Sept. 26, 1939. B. I. BECKER 2,174,173

MACHINE FOR MAKING CARD CLOTHING

Filed Aug. 1, 1938 2 Sheets-Sheet 1

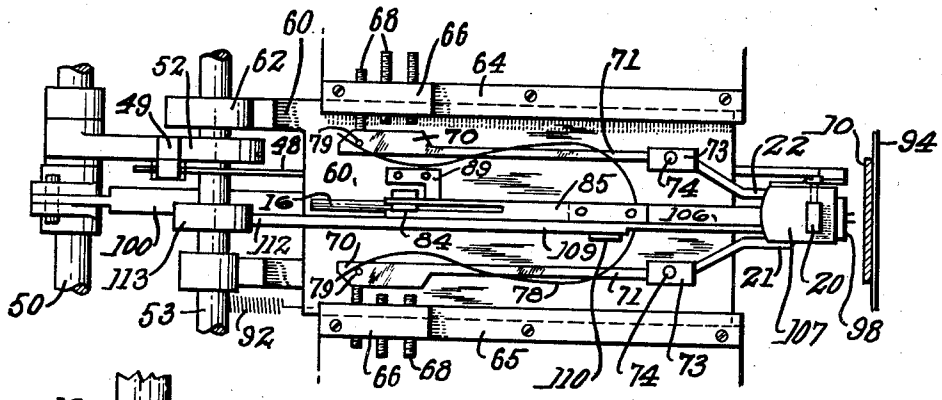

Fig. 1.

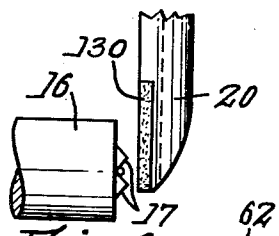

Fig. 4.

Fig. 2.

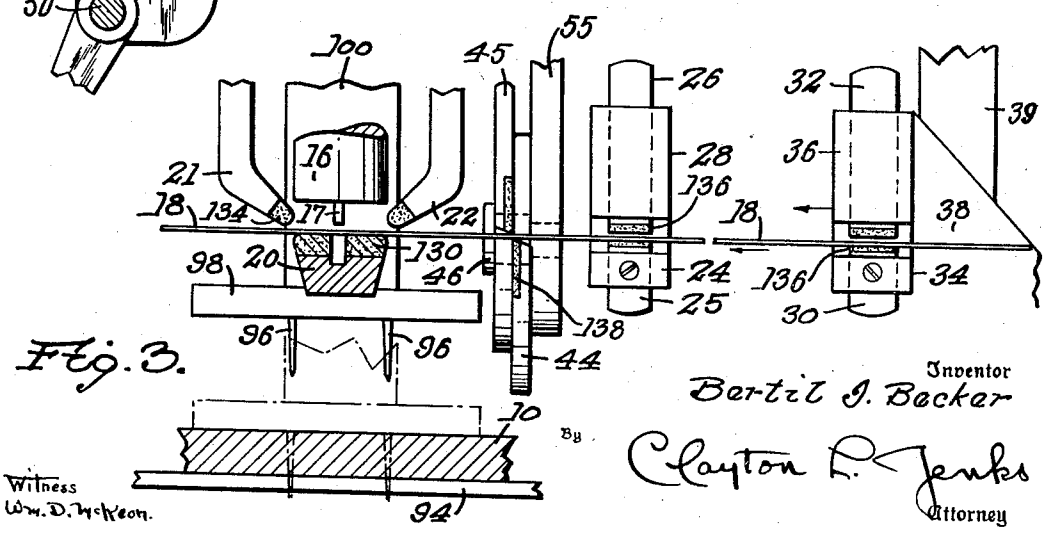

Fig. 3.

Witness
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MACHINE FOR MAKING CARD CLOTHING

Filed Aug. 1, 1938 2 Sheets-Sheet 2

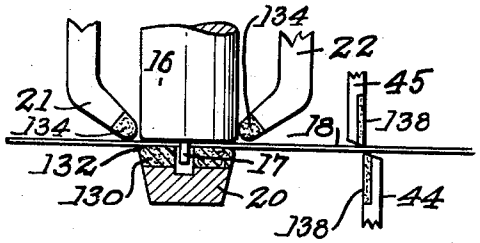

Fig. 5.

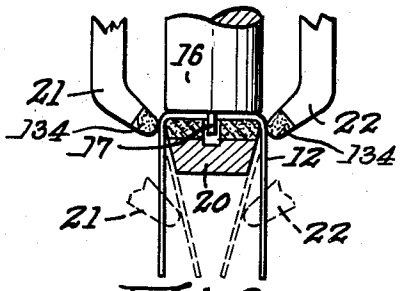

Fig. 6.

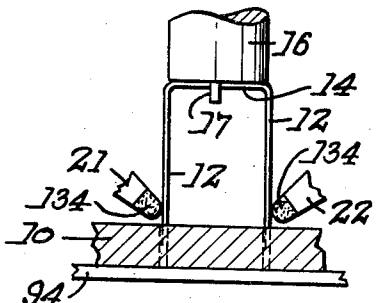

Fig. 7.

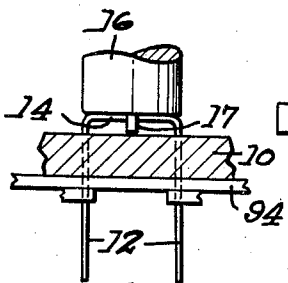

Fig. 8.

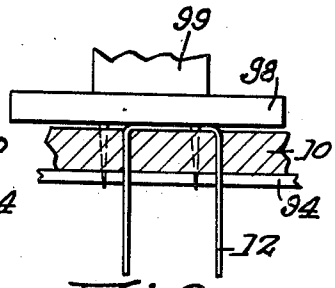

Fig. 9.

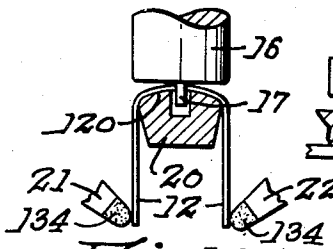

Fig. 10.

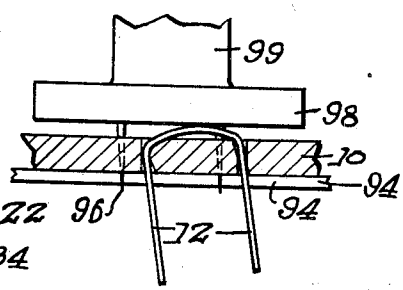

Fig. 11.

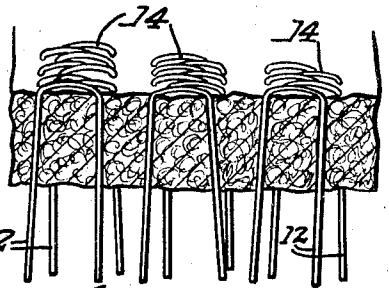

Fig. 12.

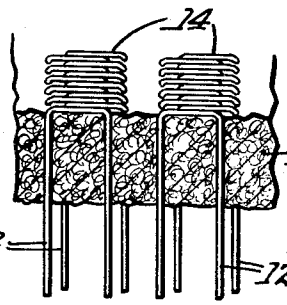

Fig. 13.

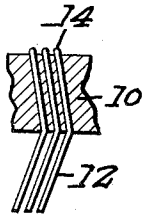

Fig. 14.

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Patented Sept. 26, 1939

2,174,173

UNITED STATES PATENT OFFICE

2,174,173

MACHINE FOR MAKING CARD CLOTHING

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Application August 1, 1938, Serial No. 222,500

1 Claim. (Cl. 140—98)

This invention relates to a machine for making card clothing.

Card clothing comprises a foundation of a thick fibrous material through which wire staples project with their free ends bent at a slight angle to a normal line, and strips of this card clothing are adapted to be mounted on a drum with the heads of the staples lying against the drum and the free ends or teeth projecting outwardly for engaging the material to be carded. It is desirable that these staples project to exactly the same distance from the foundation and that their free ends lie in the same plane. Also, these ends should be free from burrs and present a smooth finish, so that the wool or other material to be carded will not be tangled or caught on the wire teeth. The legs of these staples should be parallel with one another and they should project at the same angle to the plane of the foundation surface. These legs should have a uniform spacing and be of the same length. In particular, the staples should seat squarely on the foundation, with the cross wires parallel and positioned tightly against the foundation so that they will not change in position when mounted on the drum. These desired characteristics have not been attained heretofore to such an extent that card clothing could be made which had substantially the same structure throughout its entire length.

It is a primary object of this invention to overcome such difficulties heretofore experienced, and to provide card clothing having these desired properties and such a uniformity of structure that it will give a long life of useful service.

A further object of the invention is to provide mechanism which will make card clothing having the characteristics herein defined and which will serve to set the staples into a foundation in an invariable arrangement. Further objects will be apparent in the following disclosure.

Referring to the drawings which illustrate my invention:

Fig. 1 is a fragmentary top plan view of mechanism arranged to form and drive a staple into a card clothing foundation;

Fig. 2 is a fragmentary vertical side elevation of the same;

Fig. 3 is a fragmentary enlarged plan view of various operating parts;

Fig. 4 is a fragmentary detail of a crowner and doubler;

Figs. 5 to 9 inclusive are diagrammatic sketches showing the operation of the various parts;

Figs. 10 and 11 illustrate an incorrect procedure of applying a staple to a foundation;

Fig. 12 is an enlarged fragmentary section of such a piece of improperly constructed foundation;

Fig. 13 is an enlarged fragmentary section of a foundation card clothing made in accordance with my invention; and

Fig. 14 is an enlarged fragmentary sectional view thereof.

The card clothing, except as herein described, may be made in accordance with standard practice. It comprises, as shown in Figs. 13 and 14, a foundation 10 of fibrous material having wire staples 12 embedded in and projecting through the same, and particularly wherein the backs or cross pieces 14 of the staples lie smoothly against the back of the foundation with their top edges in substantially the same plane. These staples are usually set in a staggered arrangement, and the projecting ends of the staples are ordinarily bent at an angle just below the point where they project through the foundation as indicated in Fig. 14.

A machine for inserting these staples in the foundation may be made of standard construction, except as herein described. As shown in Figs. 1 to 4 inclusive, the machine comprises a crowner 16 having two V-shaped prongs 17 (Fig. 4) on its forward face which are adapted to straddle a short piece of wire 18 and hold it against the flat face of a doubler 20, while wings 21 and 22 move forward and bend the free ends of the wire around the sides of the doubler, as shown in the successive views of Figs. 5, 6 and 7.

The wire 18 is fed intermittently to the mechanism by a suitable device, which may comprise two pairs of grippers so arranged that one pair moves a given distance laterally to feed the required length of wire after which the other grips and holds the wire in its new position so that it may be cut to its desired length. As shown in Fig. 3, this gripping and moving mechanism comprises a stationary ring shaped support 24 over which the wire 18 is adapted to move; and this support carries a plug 25 adjustably mounted therein which projects upwardly and receives all of the wear of the wire moving thereacross. Immediately above this plug 25 is a spring pressed, cam controlled plug 26 which is vertically slidable within another hollow support 28, and it is adapted to be operated by the cam mechanism so that at desired intervals of time the plug 26 will grip the wire 18 between it and the plug 25 and thus hold it stationary. A second set of ad-

justable and movable plugs 30 and 32 of similar construction and arrangement are mounted on a carrier for movement toward and from the stationary supports 24 and 28. This may be accomplished by mounting the support 34 and 36 on a slidable carriage which carries a wedge shaped block 38 arranged to be moved by another wedge block 39 operated by a suitable cam mechanism. These parts are so constructed and arranged that they will move the plugs 30 and 32, when they are gripping the wire 18, to the left sufficiently to feed the required length of wire for the forming operation. Thereafter, the plugs 25 and 26 grip the wire while the other plugs release it and travel back for feeding a new length of wire. Then the wire is cut and fashioned. These parts will be suitably constructed for that purpose, and except as herein described form no part of the present invention.

As soon as a required length of wire has been fed forward, the wire 18 is cut by means of the stationary cutter 44 cooperating with the movable cutter 45 which serves to sever the wire just prior to the time that the wings 21 and 22 engage it to bend and form the legs of the staples. The cutters, as shown particularly in Fig. 2, are shaped like a pair of shears mounted vertically on the arm 55 and with the cutter 45 mounted on the short end of a swinging lever of the first class fulcrumed at 46 on a suitable portion of the framework. The lower and longer arm 47 of the swinging cutter is connected by means of a rod 48 to a swinging arm 49 fulcrumed on a short shaft 50 at the back of the machine. The upper end of the lever 49 is moved positively by a suitably mounted cam 52 on the shaft 53 which thus operates to thrust the upper cutter arm 45 towards the right and cut the wire thereby. A spring 54 serves to return the swinging arm 49 and the cutter 45 to their inoperative positions when permitted by the cam.

A slide 60 is suitably mounted on the machine frame to be moved by a further cam 62 on the cam shaft 53. This slide is suitably mounted to slide beneath guide plates 64 and 65. The fixed guide plates 64 and 65 have upstanding projections 66 thereon through which three long screws 68 are threaded. These screws are adapted to be so located as to ride against the cam shaped ends 70 on the left hand ends of the long lever arms 71 which project from the vertically extending block 73. The latter is pivotally mounted on the pin 74 projecting upwardly from the slide 60. Further arms 75 project from the tops of the pivoted blocks 73, and they are bent into such positions as to form the two inwardly projecting wings 21 and 22 above mentioned. These parts are made in duplicate, one on each side of the center line of the slide, and they are so arranged that the two wings will be moved inwardly simultaneously as required, when the slide 60 moves forward and the cams 70 are caused to ride over the ends of the stationary adjustable screws 68.

The crowner 16 is a rod slidably mounted on the slide 60, the front end of this rod passing through the standard 82 on the frame and the rear being secured to an upright 84. The latter projects through a slotted plate 85 secured to the standard 82 and is guided thereby. A spring 86 serves to connect the upright 84 with a post 88 (Fig. 2) on the slide 60 and thus tends to hold the crowner in a forward position. A stop 89 limits the movement of the crowner. The slide 60 is moved forward by means of the cam 62 and it is returned by means of a spring 92 suitably secured to the frame of the machine. Hence, the forward movement of the slide 60 tends to thrust the crowner 16 forward under a resilient pressure and to hold it engaging the wire, as will be presently described.

A further feature of the machine comprises means for punching holes through the foundation, and into which the legs of the staples are to be inserted. The foundation 19 is usually made as a long strip of cloth like material and it is suitably moved through the machine intermittently and as required. It is held in place by a back rest 94 arranged opposite the working parts of the apparatus. The foundation is moved upwards across the back rest, and when its movement is stopped it is perforated by the sharp needles or prongs 96 mounted on a presser arm 98. The forward face of this arm is flat and arranged parallel with the back surface of the foundation, and it is adapted to press the staples into the foundation just immediately above the top of the back rest 94.

The presser arm 98 is mounted on the upper end of a sliding and swinging member 99 which forms a continuation of a lever 100 which is pivoted at 101 on the upper end of an arm 102 pivoted on the shaft 50 and adapted to be rocked by suitable cam mechanism. An inclined slideway 104 on a fixed portion of the machine engages a pin 105 on the right hand end of the lever 100, and the parts are so arranged that as the lever 100 is moved to the right, the pin 105 will ride up the sloping surface 104 and thus thrust the presser arm 98 upward and forward into position to force the needles 96 through the foundation.

The doubler 20 is a rod like body slidably passing through the member 106 mounted on the top of the upright 82. A block 107 is fixed to the upper end of this doubler, and it carries a lug projecting downwardly therefrom to which is pivoted at 108 on the right hand end of a lever 109. This lever is pivotally mounted on a pin 110 projecting laterally from the standard 82. The left hand end of this lever 109 is bent downwardly to provide an arm 112 which is engaged and rocked by a further cam 113 on the cam shaft 53. The parts are so arranged and the cam so timed that the doubler will be moved down into position for bending the staple and then withdrawn to permit the staple to be thrust into the foundation.

The timed relationship of the various operations of this mechanism are illustrated particularly in Figs. 3 to 9 inclusive. As there indicated, a predetermined length of wire 18 is sent forward across the face of the doubler 20. Then, the crowner 16 moves forward while the doubler 20 is in its lowermost position, and the projecting jaws 17 straddle the wire 18 and enter into a slot in the doubler, thus permitting the forward face of the crowner to press the wire tightly thereagainst. As soon as this has happened, the cutters 44 and 45 cut a predetermined length of wire. It is to be observed that the crowner, the doubler and the cutter must be so located that exactly equal lengths of wire are positioned on opposite sides of the center line of the cutter and doubler. Immediately following the cutting of this length of wire, the inwardly bent arms 21 and 22 are moved straight forward by the flat portion of the cam 70 engaging the left hand screw 68, as shown in Fig. 1. As the wings move forward, the cam 70 falls from the left hand screw onto the lower positioned screws at the right and the wings 21 and 22 are thus moved inwardly to the position indicated in dotted outline in Fig. 6. The first stage of the

movement of the wings 21 and 22 is at right angles to the wire and serves to bend the wire 18 around the corners or outer edges of the doubler into the position shown in the full lines in Fig. 6. Then, the wings move inwardly and thrust the legs of the staples into the positions shown in the dotted outline, thus bending the wire farther than needed so as to overcome its resiliency. These wings are held against the cams by a U-shaped spring 78 pressing against pins 79 on the left hand ends of the cams 70 on the levers 71. As the cams 76 continue to move forward the wings move into the position of Fig. 7 near the ends of the staples and serve to guide them into the punched holes in the foundation. After the wire has been thus bent, the doubler 20 moves up and out of the way. Then the crowner 16 moves forward and thrusts the staple legs through the holes previously formed in the foundation 10. It is to be observed that the crowner moves forward only to the position shown in Fig. 8, so that the projections 17 do not strike the foundation. Following this operation, the presser arm 98 with its needle 96 moves forward and punches two new holes for the staple that is next to be bent and inserted into the foundation as shown in Fig. 9. At the same time the forward face of the presser arm 98 strikes the top of the staple and drives it from the position of Fig. 8 to that of Fig. 9 where its upper connecting portion 14 is substantially flush with the top face of the foundation.

Referring now to Figs. 10 and 11, it will be appreciated that if the doubler 20 has a rounded surface 120, then the wings 21 and 22 will shape the wire accordingly to fit that top surface of the doubler. This rounded portion of the staple will then project upwardly from the foundation 10 as shown particularly in Fig. 12, and when the card clothing is mounted on a metal drum with the top 14 of the staple against the metal drum surface, the pressure of the clothing against the drum will tend to twist the staples one way or another and leave them in various positions with the free ends of the wires out of parallelism and some projecting farther than others. Various factors enter into the production of such card clothing. The wire staples are usually made of fine wire, such as No. 32 wire having a diameter of 0.0128 inch, and the wire is usually made of a resilient steel that fractures or breaks rather easily. The doubler 20 is customarily shaped by hand filing or by honing it with an abrasive tool to provide a rounded surface of a large radius which is deemed necessary for bending a high tempered card wire thereover and particularly to provide an extensive surface which would not be cut readily by the wire. These doubler surfaces have never been made quite alike because of the hand forming operation, and they have usually contained flat or irregular portions. In particular, the standard metals heretofore used for the doublers are comparatively soft as regards their resistance to the enormous wear brought about by bending staples at a very high rate of speed across the surface of the doubler. This wear is so great that a groove is formed within a very few hours and the shape of the forming tool has departed materially from that originally made by the hand shaping operation. Consequently, unless the machine is stopped and the doubler is removed and a new surface is provided, the shape of this tool changes continuously, and the shape of the staple is therefore changed. As a result, the staples at one end of a piece of card clothing are altogether different in shape and arrangement from those at the opposite end which is formed at a slightly later period of time.

Also, the foundation 10 is usually made of a soft or yielding material, and the action of the presser arm 98 on a rounded staple tends to tilt the staple to one side or the other and so to enlarge the holes through the foundation and to leave the staple insecurely held in place, as shown in Fig. 11. Also, if the staple is embedded in the soft foundation material, this may thus damage its structure. Moreover, the needles 96 are definitely located and it is desirable that the legs of the staples be positioned exactly opposite these holes so that they will enter the foundation properly. If, however, the doubler has changed its shape during use or has been improperly shaped in the beginning, the legs of the staples may not be properly positioned by the arms 21 and 22 to enter these holes. If they do go through the holes, then the tendency for the staple to twist to the right or the left will squeeze the foundation material at one side of the hole and enlarge the same so that the staple is not properly supported. The same conditions are brought about by the end of the wings 21 and 22 wearing away under the constant sliding motion over the hard wire and as these become cut they likewise do not position the ends of the staples properly.

A still further problem in such apparatus is found in the fact that the cutters are obliged to cut staple wire at very frequent intervals and the cutters wear to the point of forming notches and dull surfaces. This leaves a burr on the end of the wire and that burr will give a defective operation in the later use of the card clothing. A still more important feature, however, lies in the fact that the operations are timed very closely and the dull or nickel cutter may not have the wire severed by the time the wings have come forward and try to bend the wire. This pulls the wire back through the crowner and leaves the left hand leg of the wire short and the right hand leg bent or dented inwardly. Similar difficulties arise when the faces of the plugs 25, 26, 30 and 32 become worn and do not feed the required length of wire and the left hand end of the staple is too short.

I have discovered that these various difficulties may be overcome by adopting certain expedients and constructional features. The doubler 20 is now shaped, as shown in Figs. 3, 5 and 6, to provide an extensive plane surface which insures that the back 14 of the staple is straight throughout substantially the width of the staple. Moreover the corners of this doubler, over which the wire is bent, are carefully shaped by a grinding operation to provide partial cylindrical surfaces of a very short radius, depending on the size of the staple and the nature of the wire. In order that card clothing may be made of uniform structure throughout the period of manufacture, I make the doubler of two parts in which the operative face is formed of an extremely hard material 130, such as cemented tungsten carbide, or boron carbide, or other extremely hard material that is non-wearable or resistant to abrasion by the steel wire that is to be formed thereover. Ordinary steels are not serviceable for this purpose, since the very short radius now desired for the corner of the doubler could not be used, due to the rapid wear and abrasion thereof.

The radius of these corners 132 of the doubler (Fig. 5) is substantially the same as the radius of the wire that is being formed although some

latitude is of course required owing to the differences in size and the types of materials used for the wire. However, I have found that in order to bend a No. 32 wire having a diameter of 0.0128 inch, I may employ a radius corresponding with a No. 28 wire having a diameter of 0.0162 inch. A standard card clothing employing No. 32 wire will have a staple approximately $\frac{13}{32}$ inch high and $\frac{5}{32}$ inch wide. By having the corner radius approximating that of the wire it will be appreciated that the flat portion 14 of the staple is almost as long as the width of the staple or merely minus substantially the thickness of the wire. Consequently, the whole width of the staple is supported flat against the foundation as shown in Fig. 13. Other sizes of wire are utilized in making card clothing, and these are also bent about cylindrical surfaces having substantially the same radius as that of the wire and ordinarily not over twice that radius. For example, Nos. 37 and 40 wires may be bent on a radius of a No. 32 wire. It will thus be appreciated that the doubler does not present a sharp corner to the wire, which would nick or cut it and cause it to break during use, nor does it make a large curve which would prevent the staple from being seated properly.

The tips 134 of the wings 21 and 22 may also be made of the extremely hard materials above defined, as well as the exposed surfaces of the plugs 25, 26, 30 and 32. If the wing tips are prevented from being cut by the abrading wire moved thereacross then the operation will remain the same from day to day. Likewise, the use of the hard alloy inserts 136 for the gripping plugs 25, 26, 30 and 32 will insure the feeding always of the same amount of wire. It is particularly important to use inserts 138 for the cutting edges of the cutter which are formed of the extremely hard tungsten carbide alloy or boron carbide or other similar material, so that the cutter will remain permanently sharp and not be able to form a burred end of the wire as above defined. Likewise, it is preferred to have the hard inserts form only a small part of the cutter and to cut the wire always at substantially the same place on the cutter and thus not affect the timing thereof. As shown, the cutters are so shaped and positioned that the wire is cut at right angles to its length and provided with a flat and non-burred end face. If the operator were obliged to grind away the cutter frequently, he might change its shape and the timing might be affected. By using the hard insert, I insure that the cutter operate always the same and cut uniform lengths of wire and leave the wire in a correct position for the forming operation.

I claim:

A machine for making card clothing comprising a crowner, a doubler and a presser having substantially parallel plane faces and the doubler having partial cylindrical corners of short radius substantially the same as the radius of the wire to be bent thereby and having its plane face of such width that the cross member of each staple is made straight throughout nearly the entire inner width of the staple, movable wings cooperating therewith to bend a cut wire over the corners of the doubler to form a staple and drive the same through a foundation, and means including a cutter for cutting the wire at right angles to its length and feeding an invariable length thereof to the forming mechanism, the parts of the cutter and doubler which control the length and shape of the wire having operative faces of substantially non-wearable material, whereby flat-ended staples of invariable shape are fashioned and located in the foundation in a uniform arrangement throughout the length of the card clothing.

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