Aug. 27, 1968 B. E. OLSSON 3,398,567

TERMINAL CRIMPING MACHINE STROKE ADJUSTMENT

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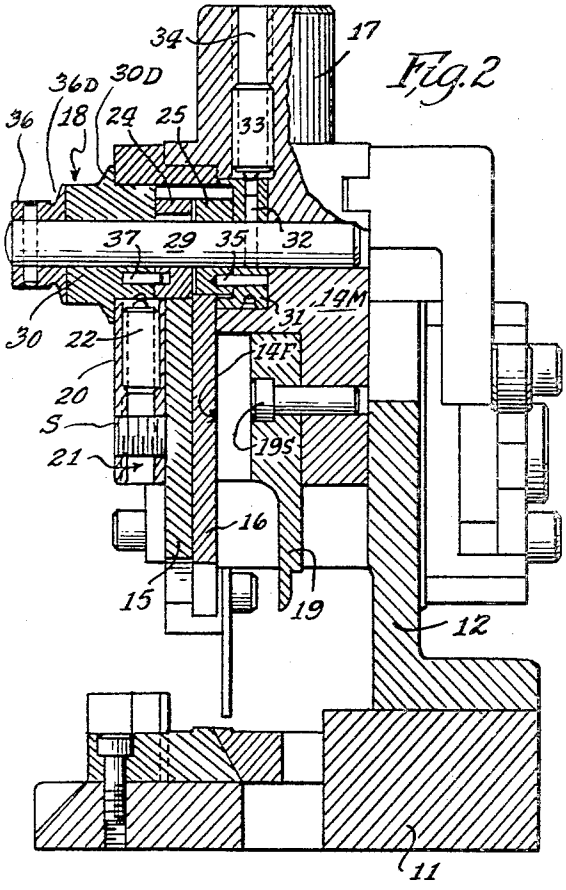


Fig. 2

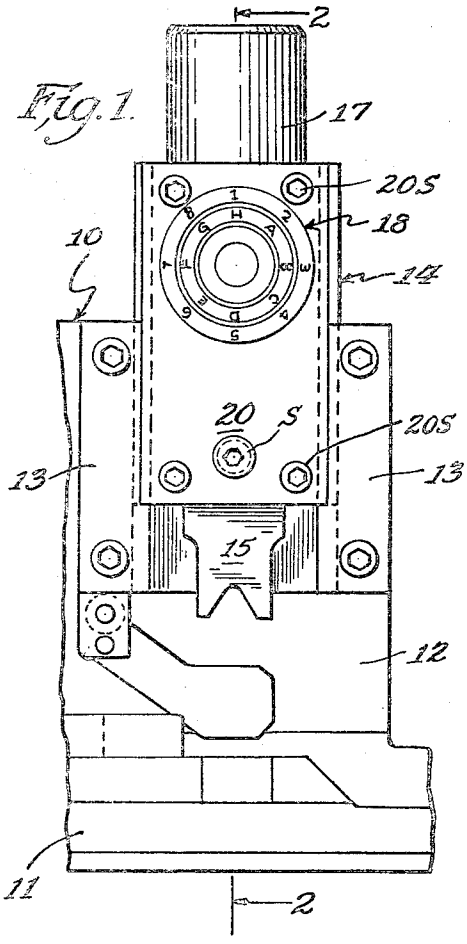


Fig. 1

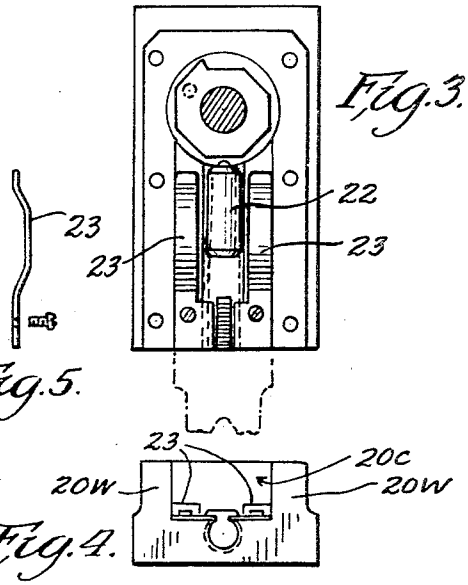


Fig. 3

Fig. 5.

Fig. 4.

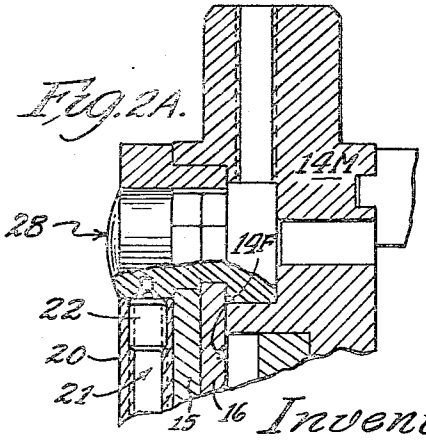


Fig. 2A.

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Fig. 6

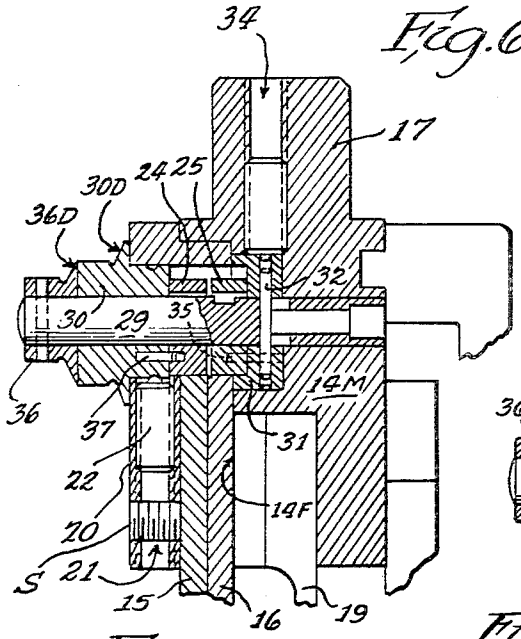


Fig. 7.

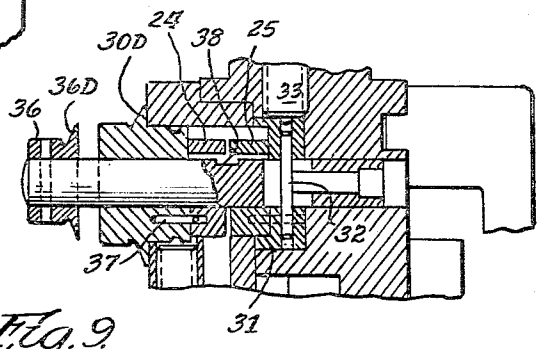


Fig. 8.

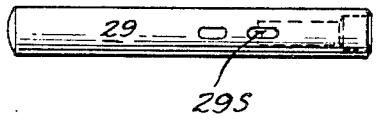


Fig. 9

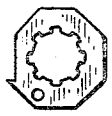


Fig. 10.

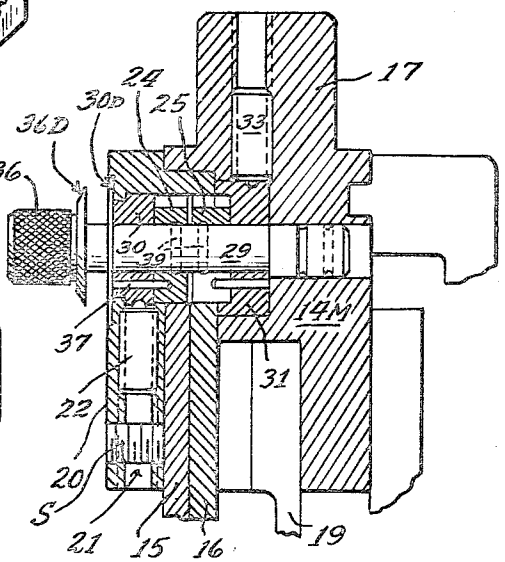
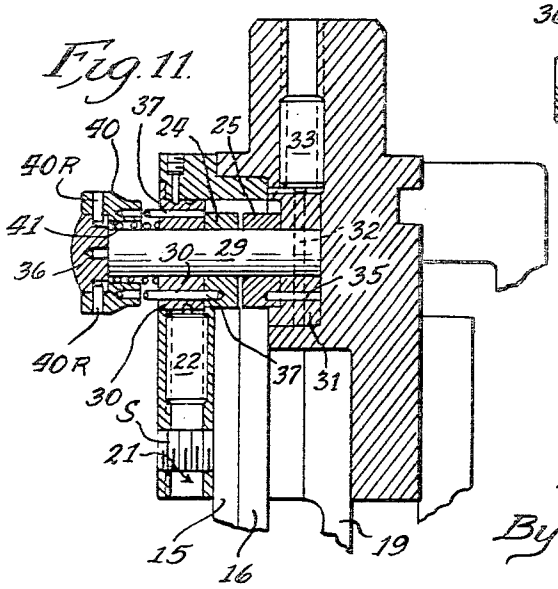


Fig. 11.



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TERMINAL CRIMPING MACHINE STROKE ADJUSTMENT

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Filed Aug. 22, 1966, Ser. No. 574,144
10 Claims. (Cl. 72—400)

This invention relates to a crimping machine for applying terminals to insulated electrical conductors and, more particularly, is concerned with an improved punch mounting and punch stroke adjustment for use in crimping machines.

Crimping machines commonly include a ram operated plunger carrying a work head that is equipped with one or more punches for folding the terminal about the conductor. The work head carries the punches in a relationship determined by a control mechanism incorporated in the work head for setting the stroke of the punch to assure accurate folding and securement of the terminal on the conductor.

Withdrawal and replacement of the punches is necessary from time to time and where a machine is used with a variety of different terminal sizes and configurations, adjustment of the punch setting is frequently required. It is desirable to simplify these set-up operations in order to facilitate conversion of the crimping machine from a run for one type of strip terminal to another. Down time on the production line thus is to be reduced. In addition, necessary repairs are encouraged and precision adjustment of the stroke length is made feasible.

In accordance with the present invention, a crimping machine work head arrangement is provided wherein a punch control mechanism is interposed between the plunger and the punches for setting the travel stroke and transmitting the crimping force for the punches. Each punch is independently slidable within the work head and the punches are loaded only transversely to establish frictional retention against accidental escape while accommodating easy endwise removal of the punches for replacement purposes. In the disclosed embodiments, the work head has a removable front cover carrying a pair of laterally acting leaf springs that pressure load the punches in frictionally retained relation in the work head.

A control mechanism projects through the front cover immediately above the punches and carries a separate cam in force transmitting relation to each punch. No interlocking exists between the control mechanism and the punches but during normal operation, the punches are retained in endwise abutting engagement with the cams by the friction loading applied through the springs. The transverse positioning and loading action of these springs enables the work head to accommodate a shear blade without unusual mounting clearance problems as have been encountered in prior art arrangements.

A number of embodiments for the punch control mechanism are disclosed and each utilizes a turret type of cam indexing structure for each punch cam, the turrets being incorporated on or as a part of concentrically mounted inner and outer rotors. Each rotor has an indicator dial to represent the cam position. Certain embodiments of the punch control mechanism provide a single control knob for selectively operating the rotors. In one form, the single knob individually adjusts each rotor while in another form, the single knob first adjusts the rotors in ganged relationship and thereafter adjusts one rotor individually.

Other features and advantages of the invention will be apparent from the following description and claims, and are illustrated in the accompanying drawings which show structure embodying preferred features of the present invention and the principles thereof, and what is now considered to be the best mode in which to apply these principles.

In the accompanying drawings forming a part of the specification, and in which like numerals are employed to designate like parts throughout the same,

FIG. 1 is a front elevational view at the crimping station of a crimping machine and illustrates a work head arrangement constructed in accordance with this invention;

FIG. 2 is a transverse section taken on the line indicated at 2—2 of FIG. 1;

FIG. 2A is a fragmentary section corresponding generally to that of FIG. 2 and illustrating a plug type control mechanism that may be utilized where punch stroke adjustments are not required;

FIG. 3 is a fragmentary view taken generally as indicated by the line 3—3 on FIG. 2;

FIG. 4 is a bottom plan view of the cover and leaf spring structure shown in FIG. 3;

FIG. 5 is an exploded side elevational view of a leaf spring mounting;

FIG. 6 is a fragmentary transverse section similar to that of FIG. 2 and illustrating another embodiment of the punch control mechanism;

FIG. 7 is a fragmentary transverse section showing the parts of the FIG. 6 embodiment in shifted position;

FIG. 8 is a top plan view of the inner rotor utilized in the embodiment of FIGS. 6 and 7;

FIG. 9 is a detailed elevational view of a cam utilized in the embodiment of FIGS. 6 and 7; and

FIGS. 10 and 11 are corresponding transverse sectional views illustrating two additional embodiments of the punch control mechanism.

Referring now to the drawings, a crimping machine, as shown generally at **10** in FIG. 1, has a rigid framing structure including a base **11**, an upstanding support wall **12**, and vertical tracks **13** carried on the wall **12**. A work head **14** is guided in the tracks **13** and carries a set of crimping punches **15** and **16**. The head **14** is carried by a ram operated plunger **17** that is vertically reciprocable for powering the crimping punches. An adjustable control mechanism **18** is provided for regulating the punch travel imparted by the plunger.

In accordance with one feature of the present invention, the insulation and conductor punches **15** and **16**, respectively, are mounted in the work head normally to maintain any prescribed set position but to facilitate removal and replacement where desired. The work head includes a main body portion **14M** suitably configured to receive the control mechanism **18**, the punches **15** and **16**, and a shear blade **19** which is fixedly mounted by a cap screw **19S**. A removable front cover **20** is secured to the main body by a set of four cap screws **20S** and has a horizontal top bore for receipt of the control mechanism **18**, a front vertical bore **21** intersecting with the horizontal bore and mounting a detent **22** to cooperate with the control mechanism. The front cover **20** is shaped to provide a hollow internal chamber **20C** which is open at the bottom and which is defined by vertical side walls **20W** to provide guidance for the punches and insure accurate vertical travel. A pair of leaf-type springs **23** are attached in cantilever fashion to the inside face of the front wall of the cover and have laterally offset intermediate regions normally resiliently contacting the outermost punch **15**. These leaf springs establish a lateral loading of the punches **15**, **16** against the adjacent face **14F** presented by the main body of the work head to establish frictional retention normally resisting random movement of the punches with respect to the work head. The removal of the punches is accomplished simply by grasping the lower ends and pulling the same downwardly against the frictional resistance established by the leaf

springs 23. Replacement of the punches is accomplished by inserting the same upwardly into the chamber 20C to stress the springs 23 sufficiently to establish gripping engagement against the punches.

In the embodiment illustrated in FIG. 2, the control mechanism 18 includes individual rotary cams 24, 25 each selectively adjustable to vary the set position of the punches 15, 16, respectively, with respect to the work head, thereby setting the bottom point of each punch travel stroke. With the present arrangement where laterally acting leaf springs retain the punches, initial clearance may exist between the adjustment cams 24, 25 and the punch ends but upon the first crimping stroke, the punches reacting against the terminal are forced upwardly relative to the cams and thereafter remain in flush contact with each corresponding cam. Each time an adjustment of the punch setting is made, this initial clearance condition may occur but it is cured in each instance with the first travel stroke of the plunger.

In the embodiment illustrated in FIG. 2A, the control mechanism 28 is not adjustable but is in the form of a dummy insert having predetermined cam faces positioned to set the punches 15, 16 which are then held by the action of the leaf springs. In this embodiment, more frequent replacement of the punches may be employed as an alternative approach for selecting different punch travel lengths so that the feature of easy removability is important. A detent pin 22 is shown in the vertical bore 21 pressing against a flat face of the control mechanism 28 to maintain it in stable relation in the work head.

Four different embodiments of adjustable punch control mechanisms are illustrated herein in FIGS. 2, 6, 10 and 11. In each of these embodiments, concentrically mounted inner and outer rotors 29 and 30, respectively, are operable about a common axis that extends generally transversely of the plunger travel. In each case, the inner rotor 29 is in the form of a central shaft having its inner end journaled in the enlarged body portion 14M of the work head and having its outer end projecting through the front cover 20 and receiving a manual adjustment knob. Correspondingly in each case, the outer rotor 30 is in the form of a ring or collar journaled on the shaft 29 and riding in a socket provided in the front wall of the cover. The shaft 29 mounts the rotary cam 25 associated with the conductor punch 16 and the collar-like rotor 30 is arranged to drive the rotary cam 24 associated with the insulation punch 15.

While the various punch control mechanisms have common features as enumerated, they are specifically different in their operating functions. For example, in the embodiment shown in FIG. 2, each punch is individually adjustable by the action of independently operating dual control knobs. In particular, an indexing turret 31 is in telescoping relation over the shaft 29 and is journaled medially in the plunger body. A drive pin 32 connects the shaft 29 to the indexing turret 31 and a detent 33 housed in a vertical bore 34 establishes exact positions of rotary adjustment by engagement in peripheral sockets provided in the turret 31. The turret 31 carries one or more endwise projecting drive pins 35 that engage the rotary conductor cam 25 so that cam movement is controlled by positive connection from a hand knob 36. The outer collar-like rotor 30 serves as a combination hand knob and indexing turret which is engageable by the detent 22. The collar 30 has endwise projecting drive pins 37 engaging the rotary cam 24 so that a positive drive connection exists between the collar 30 and the rotary cam 24. Each knob has an indicator dial 30D, 36D formed peripherally thereon, each dial providing a direct reading of the setting of the corresponding punch.

In the arrangement of FIG. 2, each punch is individually settable at exact positions of adjustment determined by flat faces on the rotary cams, with the exact rotary position being set in each instance by the turret and detent relationships.

The punch control mechanism shown in FIGS. 6 and 7 has many structural similarities to that of FIG. 2 and, in fact, it can be operated as an independent punch dual knob arrangement in a completely analogous fashion to that described with reference to the embodiment of FIG. 2. In addition, however, the punch control mechanism in FIGS. 6 and 7 can be controlled as a ganged single knob arrangement. For this purpose, the shaft 29 is provided with an elongated diametral slots 29S (FIG. 8) that receives the drive pin 32 for the turret 31. In addition, the shaft 29 is provided with a pressed in key 38 which projects radially to be engageable in internal keyways provided in each of the shaft mounted cams.

The shaft 29 is then shiftable between the positions illustrated in FIG. 6 and FIG. 7. In the FIG. 6 position, each of the control knobs 30, 36 is independently adjustable to set the corresponding cams 24, 25 respectively. In the FIG. 7 position, the shaft 29 is located so that the key 38 simultaneously engages both cams 24, 25 and rotates both cams for the purpose of finally setting the outer cam 24. When the outer cam is set by means of the shaft mounted knob, the collar 30 and indicating dial 30D are driven by means of the pin 37 which projects between these elements. After setting of the outer cam 24 and its collar 30, the shaft 29 is returned to its FIG. 6 position and the inner cam 25 is then independently set to the desired value by direct drive from the knob 36. It will be seen that since the key 38 is always in engagement with the rear cam 25, the indications on the knob dial 36D are always in accord with the setting of the cam 25. Correspondingly, the collar 30 and the front cam 24 are always drivingly connected and the dial indications are always in accord with the cam setting. Thus, the arrangement shown in FIGS. 6 to 9 is here referred to as being selectable between independent punch, dual knob operation and ganged-punch, single knob operation. This arrangement is extremely versatile in accommodating either type of selection control.

The embodiment illustrated in FIG. 10 may be described as a ganged-punch, single knob control in that both cams 24, 25 and punches 15, 16 are set when the knob 36 is rotated while in the pulled out position illustrated in FIG. 10. In this position, keying elements 39 on the shaft 29 engage internally with each cam 24, 25. Once again, the indicator dial 30D is carried on the collar-like rotor 30 which is fully recessed and which follows in slave fashion the rotation of the front cam. After both cams 24, 25 are adjusted in ganged fashion, the shaft is pressed in until the keying elements 39 both engage the rear cam 25. Rotation of the shaft at this position sets the rear cam 25 independently while the front cam 24 retains its previous adjustment.

A somewhat different embodiment is illustrated in FIG. 11 which functions with a single knob control wherein the knob 40 is shiftable to set each punch independently. In this arrangement, the shaft 29 has a keying and indicator knob 36 on its outer end which is not to be rotated directly. The manual control knob 40 is shiftable on the shaft 29 between the position in which it is illustrated wherein radial lock pins 40R project into notches milled into the periphery of the knob 36 to rotate the shaft. The parts are normally maintained in this position by means of a bias spring 41 reacting between the collar 30 and the adjustment knob 40. The knob 40 is shiftable inwardly to engage endwise projecting pins 37 carried in the collar for rotating the front cam 24 while the rear cam 25 remains in its set position.

Where desired, a pressure screw S may be mounted in the front cover 20 in each of these embodiments in order to apply positive holding pressure against the punches 15 and 16 in instances where strapping forces may be so great as to overcome the holding action of the springs 23.

Thus, while preferred constructional features of the invention are embodied in the structure illustrated herein,

it is to be understood that changes and variations may be made by those skilled in the art without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a crimping machine for attaching a terminal to an electrical conductor, a reciprocable plunger carrying a work head, punch means mounted in said head for endwise shiftable adjustment in the direction of plunger movement, control means mounted in said head to determine the position of the punch means, and spring means mounted in said head to load said punch means transversely of said direction normally to retain said punch means in the position determined by said control means while accommodating endwise withdrawal and replacement of the punch means.

2. In a crimping machine in accordance with claim 1 and wherein said control means includes a rotary cam overlying and engaging the punch means in force transmitting relation and said spring means is disposed alongside and directly presses against the punch means to load the same into frictionally retained contact with the work head.

3. In a crimping machine in accordance with claim 1 and wherein said punch means includes a pair of side by side punches and said control means includes concentrically mounted inner and outer rotors operating about a common axis extending generally transversely of said direction, each rotor mounting a corresponding rotary cam engageable with a corresponding one of said punches and a manual knob shiftably mounted on one of said rotors to move between a position for driving said one rotor and a position for driving the other of said rotors.

4. In a crimping machine in accordance with claim 1 and wherein said work head has a main body shaped to receive the punch means in frictionally slideable relation and a chambered front cover embracing the punch position and slide path, and wherein said spring means is of leaf spring type and is anchored within said cover for pressing said punch means laterally against said main body.

5. In a crimping machine in accordance with claim 4 and wherein said control means includes a rotary cam overlying and engaging the punch means in force transmitting relation and an indexing turret in rotary driving engagement with the cam, said front cover having a central vertical bore housing a detent that is engageable with the turret and said spring means comprising a pair of leaf springs extending vertically in flanking relation to said bore and simultaneously pressing against said punch means.

6. In a crimping machine for attaching a terminal to an electrical conductor, a reciprocating plunger carrying a work head, a pair of punches mounted in said head for individually shiftable adjustment in the direction of plunger movement, control means mounted in said head and operable to vary the position of each of said punches, and spring means mounted in said head to load said punches in a sense to retain said punches in any selected position of adjustment determined by said control means, the improvement wherein said control means includes concentrically mounted inner and outer rotors operating about a common axis extending generally transversely of said direction, each rotor mounting corresponding rotary cam engageable with a corresponding one of said punches and a manual knob shiftably mounted on one of said rotors to move between a position for driving said one rotor and a position for driving the other of said rotors.

7. In a crimping machine in accordance with claim 6 and wherein said inner rotor is a central shaft equipped with said manual knob and shiftable axially to accommodate shifting of said knob, keying means engageable between said shaft and a single one of said cams when said shaft is in one axial position and engageable between said shaft and both cams when said shaft is in another axial position.

8. In a crimping machine in accordance with claim 7 and wherein said outer rotor is also a manual knob having indicator means, said outer rotor being engaged with one of said cams in all positions of adjustment of said control means.

9. In a crimping machine in accordance with claim 7 and wherein said outer rotor is recessed and has externally visible indicator means, said outer rotor being engaged with one of said cams in all positions of adjustment of said control means.

10. In a crimping machine in accordance with claim 6 and wherein said inner rotor is a central shaft terminating in a key knob, said outer rotor is a recessed collar, each said rotor being engaged with a separate one of said cams in all positions of adjustment of said control means, and wherein said knob is shiftably mounted with respect to each of said rotors to move between keyed relationship with one and keyed relationship with the other.

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