the chute. The cam and the hook are swung with the arm 50, and Figure 3 shows the arm carrying a projection 54, and this projection is engaged by a cam-shaped portion 55 disposed at the end of a pivoted arm 56. The arm 56 is pivotally mounted on a bracket 57 which in turn is secured to the slide 39. A spring 58 normally keeps the arm 56 in contact with a pin 59 carried by the bracket.

During the initial movement of the slide 39 to the left in Figure 3 the triangular projection 55 will contact with the projection 54 to swing the arm 50 to the left. When the projection 54
rides to the top of the triangular projection 55 a spring 60 will quickly snap the arm 50 in a counterclockwise direction. This will cause the cam 51 to open the outlet end of the chute 28 by flexing the plate 44 and the lowest button in the chute 28 will drop into a groove 61 formed in a table top 62 of the frame 22. A fork 63 carried by the arm 50 will swing down upon the edge of the button, and cause this eyelet to be moved into a plane paralleling the top of the table 62. It should also be noted at this point that the arm 50 comes to an abrupt stop at the end of its swing, and a resulting jar will keep the buttons in a loosened/swung condition in the chute 28 and prevent them from jamming.

The movement of the slide 35 to the right will carry with it the shoe 64, and this shoe will move the button along the groove 61 into the position shown in Figure 5. When the button is in this position the eyelet is in registration with the needle 3.

It is best now to describe the means for holding the button and for clamping the thread. The holder 4 is shown in Figure 18, and so is like wise the thread arrester. The mechanism for accomplishing this is shown in Figures 10 and 11. The cam shaft 31 carries a thread and button arresting cam 65 of the shape shown in Figure 10. A rod 66 has a fork 67 straddling the shaft 31 and this fork carries a cam roller 68 that rides on the cam 65. The rod has its upper end connected to the button holding lever 69, and this lever is pivoted at 70 to a bracket 71 which in turn is supported by the table top 62. At the proper instant the lever 69 will be in the position shown in Figure 11, and will hold the button end 4 down on the button 1 as shown in Figure 18. A spring 72 exerts an upward force on the right-hand end of the lever 69, and causes the button holding end 4 to yieldingly engage with the button 1.

An arm 73 is also pivoted at 70 to the brackets 71 and carries the thread arrester 6 at its free end. This thread arrester is held down upon the foot 8 of the arm 5 by a spring 74. The parts 4 and 9 bear against the button 1, and the foot 8, during the operations shown in Figures 18, 19 and 20. In the operation shown in Figure 21 the cam roller 68 has rotated a sufficient distance to lift the cam roller 68, and this will raise the holder end 4 off the button. A pin 75 carried by the arm 73 is engaged by the lever 69, and an upward swing of the lever will move the pin and lift the arm 73 for freeing the thread arrester 9 from the foot 8. Before this movement takes place, however, the needle 3 will have carried the thread 6 through the eyelet 2 and the gripper 11 will have engaged with the lower end of the thread in the manner shown in Figure 21.

It is best, therefore, to describe at this time the

Thread feeding mechanism

In Figure 3 I shows a container 76 for holding a ball of thread 66. The container extends from the container and passes through a thread carrier 77, and then is led through an opening 78 in the top of the needle arm 5. The thread is then passed through a tube 19 and is threaded through the opening 18, see Figure 17, which communicates with the tubular needle 3. A portion of the thread projects below the lower end of the needle as shown in Figure 3.

The needle 3 is raised and lowered in a predetermined manner for carrying out the various operations shown in Figures 18 to 25 inclusive. The means for actuating the needle is shown in Figure 9. The cam shaft 31 carries a large cam wheel 80 and this wheel has a cam edge 81 against which a cam roller 82 is held. The roller is carried by a cam follower 83, and Figure 1 shows the follower 83 connected to a lever 84 which is pivoted at 85 to an upright 86 of the device. A clip 87 is connected to the needle arm 3 and to the lever, and a rocking of the lever will raise and lower the arm 5 and with it the needle 3. The thread cam edge 81 of a predetermined shape for causing the needle arm 5 to be raised and lowered to carry out the various operations already mentioned.

After the needle is moved downwardly the gripper 11 engages with the portion of thread extending below the needle and clamps this portion to the plate 12 before the needle starts on its upward movement. The mechanism for actuating the thread gripper 11 is shown in Figure 3. A cam 88 is mounted on the cam shaft 31, and a bell crank lever 89, 90, pivoted at 90 carries a roller 91 in line with the cam 88. The bell crank lever 89 is carried by a bracket 92 which, in turn, is secured to the table top 62. The thread gripper 11 is pivotally carried by the other end 93 of the bell crank lever 89, and the place of pivot is indicated at 94. A spring 95 urges the gripper in a counter-clockwise direction so that the gripper will slide along the undersurface of the table top 62. The cam 88 will rock the bell crank lever 89 for moving the gripper 11 away from the plate 12 during a portion of the cycle of the machine, and a long coiled tension spring 89' hooked to the bell-crank 89 moves the gripper resiliently but tightly against plate 12 during the time the gripper 11 holds the free end of the string 6.

Loop forming mechanism

The hooks 10 are used for forming a loop 13 in the string 6. Figure 8 shows the hooks 10 as being carried by a slide 96. Figure 7 shows the two positions of the slide 96, and further illustrates the mechanism for moving the slide.

A cam 91 is mounted on the cam shaft 31, and a cam follower 98 has a roller 99 which rides on the cam. A spring-pressed plunger 100 urges the roller 99 against the cam. The cam follower 98 is mounted on a shaft 101, and a second arm 102 is also mounted on the same shaft. The free end of the arm 102 has a link 103 connected thereto, and the other end of the link is adjustably secured to an arm 104. The adjustment comprises a bolt 105 slidable in a slot 106 in the arm 104. It is the adjustment of this bolt in the slot which varies the swing of the arm 104 with respect to the swing of the cam follower 98.

The free end of the arm 104 has a link 107 connected thereto, and this link is pivotally secured to a bracket 108 which is attached to the slide 66. The shape of the cam 97 and its position on the cam shaft 31 is such as to move the slide 96 and the hooks 10 in the manner indicated in Figures 18 to 25 inclusive. Figure 19 shows the hooks 10 moved into operative relation with respect to the button 1 prior to the moving of the needle 3 downwardly.

Knot tying mechanism

After the needle 3 has been moved downwardly through the eyelet 2, and has been retracted, the hooks 10 are moved to the right in Figure 22 and form the loop 13. The size of the loop can be...
adjusted by moving the bolt 105, see Figure 7, into the desired position in the slot 106. The ends of the loop 13 are now tied, and this mechanism is shown in Figures 12 to 14 inclusive. A shaft 109 is rotatably mounted in a bracket 110 which is carried by the table top 62, as shown in Figures 8, 15 and 16. The left-hand end of the shaft 109 carries a pinion 111, and Figures 1 and 9 show this pinion disposed adjacent to the periphery of the large cam 80. This cam has an arcurate rack 112 in its periphery which meshes with the pinion 111 during each revolution of the cam. The position of the rack 112 is such as to rotate the pinion 111 and shaft 109 after the 15 hooks 16 have formed the loop 13.

Just prior to the rotation of the shaft 109 the two strands of the loop 13 are moved against the knot forming end of the shaft 109 by a thread tightening arm 113, see Figure 15. This arm is carried by a pinion 114 which is rotatably supported by the upright 86. A rack quadrant 115 meshes with the pinion 114 and the rack is carried at the end of a lever 116 which is pivoted at 117 to the upright 86, see Figure 1. Figure 9 shows the lever 116 connected to a cam follower 118, and this follower has a cam roller 119 riding on a cam edge 120 formed in the cam 80. A spring-pressed arm 121 keeps the roller 119 in contact with the cam edge 120. The shape of the cam edge 120 is such as to move the thread tightening arm 113 which carries the thread tightening 14 against the two strands of the loop 13 as shown in Figure 23. This will cause the two strands to be pulled against the knot tying end 15 of the shaft 109.

After this movement the rack 112 reaches the pinion 111, and rotates the shaft 109 through one complete revolution. It should be noted at this point that the knot tying end 15 is composed of two jaws. The shaft 109 carries a jaw 122, while the shaft slidably carries a rod 123, which in turn carries the other jaw 124 of the knotter 15. The bracket 110 carries a cam 125, and the rod 123 carries a cam follower 126.

At the start of the rotation of the knotter the two jaws 122 and 124 abut each other as shown in Figure 12. The shaft 109 is now rotated, and during the rotation of the shaft the jaw 124 will move away from the jaw 122, and the knot will be formed in the ends of the loop 13 as indicated in Figures 16 and 24. Further rotation of the shaft 109 will now permit the spring 127 to move the jaw 124 toward the jaw 122 and to grip the thread as shown in Figure 25. The cam edge 120 will now again actuate the arm 113, and the string tightening 14 will again move against the loop 13. It should be noted that during the actual tying of the knot the string or thread tightening 14 is moved away from the loop 13 as shown in Figure 24. The second time the thread tightening 14 is moved against the loop 13 it will pull the loop off from the end of the knotter 15 and the knot shown at 16 in Figure 25 will be pulled tight due to the fact that the jaws 122 and 124 grip the ends of the loop 13, while the thread tightening 14 moves against the loop.

**Thread cutter**

The thread cutter is shown in Figure 1, and it will be seen from this figure that a cutter cam 126 is mounted on the cam shaft 31, and the cutter cam carries a projection 125 on its face that is designed to swing a bell crank lever 130. The bell crank lever carries a roller 131, and a spring 75 pressed pusher rod 132 yieldingly holds the roller 131 against the face of the cam. The lever 130 is pivoted at 133 to the plate 12 and the upper portion of the lever 130 carries the string cutting knife 17. Figure 16 shows the knife 17 in the act of cutting the string, and the knife passes 5 a stationary blade 134, and the two cooperate to perform the cutting operation. The enlargement 29 on the face of the cam 126 is positioned to cause the string to be cut after the two jaws of the knotter 15 clamp the string ends as shown in Figure 25.

After the knot has been tied, and the string cut as shown in Figure 25, the completed loop 13 carrying with it the button 1, is transferred to an exit slot 135 formed in the plate 136, see Figure 1. It will be seen from Figure 1, and also from Figures 15 and 16 that a rod 137 is carried by the arm 115, and swings with the arm. This rod cooperates with the thread tightening 14 for moving the loop into the slot 135. The knob 18 of the loop 13 is disposed on the inner surface of the plate 136 and prevents the loop from falling out of the slot 135. The hooks 10 are moved inwardly and free the other end of the loop 13 so that the loop with its button 1 will hang from the slot 135 as shown in Figure 1. In Figure 26 I show the completed article. The loop 13 is shown threaded through the eyelet 2 of the button 1, and the loop is closed by the knot 16. As the completed loops are fed into the slot 135 they are moved along the slot. From time to time the operator can remove the completed loops and buttons from the slot 135. The machine will continue to form the loops, and to thread the buttons thereon so long as the machine operates.

As already stated, the length of the loops 13 can be predetermined.

Figure 25 shows a small portion of the string 9 still gripped by the member 11 and the plate 12 after the knife 17 has severed the loop 13 from the string. The moving of the gripper 11 away from the plate 12 will free this small portion of string. In order to prevent this portion from remaining near the needle and other operating parts, and from possibly interfering with the operation of the machine, I provide a conduit 140, see Figure 17, for conveying air to a point adjacent to the gripper 11 and plate 12. The conduit 140 leads to an air pump 138, see Figure 2, and this pump is actuated by a crank arm 139, see Figure 1, that in turn is connected to the cam shaft 31. During the operation of the machine the pump 138 is continually operated and will deliver a stream of air through the conduit 140 to keep the area adjacent to the button threading part of the device clear of all foreign substances.

By arranging all of the cams on a single cam shaft 31 I provide a simple timing mechanism for causing all of the various parts to function in their proper order. The machine is automatic in operation and will feed the buttons one by one into the threading position, and then will thread the buttons on a closed loop and will finally deliver the closed loop to the exit end of the machine.

What is claimed is:

1. A machine for making mattress tufts comprising a reciprocable needle formed to enable thread to be drawn therethrough; means for successively feeding buttons to the needle and for disposing the eye of the button for passage of the needle therethrough; a fixed member, means arranged and adapted for gripping an end of the thread and holding it against said fixed member beyond the needle after passage of the needle.
through the eye to thus enable the needle while being retracted from the eye to move independently of the thread and for allowing the thread to be pulled laterally of the needle; means engaging and pulling the thread and the button laterally from and while said end of the thread is gripped at said fixed member as aforesaid and for converting the pulled portion of the thread into an open loop with the button disposed at the bight thereof; means for forming a knot in the loop to confine the button to the loop; and means for severing the loop from the thread at the needle.

2. In mechanism of the class described, a horizontally disposed member with a guide groove in its upper surface for edgewise reception therein of a button characterized by a substantially disk-like head having an eye at one side; threading mechanism including a reciprocally supported needle aligned over said guide groove; means for singly feeding buttons to the guide groove at a point laterally spaced from the needle; means for moving a button laterally along said guide groove to a position in the guide to register the eye thereof with the needle; and means for synchronizing the operation of the needle with the button moving means to effect an operative threading of a button at each operation of said button moving means.

3. In mechanism of the class described, a horizontally disposed member with a guide groove in its upper surface for edgewise reception therein of a button characterized by a substantially disk-like head having an eye at one side; threading mechanism including a reciprocally supported needle aligned over said guide groove; means for singly feeding buttons to the guide groove at a point laterally spaced from the needle; means for moving a button laterally along said guide groove to a position in the guide to register the eye thereof with the needle; and means for synchronizing the operation of the needle with the button moving means to effect an operative threading of a button at each operation of said button moving means; said means for singly feeding buttons to said guide groove comprising a hopper elevated above the guide groove arranged for gravity discharge of buttons therefrom; means for singly transferring buttons from the hopper directly to said guide groove.

4. In mechanism of the class described, a hollow reciprocal needle through which thread can be pulled and an end thereof advanced beyond one end of the needle; means including a slot in which the button rides for aligning the eye of a button with the needle to enable the needle to pass through the eye; means clamping the button in position; a fixed member, means for gripping said advanced end of the thread and holding it against said fixed member after the needle has been passed through the eye; means releasing the button clamping means; means arranged and adapted for engaging the thread at both sides of the button for pulling the thread and the button from and while said advanced end of the thread is gripped and held at said fixed member to thereby effect withdrawal from the needle of a predetermined length of the thread in which two stretches thereof are disposed in open loop formation with the button at the closed end of the loop; means for tying the stretches together to close the loop; and means for severing the loop from a conjoined length of thread at the needle.

5. In a mechanism of the class described, the combination with means for converting a length of thread into an open elongated loop with a button threaded thereon; means for forming a knot in the ends of the thread to close the loop; means for cutting the closed loop from the supply thread; a plate extending laterally from the machine having a slot therein, means arranged for transferring the closed loops to said slot and advancing them therethrough with the knot on one side and button on the other side of the plate.

6. In a button threading machine of the character described in claim 4, the means for gripping the advanced end of the thread comprising a pivotally mounted lever, a fixed plate, means for swinging the lever, means at one end of said lever arranged to impinge against said plate for clamping the thread thereagainst, and means for applying a yielding force to move said lever.

7. In a button threading machine of the character described in claim 4, the means for gripping the advanced end of the thread comprising a pivotally mounted lever, a fixed plate, an automatic means normally swinging one end of the lever toward said fixed plate, a finger pivoted to said one end of the lever arranged to impinge said fixed plate for clamping the thread, and cam-operated means for releasing the lever against the action of said automatic means.