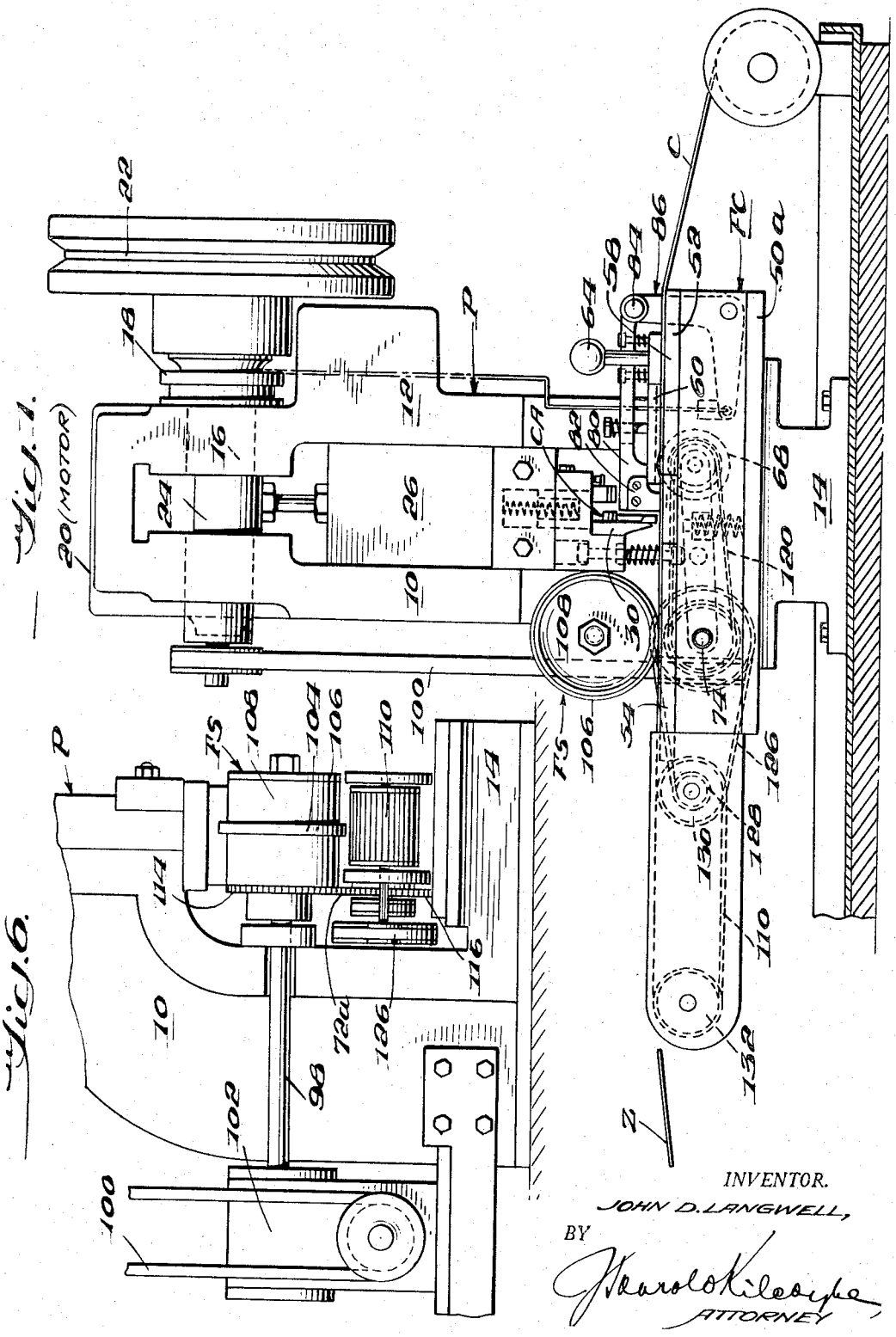
April 9, 1968 J. D. LANGWELL 3,376,772

SLIDE-FASTENER CUT-APART MEANS CONTROLLED BY WORK SENSING MEANS

Filed Aug. 31, 1966 3 Sheets-Sheet 1



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SLIDE-FASTENER CUT-APART MEANS CONTROLLED BY WORK SENSING MEANS

Filed Aug. 31, 1966 3 Sheets-Sheet 2

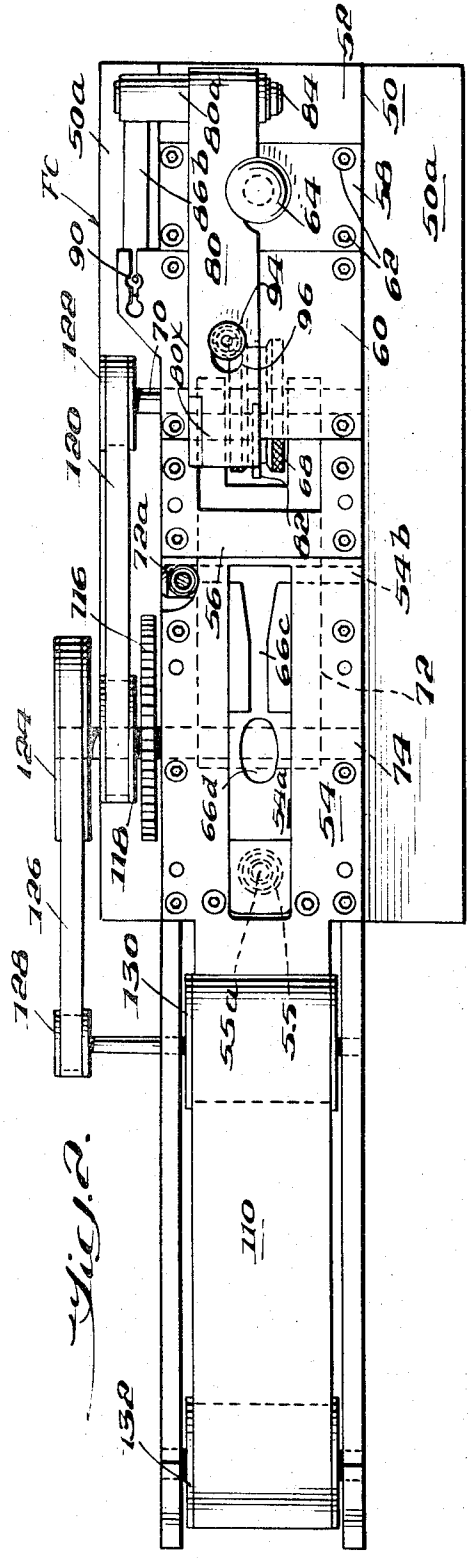


Fig. 2.

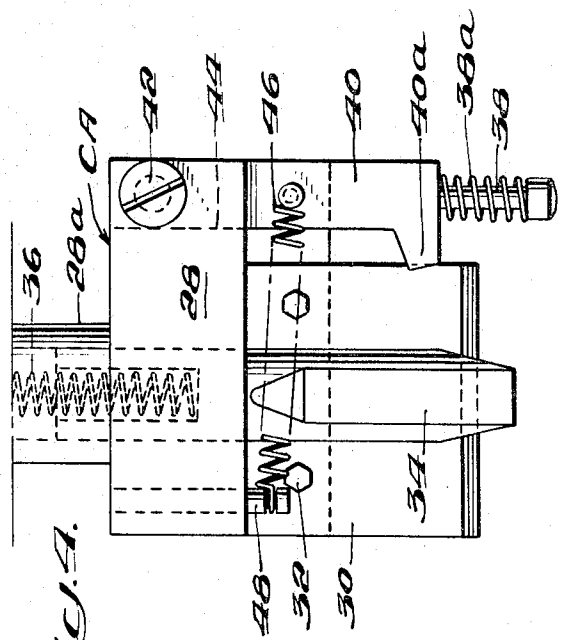


Fig. 4.

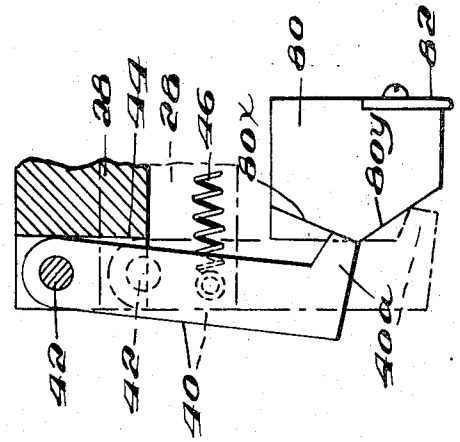


Fig. 5.

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SLIDE-FASTENER CUT-APART MEANS CONTROLLED BY WORK SENSING MEANS

Filed Aug. 31, 1966 3 Sheets-Sheet 3

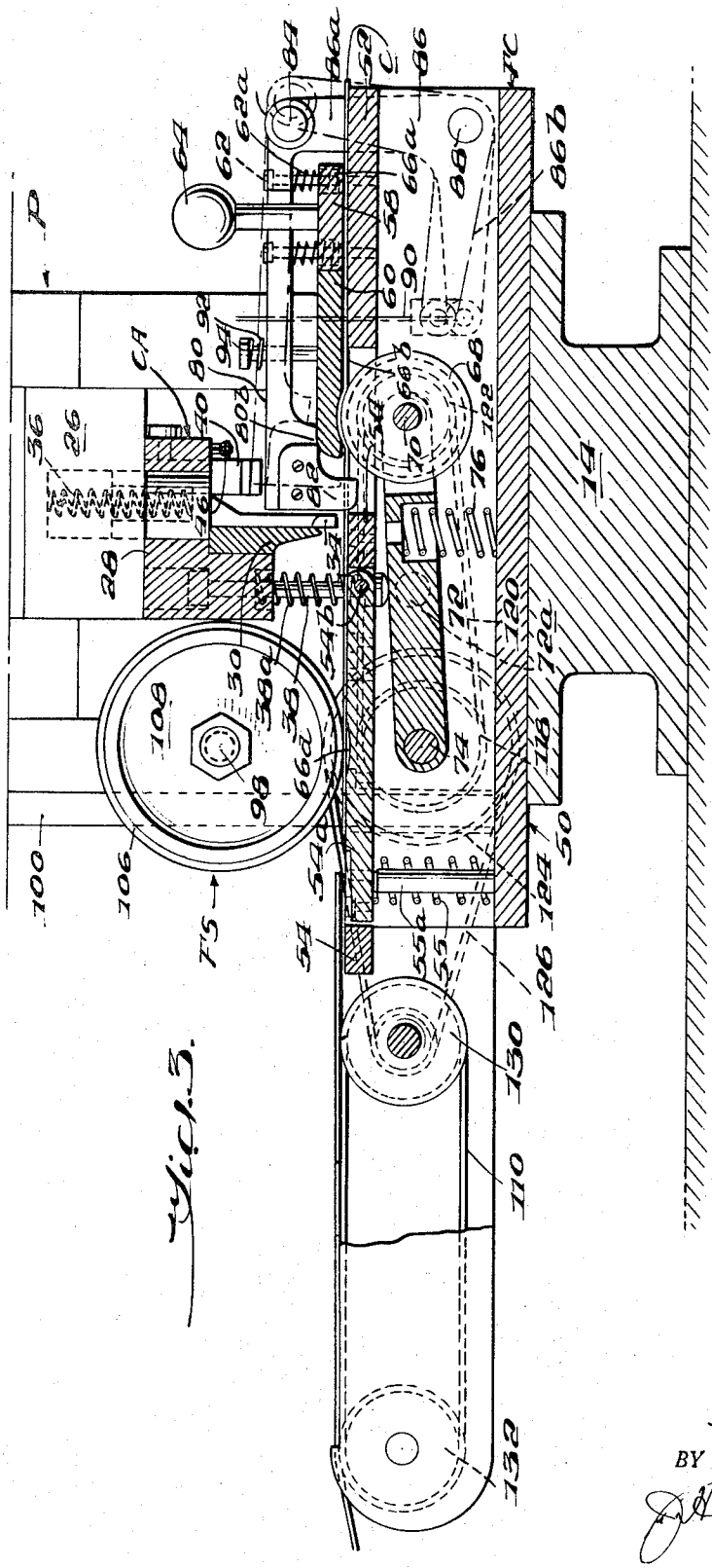


Fig. 3.

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SLIDE-FASTENER CUT-APART MEANS CONTROLLED BY WORK SENSING MEANS

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Filed Aug. 31, 1966, Ser. No. 576,310
10 Claims. (Cl. 83—154)

This invention relates to improvements in strip material cut-apart means, and more particularly to an improved automatic machine for cutting off a succession of individual slide fastener or zipper lengths of chain from a long continuous strip of slide fastener chain as the latter is positively fed through the machine.

As is well known, it has become standard practice in the production of slide fasteners, also commonly referred to as zippers, on the scale necessary to satisfy the demands of the garment, and more especially the men's trouser trade, to make up the fastener or zipper chain components thereof in the form of an initially continuous strip of slide fastener chain consisting of two fabric tapes of indeterminate length which are fastened together along adjacent, usually beaded, edges by rows of oppositely disposed, interengaged fastener elements clamped or molded to said edges and thereupon, assuming proper gapping of said continuous chain, to cut off a succession of zipper lengths from the advancing end of said continuous chain as the latter is fed through a so-called cut-apart machine, along transverse lines of severance disposed substantially midway of the length of the gaps. Usually, the chain gaps (actually short lengths of the tapes devoid of fastener elements) are provided by running the continuous strip of chain having fastener elements affixed to the tapes at a uniformly spaced pitch distance apart throughout the entire length thereof through a punch which removes a small number of the fastener elements at regularly spaced intervals along the length of the tapes, the spacing between and the length of the gaps being determined by the length of the individual slide fasteners or zippers being produced, but of course said gaps may be otherwise provided. So-called "cut-apart" machines designed to cut a succession of the individual slide fasteners or zipper lengths of chain from long strips of continuous, gapped slide fastener chain are known commercially and further are disclosed in prior patents such as Nedal No. 2,170,609 and Proud No. 2,754,908, and also in my recently issued Patent No. 3,263,542, dated Aug. 2, 1966.

Stated broadly, a major object of the present invention is the provision of an automatic machine for cutting off predetermined zipper lengths of slide fastener chain with accurate-length tape extensions from a long continuous strip of suitably gapped fastener chain, which is more positive and dependable in its action and/or of simpler construction than the prior cut-apart machines serving similar function.

More particularly, an object of the invention is the provision of a cut-apart machine as aforesaid, in which both the operation and timing of the cutting blade are controlled by simple yet positive mechanical means not likely to get out of operation or to become fouled in use, as is true of controls depending on electrical switches, for example.

Yet another object of the invention is the provision of an effective, practical and dependable mechanical control means for a machine for cutting off a succession of predetermined zipper lengths of chain from a long continuous strip of gapped slide fastener chain and more especially for controlling the operation of the cutting punch or blade of such machine responsive to pull forces

applied to a gap-sensing finger forming a component of said means by the chain during the course of its being fed through the machine.

Yet another object of the invention is the provision of a machine of the character stated which, when once placed in operation, continues to operate in fully automatic manner to cut off a succession of measured zipper lengths of chain for as long as the supply of continuous chain is maintained.

The above and other objects and features of advantage of an automatic cut-apart machine according to the invention will be set forth or appear from the following detailed description and accompanying illustrative drawings of a physical embodiment thereof, in which—

FIG. 1 is a front elevation of an automatic cut-apart machine for cutting off zipper lengths of slide-fastener chain from a long strip of continuous slide-fastener chain, according to the present invention;

FIG. 2 is a broken-away view looking down onto the combined chain feed and press control unit of the machine shown in FIG. 1;

FIG. 3 is an irregular, longitudinal section, one a larger scale than that of FIG. 1, taken through the aforesaid combined chain feed and press control unit and which further illustrates the general relationship of the latter with the cut-apart unit carried by the press ram;

FIG. 4 is an enlarged detail view of the cut-apart unit as seen from the chain feed-in side thereof;

FIG. 5 is a detail view illustrating the action of the control-arm lifting lever included in said cut-apart unit on the control arm of the press control unit; and

FIG. 6 is a fragmentary elevation looking onto the cut-apart zipper discharge end of the machine.

Referring to the drawings in detail, a cut-apart machine according to the invention is shown to comprise a standard make, electrically-driven, punch press modified as may be necessary to suit the aims and purposes of the invention; a cut-apart unit including a transversely disposed cut-off blade carried by the reciprocating ram of the press; and cooperatively related thereto a combined fastener-chain feed and press control unit mounted on the bed of the press and serving the plural functions of feeding a strip of continuous, suitably gapped slide fastener chain of indeterminate length in a straight-line path which is at a right angle to and intersects that of the reciprocating cutting blade of the cut-apart unit, and of effecting intermittent actuation of said press timed to the feed of the fastener-chain strip as provides that said cutting blade, in partaking of each of its working strokes, will cut off the most advanced zipper length of chain along a transverse line of cut extending across and substantially midway of the tape length-portions defining the gap between said most advanced zipper length and the following major-length portion of the chain.

More particularly, the aforesaid press generally designated P (FIG. 1) comprises side-frame members **10**, **12** and a forwardly offset bed **14** which is adapted to be bolted to a work bench or table. As is conventional, the upper ends of the side-frame members mount a main drive shaft **16** which is adapted to be intermittently driven via a normally deenergized, one revolution clutch **18** by an electric motor **20** through a belt and pulley drive generally designated **22**. The portion of the drive shaft which extends between the side frames is formed as an eccentric **24**, and suitably connected thereto in manner as to convert its eccentric motion to reciprocating motion is a ram **26** guided in slideways provided in the facing sides of said frame members.

According to the invention, the conventional cutting or stamping tool supplied with the press is removed and a cut-apart unit generally designated CA is substituted

therefor. As best seen in FIGS. 3 and 4, said unit comprises a tool holder **28** having a block-like body of rectangular configuration as viewed in plan, which seats against the lower face of the ram **26** and is removably affixed to the latter as by a shank **28***a* having a knock-out fit in a downwardly opening socket conventionally provided in the ram body for tool reception.

As viewed from its front, said tool holder is shaped as an L turned 90° in clockwise direction from its normal position, so that its normal vertical leg extends horizontally and its normal horizontal leg extends vertically. Such L-shaped configuration provides the holder with a front-to-rear vertical surface against which the upper thickened shank end of a cut-apart blade **30** may be laid flush and secured as by attaching bolts **32**, and it further provides a downwardly disposed horizontal surface against which the top edge of said shank may engage, the latter with the result that little or no shear forces are imparted to the blade attaching bolts.

On its fastener chain feed-in side and closely adjacent the said cut-apart blade **30**, the tool holder **28** further mounts a so-called pressure pad **34** whose lower edge normally extends a small distance below that of the cutting edge of said blade whereby it leads said cutting edge in the latter's downward motion. However, being backed by a spring **36** extending upwardly into the tool holder shank, said pressure pad may yield when its lower working edge engages a fixed surface such as that of an anvil mounted to cooperate with the cut-apart blade, as will be described.

On the fastener chain feed-out side of the cut-apart blade **30**, the tool holder in its vertical leg portion further mounts a spring-loaded pressure pin **38** having an enlarged working head which projects downwardly a substantial distance below the cutting edge of said cut-apart blade but which is also adapted to yield against the bias of its loading spring **38***a* interposed between the under face of said vertical leg portion and said working head.

Finally, the tool holder **28** mounts a generally vertically disposed control-arm lift lever **40** whose lower end, which depends downwardly a substantial distance from the horizontal leg of said holder, is formed with a forwardly offset hook-like nose **40***a*. More particularly, and as best seen in FIG. 4, said lift lever is pivotally connected at its upper end as by a pivot pin **42** to the holder whereby it may swing in front-to-rear direction, and preferably its upper portion operates during such motion in a rearwardly opening, vertical guide slot **44** provided in said tool holder body. A coil spring **46** having one end connected to a stud **48** depending from the under face of the tool holder and at its other end to an intermediate point of said lift lever normally biases said lever to its normal forward-most position in which its front side edge is adjacent the bottom of said guide slot **44**. However, the lift lever **40** may swing rearwardly from its aforesaid normal position when its forwardly offset nose **40***a*, acting as a cam follower, is cammed rearwardly, as will be explained.

Next considering the combined fastener chain feed and press control unit herein generally designated FC, such illustratively comprises an elongate body member **50** of upright channel section which is preferably provided with longitudinally extending base flanges **50***a*, by which it may be bolted to the forwardly offset bed **14** of the press P, in position thereon such that its longitudinal center line is traversed by the vertical plane of reciprocation of the cut-apart blade **30**, and further such that its ends are disposed symmetrically to the sides of said plane of reciprocation. Illustratively, the open top of the body member **50** is closed by end top plates designated **52, 54** and an intermediate anvil plate **56**, which latter is disposed directly below the tool holder portion which mounts the cut-apart blade **30** and the pressure pad **34** as aforesaid, all as best seen in FIG. 3.

By reference to FIG. 2, said top plate **54** is preferably U-shaped, with the space between its side legs, which latter extend along and are affixed to the top edges of the spaced sides of said body member **50**, providing for the accommodation of a longitudinally extending pressure plate **54***a* whose mounting and functioning will be described hereinafter.

Cooperatively associated with and seating flush against the end top plate **52** which is disposed to the fastener chain feed-in side of said cut-apart blade is a short-length friction plate or pad **58** and extending intermediate same and approximately to the anvil plate **56** is a chain guide and roller backing plate **60**. The friction plate **58** is non-rigidly attached to the top plate **52**, being normally biased downwardly against the upper surface thereof as by springs **62***a* mounted on corner bolts **62** which hold said friction plate in place, and it is provided with an upwardly extended ball handle **64** whereby it may be manually raised a limited distance from the top plate **52**, for example when it is desired to initially thread the starting end of a long strip of fastener chain into the machine. The chain guide and roller backing plate **60**, on the other hand, is rigidly secured flush against the upper surface of the top plate **52**. However, rather than having flush engagement throughout their entire under-face areas with the upper surface of the top plate **52**, the under surfaces of both the friction and backing plates are provided with chain-element receiving grooves **66***a*, **66***b* disposed in longitudinal alignment, said grooves thus defining with the portion of the upper surface of the top plate **52** which they overlie an elongate enclosed chain guideway leading to the cut-apart blade **30**. Alternately, the grooves defining the guideway may be sunk wholly or partly into the upper surface of the top plate **52**.

Positive feed motion is imparted to a continuous fastener chain interposed between the top plate **52** and said friction and backing plates **58, 60**, respectively, by the action thereon of a powered transport roller **68** which normally projects through a cut-out in the anvil-plate end of the top plate **52** into the chain guideway portion **66***b* provided in the backing plate **60**. More particularly, and as best seen in FIG. 3, said transport roller **68**, whose peripheral surface is centrally grooved to accommodate the usually metal fastener elements of the chain being fed along the guideway and is suitably knurled to both sides of the groove so that it will effectively grip the fabric tape components of said chain, is keyed or otherwise drivingly affixed to a continuously driven stub shaft **70** which is journaled for rotation in the free end of a depressible mounting arm **72** which extends centrally-lengthwise of the channel of the body member **50**. The other end of the roller-mounting arm **72** is pivotally connected to a cross-shaft **74** extending between and journaled for rotation in the spaced sides of said body member and thus said arm may swing in a vertical plane. A spring **76** held in compression between the bottom of the channeled body member and the under side of the arm **72** normally biases said arm to its uppermost position in which the peripheral surface of the transport pulley **68** extends into the guideway portion **66***b* aforesaid and bears against the under surface of the tape components of a fastener chain disposed in said guideway, thus to feed the fastener chain to the action of the cut-apart blade **30**. If desired or considered necessary, the downwardly facing bottom-wall portion of the guideway portion **66***b* against which the roller tends to press may be formed complementally arcuate to the roller periphery, thereby increasing the arcuate area of contact of said roller with the chain tapes.

According to the invention, the actuation of the ram **26** is timed so that the cut-apart blade **30** will lower against the anvil plate **56** only when the feed motion of the chain has been arrested and the then most advanced gapped-length portion of the fastener chain, i.e. the gapped-length portion extending between the most advanced individual zipper-length group of interengaged fastener elements

thereof and the following usually major-length portion of the chain, is disposed on said anvil plate and in position to be severed by said blade along a transverse line disposed midway of the length of said most advanced gapped-length portion. Such of course requires a precise control and interrelation of press actuation and chain-feed arresting or stop means, which will now be described.

Referring to FIGS. 2 and 3, there is provided an elongated control arm **80** which extends longitudinally along and generally above the guideway **66***a*, **66***b* and has length such that it extends from a point adjacent the chain feed-in end of said body member **50** to a point generally beneath the tool holder **28** but short of the path of reciprocation of the cut-apart blade **30**. At its inner or blade-adjacent end, said control arm carries a depending, preferably plane-form gap-sensing finger **82** which, in all positions of the control arm, overhangs the relatively inner edge of the transport-roller backing plate **60** and is further positioned transversely with respect to the feed path of the chain that it is disposed directly above the interengaged fastener elements of the groups thereof, whereby it normally rides on said elements.

Said control arm **80** is mounted for both limited vertical swinging motion about a transverse axis extending through its outer or chain feed-in end and for limited bodily translating motion generally in its own plane and hence toward and away from the cut-apart blade **30**. More particularly, the outer end of the control arm, which is formed as a hub having a rearwardly disposed extension portion **80***a*, is pivotally connected by means of a pivot pin **84** received in said hub and its extension, to one arm, i.e. the vertical arm **86***a*, of a right-angularly armed bellcrank lever **86** disposed to the rear of the body member **50**. Said bellcrank lever is adapted to rock about the axis of a fixed fulcrum pin **88** extending transversely across said body member and its other or horizontal arm **86***b* which is adapted to move throughout vertically ascending and descending arcs when said lever is rocked, is connected by a cable **90** to the aforesaid normally disengaged clutch **18** in the driving connection between the motor **20** and the drive shaft **16** of the press.

By virtue of the pivotal connection between the outer end of the control arm **80** and the bellcrank lever **86**, the inner end of said control arm may be raised and lowered a limited amount. Thus, if we assume a normal operating position of the control arm **80** in which it is both retracted consequent to the cable **90** being under the bias of a tension spring (not shown) interposed in its connection with the clutch **18** and which tends to rock the bellcrank **86** in clockwise direction, and in which it is also in an intermediate raised position determined by the gap-sensing finger **82** riding on the interengaged fastener elements of a zipper-length group thereof moving along the chain guideway, the aforesaid pivotal connection of control arm to bellcrank permits said control arm to lower when said finger moves into the next following gap in the chain. Such pivotal connection of control arm to bellcrank also permits the control arm to be raised from a lowermost position to which it may have lowered to and above its aforesaid normal position.

At this point of the description, it is noted that the control arm **80** is biased in downward direction towards its aforesaid normal position, and towards its lowermost position as well when it is free to partake of lowering movement, by means of a compression spring **92** mounted on an upright headed pin **94** threaded into the transport-roller backing plate **60** and which extends upwardly through said arm through an elongated aperture **96** therein, so as to be reactive between the head of the pin **94** and the upper side of said control arm. It is also explained that to prevent unlimited lowering movement of the control arm, it is provided on its under side with a depending foot **80***b* which, by its engagement with the upper side of the backing plate **60**, limits the lowering movement of which the control arm is capable.

The ability of said control arm to translate bodily a limited distance toward and away from the cut-apart blade **30** stems from the fact of the connection of its outer end to the upper free end of the vertical arm **86***a* of the bellcrank **86**, which arm swings throughout a horizontal arc struck from the axis of the pivot pin **88**. As explained above, the bias imparted to the bellcrank by the tension means interposed in the connection of cable **90** with the clutch **18** normally maintains the bellcrank in its most clockwise position, and such results in the control arm **80** being normally in a retracted position. However, when the gap-sensing finger **82** lowers into the gap of a fastener chain being positively propelled along the guideway by the action of the aforesaid powered chain feed or transport roller **68**, the rearward edge of said finger is immediately engaged by the most forward of the interengaged fastener elements of the next following zipper-length group thereof. Consequent to this engagement, the control arm is bodily pulled forwardly in the direction of the cut-apart blade **30** and, in partaking of this motion, it rocks the bellcrank **86** in counterclockwise direction. Such in turn results in a positive pull being applied to the cable **90**, which by design is sufficient first to overcome the bias of the aforesaid tension means and then a cause engagement of the clutch **18**. Thereupon, drive is transmitted to the press drive shaft **16** which results in the press ram and cut-apart blade being actuated throughout their working and return strokes.

During the course of the working stroke of the ram, the following actions occur: First, the pressure pin **38** moves downwardly against a rearwardly projecting offset **72***a* (FIG. 2) provided on the aforesaid transport-roller carrying arm **72** and depresses said arm and correspondingly the feed or transport roller **68** carried thereby, thus to arrest feed of the slide fastener chain. Next the pressure pad **34**, which slightly leads the cutting edge of the blade **30** in the latter's downward motion moves against the gapped-length portion of the chain which has just previously been sensed by the sensing finger **82** and presses the same against the anvil plate **56** with appreciable pressure, thus to clamp said tape-length portion in fixed position at a point immediately adjacent the line of cut which said cutting edge will make. Thereupon the cutting edge of the cut-apart blade lowers against said gapped tape-length portion and cuts same apart on a transverse line of severance.

From the above, it will be seen that by imparting to the slide fastener chain moving through the guideway under the action of the feed or transport roller **68** a rate of feed which is such as to produce feed movement of the chain an amount substantially equal to half the length of the gaps between zipper-length groups of fastener elements thereof in the interval between the instant of lowering of the gap-sensing finger **82** into each chain gap as aforesaid and the instant that each gapped tape-length portion is engaged by the cut-apart blade, said blade will make its cut substantially along a transverse line which extends midway of the length of each said gapped tape-length portion.

When the gap-sensing finger **82** lowers into a gap, it tends to maintain said position under the bias of the aforesaid spring **92** effective on the control arm **80**, with the result that the control arm does not of its own accord reset itself. However, the function of the aforesaid lift lever **40** carried by the tool holder **28** is to positively lift or raise the finger-carrying end of the control arm to a position as provides for re-setting of said control arm under the bias of the tension means in the clutch-actuating cable **90**. More particularly, responsive to lowering movement of the ram **26** and thereby the tool holder, the lift lever **40** also lowers, with the result that its forwardly offset nose **40***a*, which in the raised position of the lift lever

is accommodated in a downwardly-rearwardly inclined relieved side-edge portion **80***x* provided on the rear side face of the finger-carrying end of the control arm **80**, is cammed rearwardly by said side-edge portion **80***x* but thereafter moves in under the downwardly-forwardly inclined under face portion **80***y* of said control arm, under the bias of the lift-lever biasing spring **46**. Thus, when the ram and tool holder move on their up or return stroke, the lift lever **40** is enabled to exert a lifting force on the finger-carrying end of the control arm of a magnitude sufficient to raise the gap-sensing finger **82** above the level of the upper surfaces of the interengaged fastener elements of the chain moving along the guideway. By design, when this level has been reached, and this is generally determined by the spring **92** being compressed beyond its yield point, the lift-lever biasing spring **46** yields under the camming action of the inclined control-arm surface or portion **80***y* on the nose end **40***a* of the lift lever, as permits said nose end to in effect disengage from the control arm. When the control arm **80** has been raised clear of the interengaged fastener elements of the chain as aforesaid, it together with the bellcrank **86** will re-set themselves in their initial position in which the control arm is retracted and the bellcrank is in its right-most or clockwise position.

According to yet another feature of the invention, the press mounts an auxiliary fastener-chain feed means which functions, in addition to advancing each cut-apart zipper length to a discharge conveyor, to apply light tension to each gapped-length portion of the chain when it is being acted on by the cut-apart blade **30**. More particularly, and as best seen in FIG. 6, there is provided a friction wheel-slip clutch assembly FS on a front-to-rear mounted shaft **98** which extends transversely of said body member **50** on the discharge side of the ram and is driven off the press motor **20** through a belt-pulley take-off means designated **100** and a speed reducer **102**.

Said assembly generally includes a driven friction wheel **104**, so called because its periphery is surfaced or otherwise provided with a composition friction material **106** such as that sold under the trademark "Tygon," which rotates in a plane disposed in longitudinal alignment with the aforesaid guideway **66***a*, **66***b* and at a level such that its said peripheral friction surface bears on the chain or portion thereof moving along the aforesaid pressure plate component **54***a* of the top plate **54** which supports the most advanced zipper-length portion of the chain prior to and after its severance from the main or following strip of fastener chain.

At this point of the description, it is explained that said pressure plate **54***a* is pivotally connected at its forward end to the side arms of the top-plate body member **54** by a hinge pin **54***b* extending between said side arms, and that its outer or discharge end is urged in upward direction by a spring **55** carried by an upright stop pin **55***a* affixed to the bottom wall of the body member **50**, all as generally shown in FIG. 3. FIG. 2 further shows that the upper surface of said pressure plate **54***a* is provided with a longitudinally extending groove **66***c* defining a guideway extension and is further provided with a concavity **66***d* disposed directly beneath the friction wheel **104**, whose presence is designed to increase the effectiveness of said friction wheel in propelling the severed zipper lengths toward their discharge point.

The aforesaid friction wheel-slip clutch assembly FS further includes a slip clutch **108** whose setting is such that it normally operates to transmit drive from shaft **98** to the friction wheel **104** and thereby feed motion to the chain or portion thereof engaged by its peripheral surface **106**, while at the same time it will slip when continued rotation of the friction wheel would impart tension in excess of that desired to the chain or tape portions thereof. In actual practice, the slip clutch is set to slip when, upon the pressure pad **34** having lowered into engagement with a gapped length portion of the fastener chain as aforesaid to hold same stationary during the cutting-apart operation, the friction wheel imposes a predetermined slight amount of tension to the so-held chain or portion thereof.

Such a clutch setting further insures that upon severance of the most advanced zipper length of chain having been effected followed by raising motion of the pressure pad **34** from the chain tapes which it had clamped during the cutting-apart operation, the slip clutch will again become operative to transmit drive to the friction wheel **104**. Thereupon, said friction wheel functions to propel each cut-apart zipper length of chain to a powered, horizontally disposed discharge conveyor belt **110** extending in continuation of the body member **50** and which discharges said zipper length to a suitable bin or receptacle (not shown).

FIG. 6, in conjunction with FIGS. 2 and 3, illustrates a preferred means for driving both the transport roller **68** and the discharge conveyor belt **110** from the same shaft **98** which drives the friction wheel-slip clutch assembly FC. More particularly, said shaft **98** mounts fast thereon and disposed just to the rear of said assembly and also of said body member **50**, a spur gear **114** which meshes with a spur gear **116** keyed or otherwise affixed to the aforesaid shaft **74** about whose axis the transport roller-carrying arm **72** pivots and which is disposed below said shaft **98**. Affixed to said shaft **74** rearwardly of the body member **50** is a pair of stepped-diameter pulleys, the smaller pulley **118** receiving a driving belt **120** extending to a pulley **122** fast on the aforesaid stub shaft **70** to which the transport roller **68** is keyed, and the larger pulley **124** receiving a driving belt **126** to a pulley **128** which drives the driven roller **130** about which and a companion idler roller **132** the endless discharge conveyor belt **110** extends. It will be observed from FIG. 6 that all said spur gears, pulleys and driving belts are disposed to the rear of the body member **50** of the combined chain feed and press control unit FC and generally intermediate said body member and press side frames so as to be more or less guarded by said member and frames.

While it is believed that the operation of the above described cut-apart machine will be clear to those skilled in the subject art of slide fastener manufacture, such will be briefly summarized as follows: First, the main driving motor **20** is energized by closing a suitable control switch (not shown) in the supply circuit thereto, thus imparting drive to the transport roller **68**, the friction wheel **104** and the discharge conveyor belt **110**. Since the clutch **18** is normally disengaged, the ram **26** remains stationary although in position to partake of its operating cycle consisting of a working and a return stroke.

The starting end of a long strip of continuous gapped slide fastener chain (designated C in FIGS. 1 and 3) to be cut apart into individual zipper lengths is now threaded into the machine. This is simply achieved by first manually grasping the handle **64** and lifting the friction plate **58** and then threading said starting end into the guideway portion **66***b* between the transport-roller backing plate **60** and the top plate **52** and then permitting said friction plate to lower after insuring that the strip will extend through its guideway portion **66***a*. The strip of continuous chain is then pushed inwardly, i.e. towards the raised cut-apart blade **30**, until it is engaged by the transport roller **68** which proceeds to power-feed the entering end of the chain toward the ram **26**, and such feed is permitted to continue until the entering end of the chain proceeds past the still-raised ram to a position beneath the rotating friction wheel **104**. During this preliminary feeding-in operation, the control arm **80** is manually held in its full-raised position in which its sensing finger **82** is disposed slightly above the chain.

With the chain now being positively fed forward, the control arm **80** is left to lower to its normal operating position, i.e. its broken-line position, FIG. 3, in which the sensing finger **82** rides upon a group of the interen-

gaged fastener elements of the chain then assumed to be disposed below same.

When the next following gapped length portion of the chain advances to a position beneath the finger, the latter lowers into the gap and, with slight further feed motion of the chain, the control arm is translated, i.e. pulled forwardly, to its full-line position (FIG. 3). This motion of the control arm rocks the bellcrank **86** in counterclockwise direction, resulting in a pull force being applied to the cable **90** which in turn effects engagement of the one-revolution clutch **18**. Consequent to such engagement, the ram **26** is actuated throughout its working and a following return stroke. On its working stroke, the ram actuates the tool holder **28** towards the gapped length portion of the chain now disposed beneath same, whereupon, in the order stated, the pressure pin **38** first proceeds to depress the transport roller **68**; then the pressure pad **34** lowers against the tapes of said chain portion and clamps said tapes against the anvil plate **56**, whereupon the rotating friction wheel **104** proceeds to exert light tension on said tapes; and finally the cutting edge of the cut-apart blade lowers against said tapes and cuts through same along a line of cut extending transversely of and also substantially midway of the length of said gapped length portion. The cut-apart length of chain continues its motion under the action of the rotating friction wheel **104** and moves to the discharge conveyor **110** which effects its discharge from the machine and preferably drops same to a storage bin or receptacle.

On the return stroke of the ram and tool holder, first the cut-apart blade and then the pressure pad **34** disengage from the chain tapes. Next, the lift lever **40**, whose nose end **40***a* had moved in under the finger-carrying end of the control arm **80** on the down or working stroke of the ram, and which has earlier lifted said end, and thereby the finger **82** from the gap into which it has lowered responsive to initial upward movement of the ram, disengages from said control arm. Finally, the pressure pin **38** by its motion away from the offset **72***a* on the transport-roller mounting arm **72** permits resumption of chain feed by said transport roller **68**.

When lifting of the control arm **80** has been effected as aforesaid, it, together with the bellcrank lever **86**, will move to their initial positions shown in broken lines, FIG. 2, i.e. they will re-set themselves, under the bias of the tension spring in the cable connection to the clutch **18**. Thereupon the cycle of operation as aforesaid is repeated so long as the supply of gapped chain is maintained. When such runs out, the motor **20** and parts powered thereby will continue to operate until the motor is deenergized, but the press will be deactivated inasmuch as the clutch **18** through which drive is supplied to its main drive shaft is normally disengaged.

Without further analysis, it will be seen that an automatic fastener chain cut-apart machine as described and illustrated achieves the objectives of the invention set forth herein in simple, practical and thoroughly dependable manner. However, various changes in construction are possible without departing from the scope of the invention as defined in the appended claim. For example, the discharge conveyor **110** may be eliminated entirely, and a mechanical device which pulls or pushes the cut-apart zipper from the body member **50** may be substituted. It is also possible to pneumatically remove the cut-apart zippers by air jet means.

It is moreover possible to adapt, without substantial modification thereof, the herein cut-apart machine to the cutting apart of entire fly-closure units, i.e. zippers with fly strip attached thereto, from an indeterminate length of an assembly of continuous gapped zipper chain and continuous fly-strip tapes sewn thereto. Thus, when so adapted, the present cut-apart machine is capable of being used just as or in place of that disclosed and claimed in my aforesaid Patent No. 3,263,542.

Hence, as the above and other changes could be made in carrying out the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. An automatic slide-fastener chain cut-apart machine comprising, in combination:

means defining a straightway extending guideway for a continuous slide-fastener chain consisting of a pair of elongate flexible tapes secured together along adjacent edges by a succession of spaced-apart groups of interengaged fastener elements and with the edges of the tape length-portions which extend between said groups defining gaps;

a cut-apart blade reciprocable in a path intersecting said guideway;

means for reciprocating said blade intermittently;

means driven by said last means for positively feeding said continuous slide-fastener chain along said guideway to the action of said blade;

and means for controlling actuation of said blade-reciprocating means and said fastener-chain feed means whereby the blade is actuated throughout each of its working strokes only when the feed motion of the chain is arrested and the then most advanced gapped-length portion of the chain is disposed in said guideway in position as to be acted upon by said blade, said means including a gap-sensing finger disposed to the feed-in side of said blade and depending into the guideway and positioned therein so as normally to ride on the interengaged fastener elements of the successive groups thereof moving along said guideway;

means mounting said finger for relative raising and lowering movement and for bodily motion toward and away from said blade, whereby the finger is free to lower into the gaps in the gapped length portions between the successive groups of interengaged fastener elements when such move under the same and is translatable towards the blade when, following each such lowering movement, it is abutted by the forward-most interengaged fastener elements of the next oncoming group of said elements;

means responsive to such lowering and translating motion of said finger for effecting actuation of said blade reciprocating means and thereby motion of the blade throughout its working and return stroke;

and means for deactivating the chain feed means immediately prior to the blade, in partaking of its working stroke, moving into cutting engagement with each said gapped length-portion of the chain.

2. An automatic slide-fastener chain cut-apart machine according to claim **1**, and further including guideway extension means in alignment with said guideway; and means also driven by said blade-reciprocating means and being disposed to the feed-out side of the cut-apart blade for feeding the individual cut-apart lengths of chain along the guideway extension means.

3. An automatic slide-fastener chain cut-apart machine according to claim **2**, wherein said last means is effective to apply light tension to each gapped length portion of chain as it is being acted upon by said blade.

4. An automatic slide-fastener chain cut-apart machine according to claim **1**, wherein the finger mounting means comprises a control arm disposed above and extending longitudinally along the chain on the feed-in side of the blade, said finger being affixed to and depending from the relatively inner end of the control arm, the relatively outer end of said control arm being pivotally connected to one arm of a bellcrang mounted for rocking motion and whose other arm is connected in actuating relation to said means for reciprocating the blade, the construction and arrangement being such that translating motion of said finger effects corresponding motion of the control arm, rocking motion of the bellcrank, and actuation of said means for reciprocating the blade.

5. An automatic slide-fastener chain cut-apart machine according to claim 1, wherein said blade is carried by a reciprocating ram and said ram further mounts yieldable means closely adjacent the blade and leading same into engagement with the chain for applying a hold-down force on each said gapped length portion of the chain as it is being cut apart by said blade.

6. An automatic slide-fastener chain cut-apart machine according to claim 1, wherein said blade is carried by a reciprocating ram and said ram further mounts said means for deactivating the chain feeding means just prior to the blade moving into cutting engagement with each said gapped length portion of the chain.

7. An automatic slide-fastener chain cut-apart machine according to claim 1, wherein said blade is carried by a reciprocating ram and said ram further mounts means operative on its return stroke for positively lifting the gap-sensing finger from a gap into which it has lowered following completion of each cutting-apart operation, thereby to reset the finger for lowering into a next following gap.

8. An automatic slide-fastener chain cut-apart machine according to claim 4, wherein the cut-apart blade is carried by a reciprocating ram and said ram pivotally mounts a lift lever having a free offset end which is spring-biased towards the finger-carrying end of said control arm, the construction and arrangement being such that responsive to the ram moving throughout its working stroke the offset end of said lift lever moves in under said finger-carrying end and that responsive to the ram moving on its return stroke said offset end effects lifting of said finger-carrying end and thereby the gap-sensing finger from any gap into which the finger had previously lowered.

9. An automatic slide-fastener chain cut-apart machine according to claim 1, including means for applying light tension to each said gapped length portion of the chain immediately prior to and as it is being engaged by said blade.

10. An automatic slide-fastener chain cut-apart machine according to claim 9, wherein said means include a rotary friction wheel and a coacting spring-biased pressure plate disposed to the feed-out side of the blade and adapted to exert a slight pull on each forward-most length of chain then being severed.

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