Feb. 1, 1966 P. C. DAVIS 3,232,155

METHOD OF MAKING PATTERN JACKS AND SIMILAR PARTS

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Fig. 1.

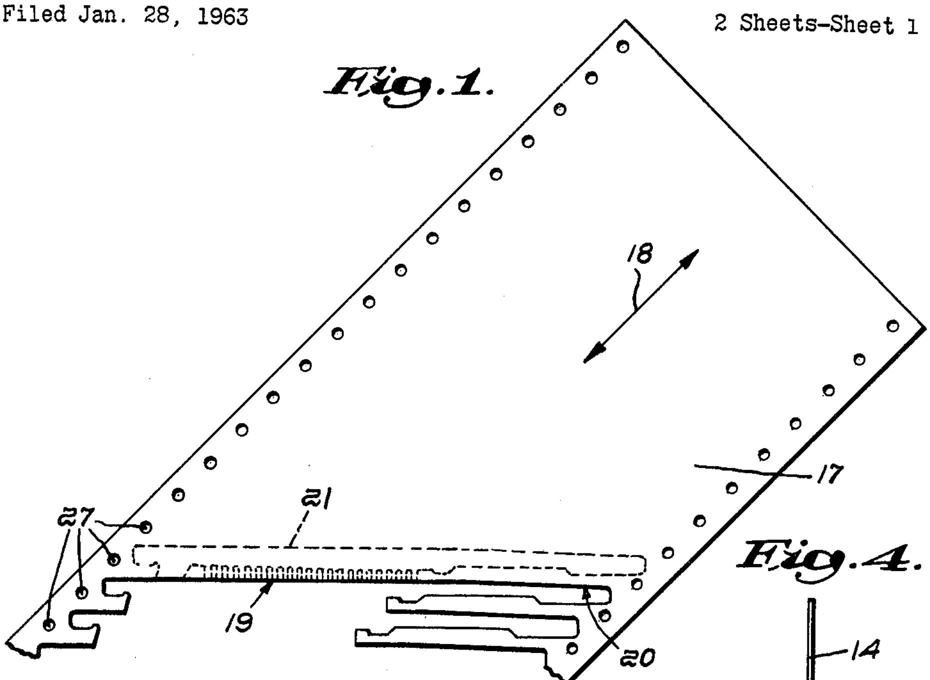

Fig. 4.

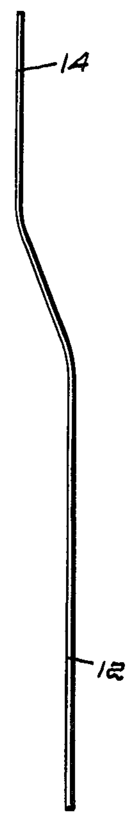

Fig. 2.

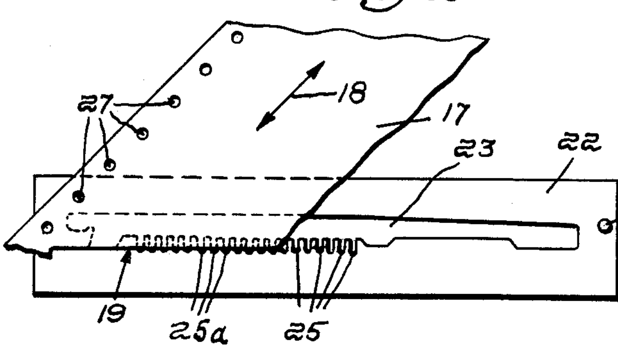

Fig. 3.

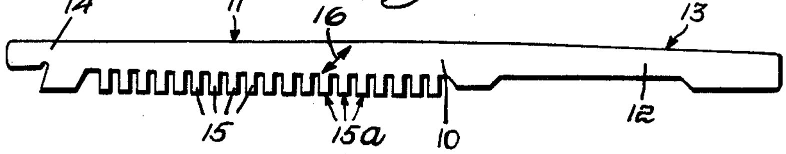

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Fig. 5.

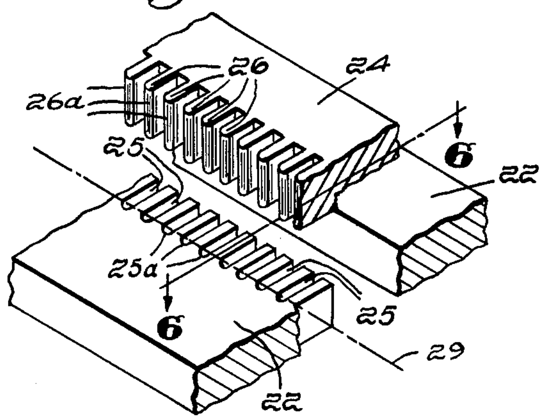
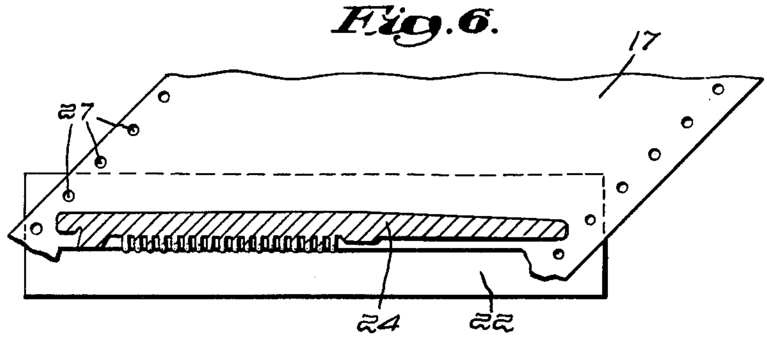


Fig. 6.



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METHOD OF MAKING PATTERN JACKS AND SIMILAR PARTS

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4 Claims. (Cl. 83—32)

This invention relates to pattern jacks and similar parts used in knitting machines, for example machines which produce jacquard types of patterns.

Pattern jacks of the type to which this invention relates are mounted in slots in the knitting head of a machine and are used to control the movement of the needles to produce various patterns. Typical jacks are made from uniform blanks of narrow strip shape originally equipped with a number of teeth along one edge. All but a selected number of teeth are cut off on each blank and the remaining teeth engage cams which operate the needles. The positions of the selected teeth in a sequence of jacks determines the pattern which will be produced. The jacks are bent at various points to fit certain positions in the knitting head. In operation the teeth are subject both to wear along their top edge and to shear stress in the longitudinal direction of the blank.

The jack blanks are customarily made from hardened rolled steel which has a characteristic "grain" structure lying parallel to the direction of rolling. The shear strength of this material, along the grain, is appreciably lower than the shear strength across, or perpendicular to, the grain. The wear resistance of an edge cut across the grain is greater than that of an edge cut parallel to the grain. Finally, the material holds a bend well when bent around an axis perpendicular to the grain and poorly when bent around an axis parallel to the grain.

According to previous practice jack blanks are punched from a narow strip with the longitudinal direction of the blank lying parallel to that of the strip and to the grain. Jacks cut in this maner have good bend retention in the desired direction, that is around axes transverse to the blank. The teeth have relatively poor shear strength, however, because they are subject to shear stress in the longitudinal direction of the blank, which corresponds to the grain direction. As a result, the teeth sometimes break.

When punching blanks longitudinally from a strip, a certain margin of waste material must be left on each side for proper punching action. Furthermore, for proper operation and maximum wear resistance on the top edges which engage the cams the teeth should have square ends. As it is difficult to machine and maintain sharp corners on dies and punches adapted to cut the rather fine teeth, the blanks are usually punched in two operations, by forming the blank and then cutting slots to form the teeth.

The principal object of this invention is to produce a pattern jack having adequate bend retention characteristics in the desired direction, and in which the teeth have both high shear strength and good edge wear resistance. Another object is to provide a method of producing jacks having the aforesaid desirable properties which results in a considerable saving of stock, and permits jack blanks to be punched complete with teeth in a single operation, thus ensuring greater accuracy and uniformity of the blanks.

The improved pattern jack here shown is punched obliquely from a strip of stock, so that the grain is oblique to the longitudinal direction of the jack and to the teeth. The teeth thus have both good wear resistance at their top and side edges and high shear strength in the longitudinal direction. The blank also has good bend retention characteristics. According to the improved method of production, the strip is fed to the punching die at an oblique angle. The die cavity has tooth-forming slots and the punch has corresponding teeth, somewhat longer than the finished length of the jack teeth. The straight edge left in the stock by punching out the rear edge of one jack blank is laid on the die partway over the slots and becomes the ends of the teeth of the next blank. Teeth of the desired square ended shape are thus produced in one operation.

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In the drawings illustrating the invention:

FIG. 1 is a plan view of a piece of stock from which several jack blanks have been punched out according to the method here disclosed;

FIG. 2 is a schematic plan view, partly broken away, of the stock in position over a die for punching a blank;

FIG. 3 is an enlarged plan view of a finished jack blank;

FIG. 4 is an enlarged view, taken in the direction of line 4—4 of FIG. 3, showing a jack blank bent to a typical form;

FIG. 5 is an enlarged fragmentary prospective view of a punch and die used in the method; and

FIG. 6 is a cross-section, somewhat reduced in scale, taken along line 6—6 of FIG. 5, showing the stock in place to be punched.

The jack blank generally indicated by the numeral **10** shown in FIG. 3, has a straight rear edge portion **11**, a lower end portion **12** having a rear edge **13** somewhat oblique to edge portion **11**, an upper end portion **14**, and a number of teeth **15** with square cut ends **15*a***. The grain of the rolled hardened steel stock from which the jack is made lies obliquely to the end-to-end direction of the jack, the direction of the grain being indicated by arrow **16**.

In FIG. 1 a typical strip **17** of the rolled steel stock is illustrated. As is customary, the grain runs in the longitudinal direction of the strip, as indicated by arrows **18**. Several jack blanks have been cut from the lower portion of the strip at an oblique angle. The last blank cut out leaves a straight edge portion **19** and an edge portion **20** slightly oblique to **19**. These edge portions correspond to rear edge portions **11** and **13**, respectively, of the jack just cut out.

The outline of the next blank to be cut from the strip is indicated by the dotted line **21**. The jack blanks are cut from the strip **17** by means of a die **22** having a cavity **23**, and a sheet metal punch **24** having a configuration mating with the die cavity. The cavity has slots **25** which receive corresponding teeth **26** on the punch for cutting out the jack teeth. The slots and corresponding punch teeth are deeper than the desired length of the teeth on the jacks. The strip **17** is positioned on the die at an angle oblique to the longitudinal direction of the cavity **23**, and is placed so that the straight edge **19**, left by cutting the previous blank lies part way over slots **25**, for example in line **29** of FIG. 5, leaving the bases **25*a*** of the slots exposed. In this manner, teeth with square ends are cut in the jack, even though bases of slots **25*a***, and the corresponding ends **26*a*** of the punch teeth are made with rounded corners for better wear and ease of machining. The bases of the slots and the end portion of the teeth which project beyond the position of the edge of the stock need not mate precisely because the punch and die do not perform any cutting in this region. Indexing holes **27**, spaced to correspond to the blank dimension in the direction of the strip, may be punched along the side margins of the strip in any suitable manner, and engaged successively by pins **28** on the die to align the strip in the correct position for each punching operation.

For obtaining the optimum combination of shear strength and top edge wear on the teeth, it is preferable to punch pattern jacks at an angle of 45° to the longitudinal direction or grain direction of the strip of stock. At this angle, the jack has satisfactory bend retention characteristics when bent for use in a knitting machine, as exemplified in FIG. 4. The amount to which the angle of the jack to the grain may be reduced below 45° is limited by geometric considerations, because beyond a certain point the ends of the right-hand teeth would fall on edge **20**. For a typical four inch jack having a straight edge **11** about three inches long, the lower angle limit is about 20°. A smaller angle down to about 10°, for example, where the configuration of the jack permits, would still give some improvement in the shear strength of the teeth as compared to jacks cut parallel to the grain of the strip in the usual manner.

As the angle of the jack of the strip is increased from 45° toward 90°, or across the grain, the edge wear resistance of the teeth and the bend retention characteristics are both decreased.

A pattern jack punched at an angle to the grain, as here described, is superior to previous jacks from the standpoint of shear strength of the teeth and yet has adequate wear resistance and ability to retain bends.

It is understood the method here described may be used to produce selector jacks, needles and other parts which are customarily punched from flat stock and have portions which, like the teeth of a jack, have to be cut to a square-edged configuration. If bend retention and edge wear resistance are of secondary importance in the particular part, the parts may be punched at 90°, or across the grain of the stock. In either case, whether the parts are punched obliquely or at 90° to the grain of the stock, the method here disclosed provides the advantages of punching a part with square-edged teeth in a single operation without machining, and maintaining sharp corners on the die and punch, and effects a considerable saving in stock, for example about 25%, as compared to the old method of punching blanks longitudinally in end-to-end arrangement.

What is claimed is:

1. The method of making pattern jacks, and similar parts of the type comprising an elongated body having a straight rear edge and a front edge carrying teeth with straight ends, which comprises punching the parts in succession from a strip of rolled sheet metal by means of a die having a rear edge-forming portion and a tooth-forming portion, and postioning the strip for each punching operation so that the edge left on the strip by the rear edge-forming portion in the preceding punching operation overlies the tooth-forming position and the strip material adjacent that edge is supported by the tooth forming portion.

2. The method described in claim **1**, the edge overlying the tooth-forming portion being positioned, in each operation, to coincide with the desired position of the ends of the teeth in the part about to be punched.

3. The method described in claim **1**, the parts being formed obliquely with respect to the strip.

4. The method described in claim **1**, the parts being punched at an angle in the range from 10° to 90° with respect to the strip.

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