July 3, 1956 J. G. SOAVE 2,752,997

SLIDE FASTENER MANUFACTURE

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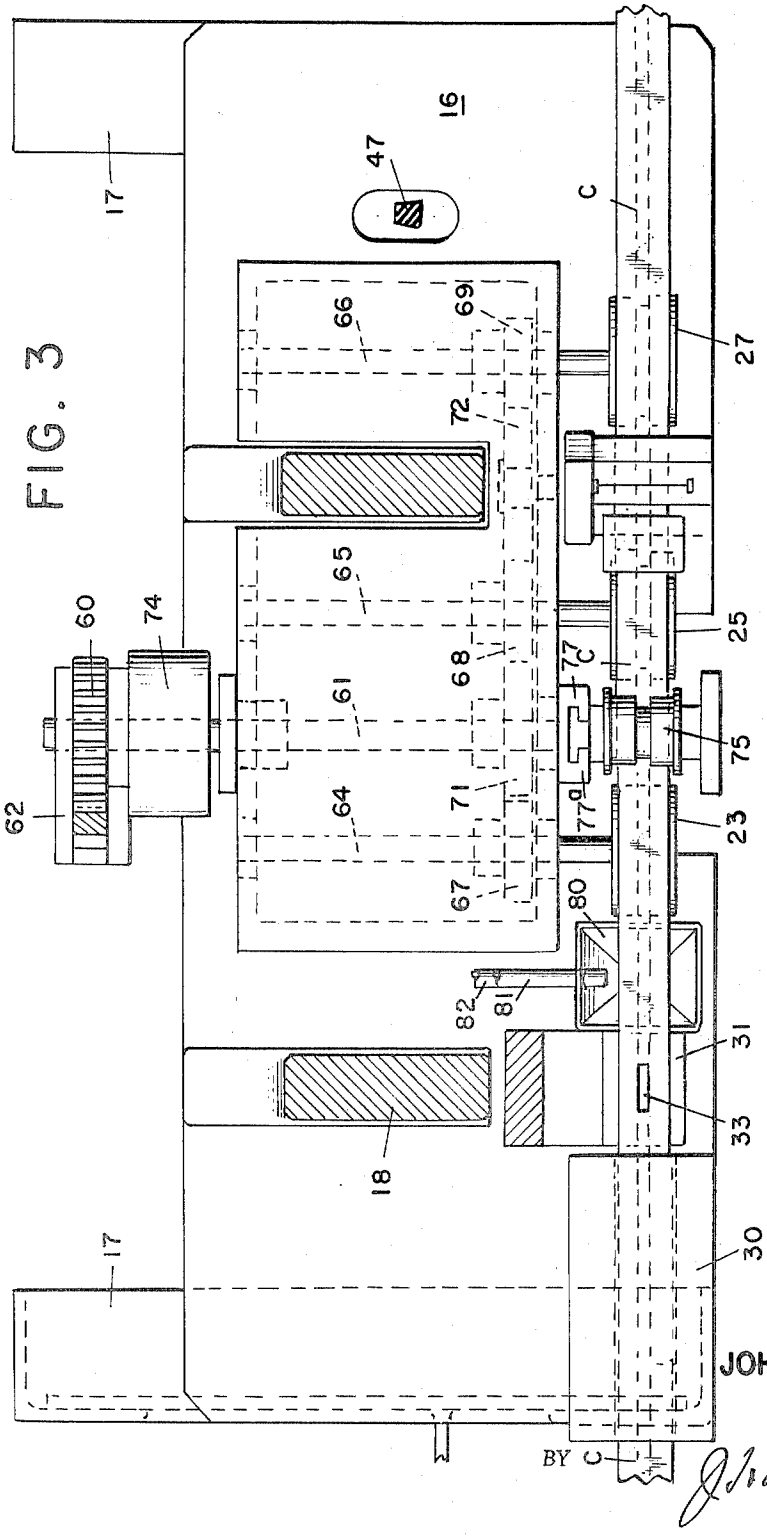


FIG. 3

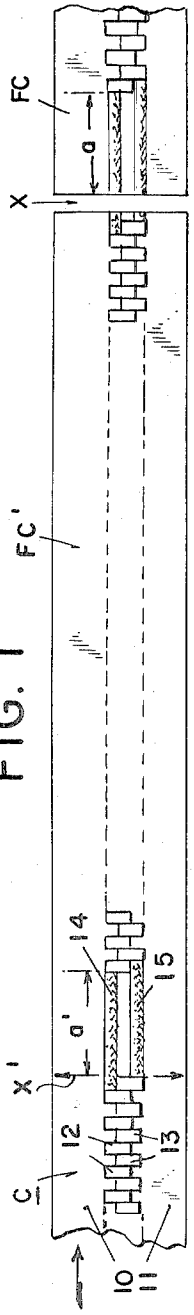


FIG. 1

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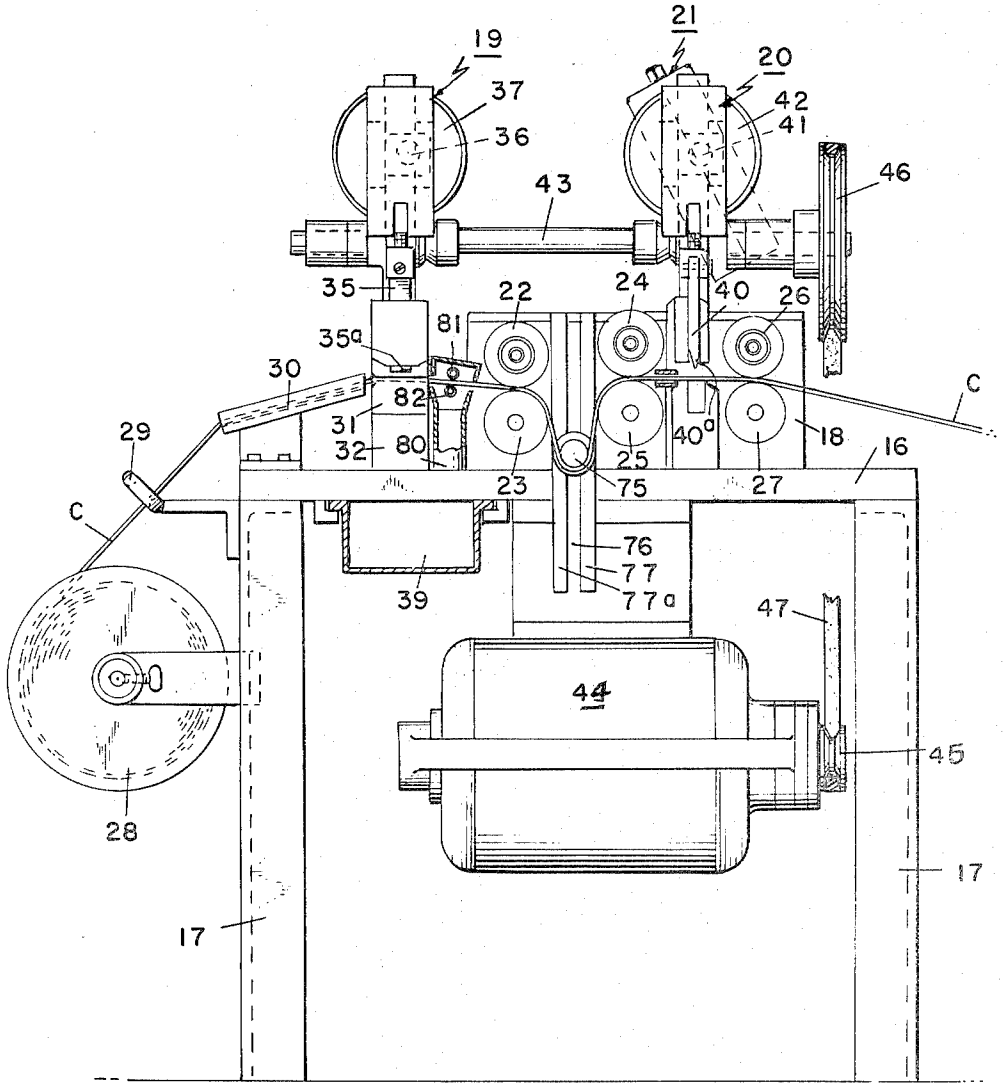
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SLIDE FASTENER MANUFACTURE

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FIG. 2



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SLIDE FASTENER MANUFACTURE

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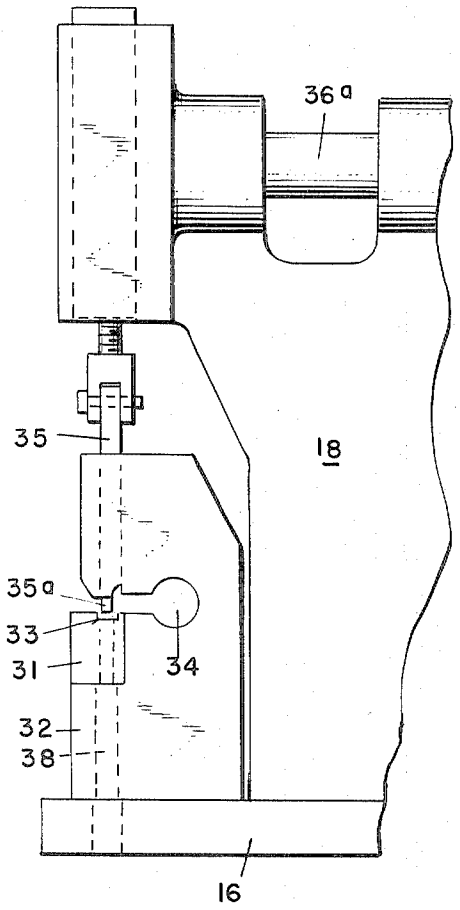


FIG. 4

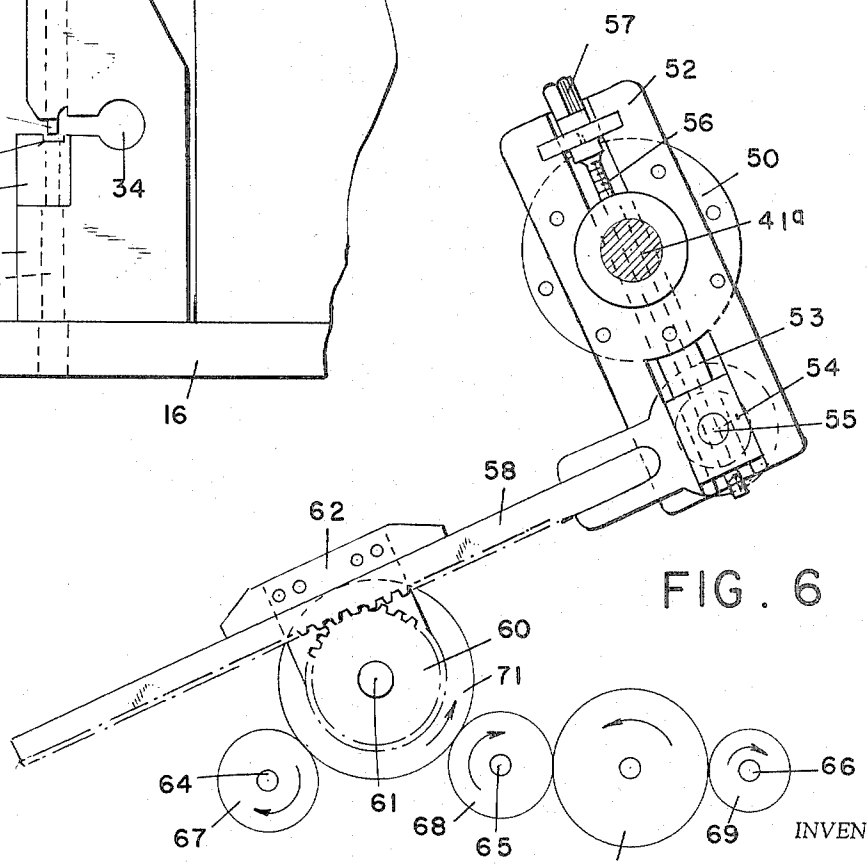


FIG. 6

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SLIDE FASTENER MANUFACTURE

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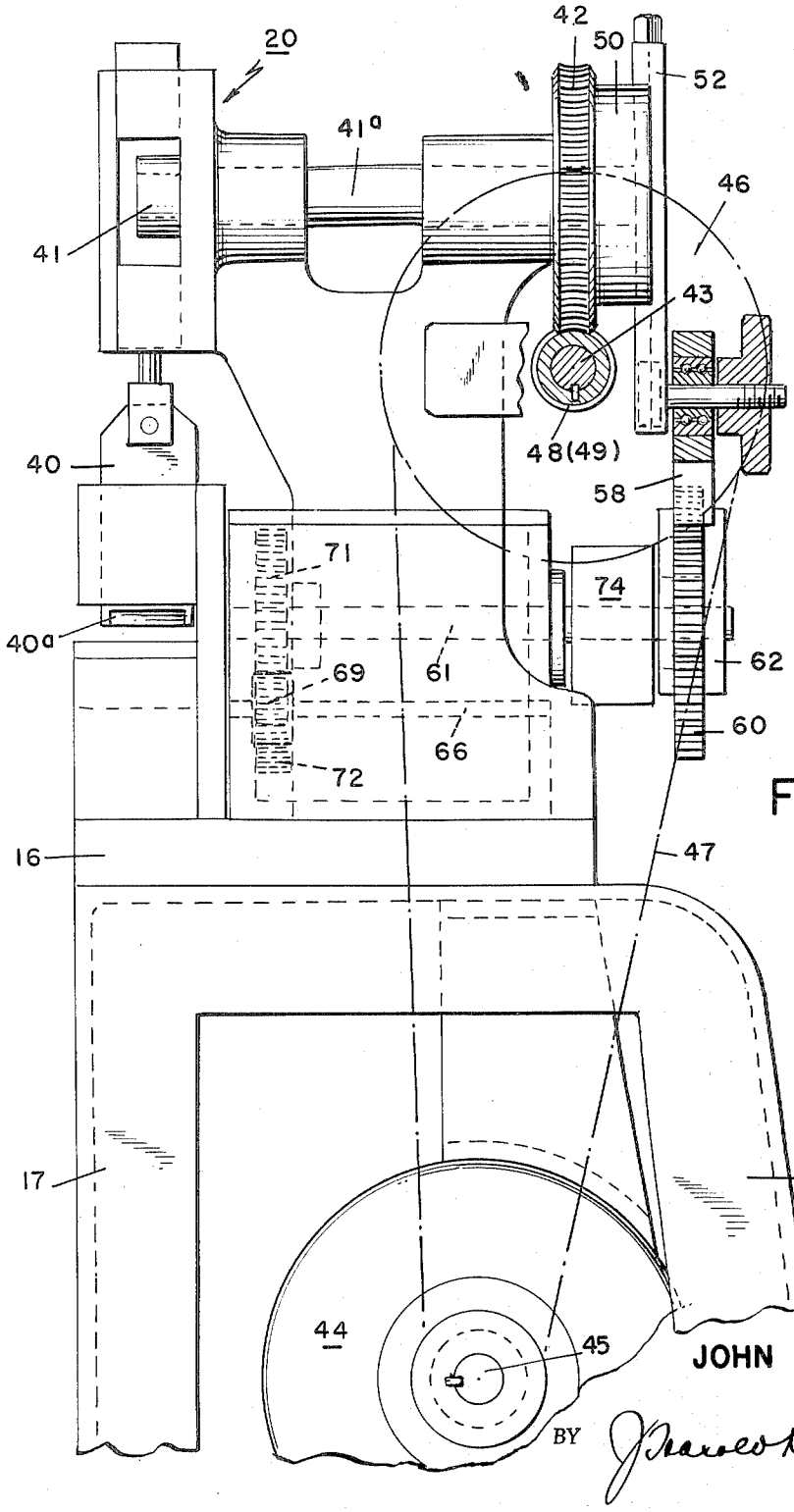


FIG. 5

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SLIDE FASTENER MANUFACTURE

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Application August 20, 1953, Serial No. 375,437

5 Claims. (Cl. 164—15)

This invention relates to improvements in slide fastener manufacture, and more particularly to an improved method of and a machine for producing in quantity measured lengths of slide fastener chain from a so-called continuous fastener chain.

In the mass production of articles such as trouser flies provided with a slide fastener or "zipper" closure, it is more or less standard practice for economical reasons to form the individual fastener chains, which together with the slider and end-stop or end-stops constitute the fastener, from a continuous fastener chain supplied in roll-form on a reel or drum, the term "continuous fastener chain" (or "continuous chain") signifying a long length of two inter-connected stringers i. e. fastener tapes carrying uniformly spaced interlocking fastener elements along their adjacent beaded edges for the entire length of said tapes. From such a continuous chain, measured lengths of fastener chain conforming to the length of the article being produced are either sewn to the article prior to severance from the continuous chain and are thereupon severed therefrom; or individual measured lengths of fastener chain are severed from the continuous chain and thereupon sewn to the article or are stored for future use.

The aforesaid method of forming individual or single fastener chains from a continuous chain is open to the objection that the individual fastener chains so produced have fastener elements attached thereto throughout their full length and hence are devoid of an element-free extension at one or both ends of the chain. On the other hand, such an element free extension or extensions is desirable for the purpose of applying the fastener end stop or end stops, or in sewing the end or ends of the fastener chain into the folds of an article, such as the waist band of a pair of trousers.

Stated broadly, an object of the present invention is the provision of an improved method of and a machine for the high speed production of measured lengths of fastener chain having an element free extension at one end thereof from a continuous fastener chain.

Another object of the invention is to greatly simplify and effectively mechanize the procedure for producing measured lengths of fastener chain having an element free extension at one end thereof from a continuous chain.

A further object of the invention is the provision of a method of and a machine for the mass production of fastener chains having an element free extension at one end thereof from a continuous chain, according to the various lengths required for the article to which the fastener chain is to be attached.

Another object of the invention is the provision of a machine for the quantity production of fastener chains having an element free extension at one end thereof, characterized by means for pulling off or drawing from a reel or drum mounting a roll of continuous fastener chain a succession of measured lengths of said chain corresponding to the desired length of fastener chain, operating in conjunction with means for removing a number of fastener

elements from a short-length portion of each measured length of the continuous chain which ultimately is to provide the element free extension of the fastener chain, and with means for cutting off the successive lengths of fastener chain and their element-free extension from the continuous chain.

A further object of the invention is the provision of a machine characterized as in the foregoing which is further so constructed and arranged that the operation of the pull-off means, the element removing means and the fastener chain cut-off means is so timed that the pull-off means operates when the element removing means and the cut-off means are at rest, and the element removing means and the cut-off means operate in synchronism when the pull-off means is at rest.

Another object of the invention is a machine characterized as in the foregoing, and which incorporates a special cyclically-operable variable feed means for drawing off a pre-determined length of chain from the roll of continuous chain per each cycle of its operation and for presenting a succession of such lengths to the cut-off means in proper relation thereto as insures that the chain is severed between the endmost element-free portion of the chain and the next following fastener-chain length thereof.

Yet a further object of the invention is the provision of a machine for producing measured lengths of fastener chain having an element free extension at one end thereof from a continuous chain, which incorporates element removing and cut-off stations which are spaced a fixed distance apart, and means for feeding successive lengths of continuous chain through said stations at a rate such that a line of cut is always produced between the endmost element-free extension portion with which each measured length of fastener chain is provided and the next following length of unsevered fastener chain.

A still further object of the invention is a machine of the character last specified which is so constructed and arranged as to sever variable lengths of fastener chain from a continuous chain, which lengths may be greater or less than the spacing between the element-removing and the cut-off stations.

Yet another object of the invention is the provision of a machine for producing measured lengths of a fastener chain having an element free extension at one end thereof, and which lengths may be greater or less than the spacing between the element-removing and cut-off means, characterized by means functioning to maintain the length of fastener chain between such means under proper tension.

Yet another object of the invention is the provision of a machine as aforesaid which incorporates a variable feed driving means including an adjustable stroke rack, the stroke of which determines the length of chain fed to the cut-off means in the interval between two consecutive operations thereof.

A still further object of the invention is the provision of a machine for producing measured lengths of fastener chain having an element free extension at one end thereof from a continuous chain characterized by intermittently operable means for removing fastener elements from the chain for a short-length portion thereof which ultimately forms the element-free extension of the fastener chain and by means for removing any remnants of the elements still adhering to the tape components of said chain following the operation of the element-removing means.

The above and other objects and advantages of the method and machine according to the invention will be apparent from the following detailed description thereof, reference being had to the accompanying drawings illustrating a preferred machine for carrying out said method, in which

Fig. 1 is a plan view of a length of continuous chain

supplied from a roll thereof mounted on a reel or drum, the view further containing indication of the operations performed on said chain in producing measured lengths of fastener chain each having an element free extension at one end thereof in accordance with the present invention;

Fig. 2 is a side elevation of a machine according to the invention for producing such a fastener chain;

Fig. 3 is a plan view of Fig. 2, with the element removing and cut-off punches and upper chain-feed rollers omitted;

Fig. 4 is a partial side elevation of the element-removing punch, as same is viewed from the right in Fig. 2;

Fig. 5 is a part-sectional end elevation of the machine illustrated in Fig. 2 as viewed from the right end thereof; and

Fig. 6 is a somewhat diagrammatic front elevation of the special variable-feed driving means of the invention.

Referring to the drawings wherein like reference characters and numerals indicate like parts throughout the several views, reference character C (Fig. 1) designates a length of continuous fastener chain supplied from a roll thereof mounted as on a drum or spool, reference character FC' designates a measured length of chain prior to severance thereof from the chain proper along cutting line x', and FC designates a fastener chain severed from the chain proper along the cutting line x. The continuous fastener chain C comprises a pair of tapes **10** and **11** carrying along their adjacent beaded edges rows of oppositely disposed fastener elements **12**, **13** which are interconnected as shown, the tape edge-beads being indicated at **14**, **15**. Said fastener elements in the so-called continuous chain are uniformly spaced throughout the entire length thereof. Hence, in producing a fastener chain FC of pre-determined length and having an element free extension a at one end thereof, it is necessary not only to sever the predetermined length of chain FC' from the continuous chain C along a cutting line x' spaced a distance corresponding to said length from the free end x of the chain as formed by a preceding cut-off operation, but also to remove the elements along the short-length portion a' of the chain tapes which ultimately provides the element-free extension a of the severed length of fastener chain FC. As will be explained in the following, the present invention provides a method and machine for the high speed production of such a fastener chain of pre-determined length and having an element-free extension a at one end thereof.

Referring to Fig. 2, a machine according to the invention illustratively comprises a base in the form of a table **16** supported on legs **17**, the table supporting a frame **18** which mounts an element removing punch generally designated **19**, a cut-off punch generally designated **20**, and variable-feed driving means generally designated **21** which includes sets of feed rollers **22—27**, of which the lower rollers **23**, **25** and **27** are driven as will be explained later. It will be seen that roller sets **22**, **23** and **24**, **25** are disposed in the space between said punches **19**, **20** and that the third roller set **26**, **27** is disposed to the side of the punch **20** remote from punch **19**.

The feed rollers **22—27** together function to draw off the continuous chain C from a drum **28** supported from the machine base generally as indicated, the chain feeding through a fixed eye or loop **29** and thereupon through a guide sleeve or tube **30** to the element removing punch **19**. As best seen in Fig. 4, said punch includes an anvil **31** fixed in a standard **32** supported on the table **16**. The anvil is provided on its upper face with a recess **33** for accommodating the interconnected fastener elements **12** and **13** of the chain moving over said face, and to accommodate the inside tape **10** of the chain, the standard **32** is provided with a clearance **34**. The element-removing punch proper is indicated at **35** and operates in a suitable bore provided in the standard **32**. Reciprocating movement is imparted to the punch element **35** by means of an eccentric **36** carried at the forward end of a cross shaft **36***a* driven by a worm gear **37**. The cutting edge **35***a* of the punch **35** is disposed lengthwise of the continuous chain C feeding thereunder, and has length corresponding to the distance a' (Fig. 1) which is equivalent to a length portion of the chain tapes carrying approximately six or eight fastener elements **12**, **13**. Thus, on each stroke of the punch, it removes the fastener elements of the continuous chain for a length thereof corresponding to that of the element free extension a of the fastener chain FC as severed from the continuous chain.

Since it is not possible for the punch **35** to completely cut through the attaching ends of the fastener elements, as such would impair the tape beads **14**, **15** thereof, the punch is of width as only to cut through the coupling head ends of the elements, which upon severance drop through a slot **38** provided in the standard **32** to a collector receptacle **39** removably affixed to the under surface of the machine table **16**. Any remnants of the fastener elements adhering to the tape beads are carried along with the chain and are subsequently removed as will be later explained.

As best seen in Fig. 5, the cut-off punch proper **40** of the cut-off punch generally designated **20** preferably takes the form of a blade whose cutting edge **40***a* is arranged transversely of the chain, so as to cut through the entire width thereof. Reciprocating motion is imparted to the cut-off punch **40** by means of an eccentric **41** carried at the forward end of a cross shaft **41***a* driven by a worm gear **42**.

The aforesaid worm gears **37** and **42** are driven by a main drive shaft **43** powered as by a constant speed electric motor **44** through pulleys **45**, **46**, belt **47**, and worms **48**, **49** mounted on said drive shaft which mesh with the worm gears **37**, **42** respectively. Thus rotation of the main drive shaft results in the eccentrics **36** and **41** imparting reciprocating motion to the element-removing and cut-off punches **35**, **40** respectively. It is to be understood that said eccentrics **36**, **41** are set so that the punches **35**, **40** partake of their downward strokes at the same time, and hence the element-removing and chain cut-off means operate in synchronism with one another.

According to the invention, the chain C is drawn from its reel or drum **28** with an intermittent or step-by-step motion by means now to be described. Referring to Figs. 3 and 6, the aforesaid worm gear **42**, which is of course driven continuously, may be formed with a rearwardly extending disc or plate **50**, although said disc may be separately formed and keyed to the cross shaft **41***a* which mounts said worm gear **42**. The disc **50** functions as a carrier for a crank arm **52** which rotates therewith. The crank arm is provided with a diametral slide-way **53** in which is slideably arranged a slide block **54** carrying a crank pin **55**. The effective length of the crank arm **52** and hence the turning radius of the crank pin **55** is adjustable through the provision of an adjusting screw **56** accommodated in the slideway **53** and having a threaded connection with the slide block **54**. The operating or head end **57** of said screw is squared or otherwise formed to receive a turning tool, and hence, by turning the adjusting screw **56**, the crank pin **55** may be moved closer to or further away from the axis on which the carrier disc **50** rotates.

Pivotally connected to the crank pin **55** is a rack **58** whose free end meshes with a gear **60** carried by a cross shaft **61**. A guide bracket **62** journaled on the shaft **61** embraces the rack **58** and serves to hold same in tangency and hence in meshing engagement with gear **60** in all angular positions of the rack. From the above it will be obvious that by varying the radial position of crank pin **55**, the stroke of the rack **58** and hence the amount of rotation imparted thereby to the gear **60** may be correspondingly varied.

The aforesaid cross shaft **61** is journaled in the frame **18** as are the cross shafts **64**, **65**, **66** on which the lower chain-feed rollers **23**, **25** and **27** are respectively mounted.

Affixed to said shafts are the driving gears **67**, **68**, **69** which respectively drive said rollers. Of said gears, gears **67** and **68** which drive the rollers **23**, **25** are directly driven by a gear **71** fast on the shaft **61** which is driven by the rack **58** via gear **60** as aforesaid. The gear **69** is driven from the gear **68** by an intermediate idler gear **72**. The aforesaid upper chain-feed rollers **22**, **24** and **26** are friction driven, being spring-urged downwardly so as to bear with substantial pressure against the intermediate chain tapes, by spring means not shown. Thus, the upper rollers **22**, **24** and **26** serve as hold-down rollers for the chain moving between the roller sets.

Reverting to the rack-driven gear **60**, such as drivingly connected to the shaft **61** carrying same by means of a one-way clutch generally designated **74** which functions to hold gear **60** and hence shaft **61** stationary while rack **58** makes its rearward stroke. Accordingly the gear train **71**, **67**, **68**, **72** and **69** and hence the roller feed rollers **23**, **25** and **27** are at a standstill during the interval of the rack **58** partaking of its return or rearward stroke. By design, punches **19** and **29** partake of their downward or working stroke during the interval that the feed rollers **23**, **25** and **27** are at rest, as aforesaid.

For proper functioning of a machine as aforesaid, it is necessary that chain C be held in tension throughout its travel from drum **28** until it is free of the last roller set **26**, **27**. Normal tension on the chain is provided by the loop or eye **29** adjacent the drum through which the chain feeds, in conjunction with the last roller set **26**, **27**, of which the lower roller **27** is driven at a slightly faster rate than the preceding lower rollers **23**, **25** as by forming gear **69** which drives said roller **27** to a slightly smaller diameter than the other gears of the train, so that its peripheral speed is somewhat greater. Accordingly, the last roller set **26**, **27** in conjunction with the eye **29** maintains the length of chain C intermediate drum **28** and the last roller set under normal tension.

While such normal tensioning means suffices in the case of the measured length of fastener chain being produced corresponding to the distance between the element-removing punch **19** and the cut-off punch **20**, or being of a length that is exactly divisible into said distance, a different condition exists when the measured length bears a different relation to said distance. In explanation, if the distance between the aforesaid punches **19** and **20** is 9 inches, and fastener chain lengths of 9 inches or 4½ inches or 3 inches are to be produced, the aforesaid normal tensioning means suffices. However, if a 15 inch length of fastener chain is desired, still assuming the distance between the element-removing and the cut-off punches to be 9 inches, additional means must be provided to take up the six inches of slack which would otherwise be formed in the length of chain traveling between punches **19** and **20** and to maintain same under tension. Similarly, if lengths of fastener chains less than the 9 inch distance between punches and not exactly divisible into 9 are desired, such requires that the length of chain extending between punches **19** and **20** be in excess of said distance by the difference between a multiple of the desired length which is next higher than said distance and said distance itself. Such excess, in the case of a 6 inch length of fastener chain, is 3 inches, which is the difference between 12 inches (the multiple of 6 next higher than 9) and the 9 inch distance between punches. To take up such excess (slack), additional tensioning means must also be provided.

Such additional tensioning means preferably takes the form of an adjustable position tension roll **75** mounted for vertical movement along a trackway **76** provided by a pair of horizontally spaced upright rails **77**, **77***a*. As seen in Fig. 2, the trackway **76** is disposed between the first and second feed roller sets **22**, **23** and **24**, **25**. Obviously on the vertical position of the roll **75** along the trackway **76** depends the length of the loop formed in the chain portion extending between said first and second sets of feed rollers, and consequently the total length of the chain extending between the element removing and cut-off punches **19** and **20** respectively. By adjusting the roller **75** along the trackway **76**, the aforesaid total length of the chain can be made to correspond to a desired length of fastener chain greater than the distance between the punches **19** and **20** or to a multiple of the desired length which is next higher than the distance between said punches.

To provide for the removal of any remnants of the fastener elements holding to the tape beads **14**, **15** following action of the element-removing punch **19**, an enclosure **80** is arranged in the space between said punch and the first set of feed rollers **22**, **23**, through which the chain leaving the punch **19** travels. Air nozzles **81**, **82** mounted in said enclosure direct a blast of air against the upper and under surfaces of the chain with sufficient force as to remove the remnants of the elements which also drop to the aforesaid receptacle **39**. Brushes or similar means may be substituted for the air nozzles **81**, **82** as described above.

The practice of the present invention is as follows: First, the position of the crank pin **55** is adjusted along the slide-way **53** so that a desired length of continuous chain will be drawn from drum **28** consequent to the rack **58** partaking of its working stroke. If we assume that a standard 9 inch length of fastener chain is to be produced, the setting of the crank pin **55** is such as to draw off 9 inches of chain from the drum **28**, and such 9 inch length is fed between the element removing punch **19** and the cut-off punch **20** per each complete cycle of operation of the machine. In such case, tension roller **75** may be moved to an inactive position above the path of the chain moving between the roller sets **22**, **23** and **24**, **25**, the normal tension applied by the final set of feed rolls **26**, **27** sufficing. However, if a greater length of fastener chain is desired, crank pin **55** is moved outwardly along the slideway **54** an amount such that each throw of the rack **58** will draw off the greater length of fastener chain from the drum **28**. To take care of the slack that would otherwise result in the length of chain extending between punches **19** and **20**, and to assure proper tension being applied to the chain feeding between said punches, the roller **75** is lowered to a position such that it takes up the excess (difference) between the greater length and the distance between punches. On the other hand, if a length of fastener chain less than the standard or 9 inch length is desired, the crank pin is moved up the slideway **53** an amount such that the throw of rack **58** draws the shorter length of continuous chain from the drum **28**. In order to present the shorter lengths of chain to the cutting punch **40** in position such that the punch will sever the chain at the proper point in its length, i. e., between the endmost element-free portion *a* and the next following fastener-chain length moving between punches, it is necessary that a loop be formed in the chain length extending between the punches of a length which is the difference between the multiple of the desired fastener-chain length next above the standard length minus said standard length. For example, assuming a 6 inch length of fastener chain is desired, the multiple of 6 inches next above 9 inches is 12 inches, and hence a 3 inch loop must be provided in the length of chain between the punches **19** and **20**. Such is simply achieved by adjusting the position of roller **75** so that it provides the requisite length of loop and at the same time maintains the chain between punches under tension.

From the above, it will be appreciated that the length of fastener chain severed from the continuous chain upon each operation of the cutting punch **20** not only exactly equals the amount of chain drawn from the drum **28**, but also that the line of cut or severance made by the cutting punch is always between the end-most element-free extension portion of the most advanced fastener-

chain length and the next following length, the latter following from the fact that the fastener elements are removed from the chain for a short length portion thereof which is spaced from the free end of the chain a distance which is a multiple (multiples 1, 2, 3, etc.) of the measured length desired. Accordingly, the invention insures travel of the chain along its path of movement towards the cutting punch in the proper amount and at the proper rate as to produce slide fastener chains of desired length and characterized by an element-free extension at an end thereof at an exceedingly rapid rate.

As many changes could be made in the above described method and constructions without departing from the scope of the invention, it is intended that the description thereof and the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A machine for producing measured lengths of slide fastener chain having an element-free extension at one end thereof from a roll of continuous fastener chain comprising, in combination, punch means for removing the fastener elements from a short-length portion of the chain, chain-cutting means spaced a fixed distance from said element-removing means for cutting-off lengths of the chain, means for operating said element-removing means and said cutting means in synchronism and at regularly spaced intervals, intermittently operable means for drawing chain from the roll in measured lengths equaling the desired length of fastener chain being produced and which may be equal to, greater than or less than said fixed distance and for feeding said lengths in forward direction only and with a step-by-step motion along a path traversing both said element-removing means, adjustable means disposed intermediate said element-removing means and said chain-cutting means for taking up any desired fixed amount of slack in the chain extending between said means occurring when certain measured lengths of chain drawn from the roll have lengths different than the fixed distance between said means, and said chain cutting means, and means for effecting actuation of said operating means during the intervals that the chain drawing and feeding means is at rest.

2. A machine as set forth in claim 1, together with means for applying a normal tension to said chain moving along said path.

3. A machine for producing measured lengths of slide fastener chain having an element-free extension at one end thereof from a roll of continuous fastener chain comprising, in combination, means for drawing off measured lengths of chain from said roll and advancing same intermittently along a generally straight-line path, means along said path for removing the fastener elements from a short-length portion of said chain, cutting means disposed a fixed distance farther along said path, which distance may be equal to, greater or less than the desired measured length of fastener chain, for cutting from the free end portion of the chain presented to it lengths of chain corresponding exactly to the measured lengths drawn from said roll by said first means, means for operating said element-removing means and said chain-cutting means in sychronism and in the intervals during which the chain is at rest, means for varying the measured lengths of continuous chain drawn from the roll in accordance with the length of fastener chain desired, and normally inactive adjustable means operative when rendered active to take up any desired fixed amount of slack in the length of chain extending between said element-removing means and said chain-cutting means occurring when certain lengths of fastener chain different from said fixed distance are drawn from said roll.

4. A machine as set forth in claim 3 wherein said slack take-up means includes means for forming a loop in said chain between said element-removing means and said chain-cutting means of length insuring substantially uniform tension on said chain and feeding of a length of chain to the cutting means which corresponds to the desired length of fastener chain.

5. A machine for producing measured lengths of slide fastener chain having an element-free extension at one end thereof from a roll of continuous fastener chain comprising, in combination, punch means for removing the fastener elements from a short-length portion of the chain, chain-cutting means spaced a fixed distance from said element-removing means for cutting off lengths of the chain, means for operating said element-removing means and said cutting means in synchronism and at regularly spaced intervals, intermittently operable means for drawing chain from the roll in measured lengths equaling the desired length of fastener chain being produced and which may be equal to, greater than, or less than said fixed distance, and for feeding said lengths in forward direction only and with a step-by-step motion along a path traversing both said element-removing means and said chain-cutting means, said chain drawing and feeding means including a manually settable variable feed-driving means, means for maintaining a normal tension on the chain when the setting of the feed-driving means is such as to feed a length of chain which equals the fixed distance between said element-removing means and said chain-cutting means, or is a multiple of said distance or vice versa, and adjustable means for forming a desired fixed size of loop in said length and for maintaining tension thereon when the setting of the feed-driving means is such as to feed other lengths of chain, said adjustable means being operative to form said loop in the portion of chain extending between said punch means and said chain-cutting means.

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