United States Patent

[11] 3,601,891

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[22] Filed **Aug. 1, 1969**

[54] **STRIPPING TOOL FOR REMOVING SEMICONDUCTING INSULATION SHIELD**
9 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** ..... **30/90.1,** 30/95, 82/4 R
[51] **Int. Cl.** **Ho2g 1/12**
[50] **Field of Search** 30/90.1, 90.2, 90.3, 92, 93, 94, 95, 356; 81/9.5; 82/4, 70.2; 83/924

[56] **References Cited**

UNITED STATES PATENTS

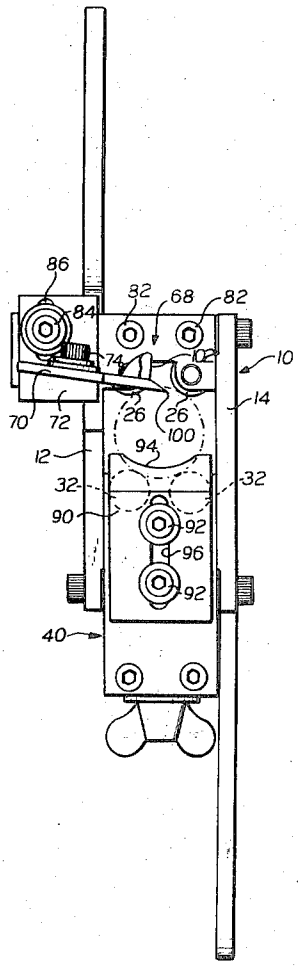
1,215,121	2/1917	Cramer	30/94
1,382,932	6/1921	Ramsdell	82/4

FOREIGN PATENTS

200,738	1/1939	Switzerland	82/4

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Attorney—Sandoe, Hopgood & Calimafde

ABSTRACT: This stripping tool has a guide adjustable to different diameters of electrical cable. During relative longitudinal and rotary movement of the cable and guide, a cutter knife removes material from the outside of the cable; and the knife is adjustable angularly about axes in different planes for removing an insulation shield; a sheath and insulation shield simultaneously; an insulation and conductor shield; and for tapering the insulation or other material for a part of the length of the cut. The guide has roller contact with the cable, and the adjustable rollers are carried by a sliding block.



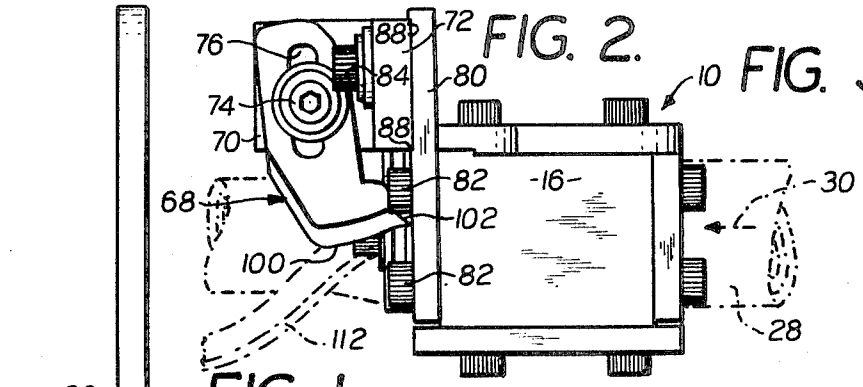


FIG. 2.

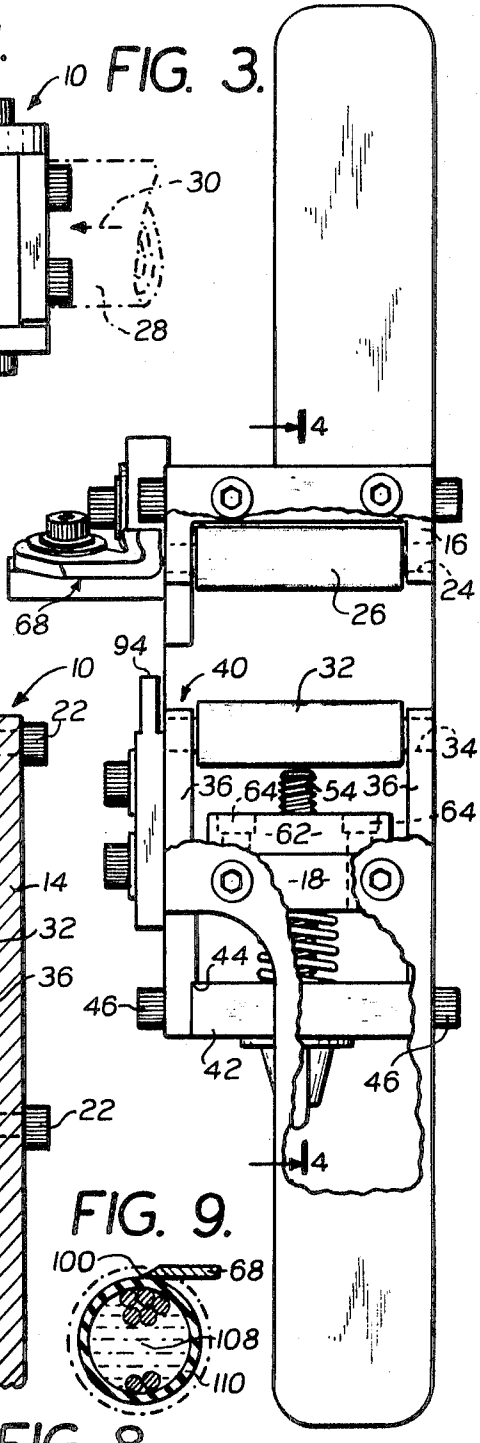


FIG. 3.

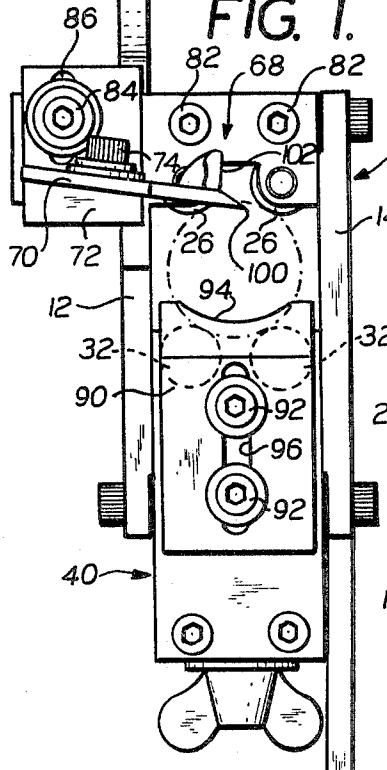


FIG. 1.

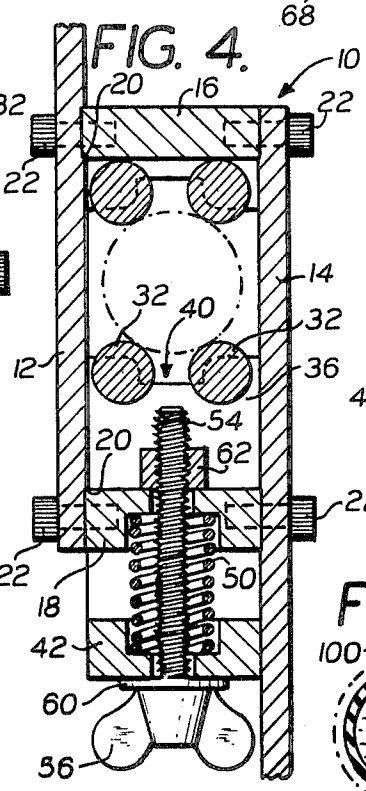


FIG. 4.

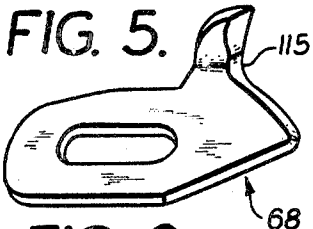


FIG. 5.

FIG. 9.

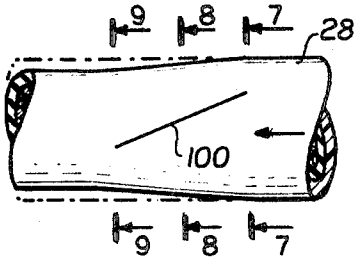


FIG. 6.

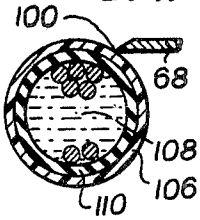


FIG. 7.

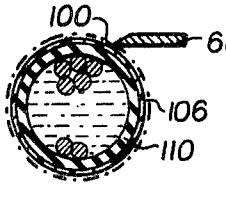


FIG. 8.

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STRIPPING TOOL FOR REMOVING SEMICONDUCTING INSULATION SHIELD

BACKGROUND AND SUMMARY OF THE INVENTION

Extruded semiconducting conductor and insulation shields firmly bonded to the inner surface and outer surface of the insulation, respectively, as manufactured, is an important design feature in high-voltage solid, dielectric power cables in order to preclude the possibility of voids at these important interfaces. This strong bond insures that voids will not be present at the boundaries of the insulation as the cable is manufactured and that they will not occur due to mechanical working of the cable during installation and in service under load cycling conditions.

Although a strong bond between the insulation and extruded conductor and insulation shields is desirable for all solid dielectric power cables with a circuit voltage of 3,000 volts and higher and for lead sheathed, jacketed and 1 power cables, it assumes increasing importance with increasing voltage rating of the cable due to higher operative stresses.

This invention provides an improved tool for removing the strongly bonded semiconducting insulation shield from the insulation at the insulation at the cable ends when splicing and terminating the cable in the field. The tool of this invention accomplishes this result in an economical and workmanlike manner.

This stripping tool was originally designed to strip semiconducting polyethylene or cross-linked polyethylene from an insulated cable. By adjusting the knife and adjusting for size, the knife edges will cut into the semiconducting material and also remove a slight amount of the insulation. This is done so as not to leave any black particles on the insulation. With continuous turning and application of pressure on the tool, a continuous strip of the shield can be removed. It can be adjusted to various size cables by turning screws for movement in or out on the tool.

One feature of the invention is that it will operate on cables having different diameters over a wide range without the addition or insertion of any further tools or bushings. Ordinarily the tool is not used for removing insulation from a conductor but for removing shielding from the insulation. Another feature of the invention is that it leaves the insulation smooth and that no clamping device is needed. The preferred construction has a knife with two cutting edges in different planes to insure cutting without tearing. This is important in order to do neat work on certain types of material used with electrical cable.

Because of the kind of knife used and the adjustment of the knife with various combinations of radial and transverse angular movement with respect to the longitudinal axis of the cable guide, the tool can be used for various operations without any changes other than the knife adjustment. For example: in addition to its primary object of removing the insulation shield, the tool of this invention can be used for the following operations:

1. To remove the insulation shield.
2. To remove the lead sheath and the insulation shield simultaneously from a lead-sheathed cable.
3. To remove the insulation and the conductor shield.
4. To taper the insulation.

This invention has a main frame with handles for rotating it about a cable. The movable frame is adjustable on the main frame to change the diameter of a guide through which the cable passes. The main frame carries a knife on a knife bracket. By having the knife adjustable on the bracket and the bracket adjustable on the main frame, with the adjustments about axes in planes substantially normal to one another, a guide range of knife positions can be obtained for different cutting operations.

The knife edge has different portions which extend in different planes and this makes possible neat cutting of materials that would otherwise tear in one direction if the knife were adjusted to merely peel the material from the cable.

Other objects, features and advantages of the invention will appear or be pointed out as the description proceeds.

BRIEF DESCRIPTION OF DRAWING

In the drawing, forming a part hereof, in which like reference characters indicate corresponding parts in all the views:

FIG. 1 is an end view of a tool made in accordance with this invention;

FIG. 2 is a top plan view of the tool shown in FIG. 1 and with a cable shown in phantom:

FIG. 3 is a side view, partly broken away, of the tool shown in FIG. 1;

FIG. 4 is a sectional view on the plane 4—4 of FIG. 3;

FIG. 5 is an isometric view of the knife removed from the cutter shown in the other figures;

FIG. 6 is a view of a cable and a diagrammatic showing of the position of the knife blade when looking down on the cable from the top, as in FIG. 2;

FIGS. 7–9 are diagrammatic sectional views taken on the planes 7–7, 8–8 and 9–9, respectively, of FIG. 6.

DESCRIPTION OF PREFERRED EMBODIMENT

The tool shown in the drawing has a main frame 10 consisting of parts rigidly connected together. These parts include handle frames 12 and 14 connected together by cross blocks 16 and 18 (FIG. 4). In the construction illustrated, the handle frames 12 and 14 have slight depressions providing shoulders 20 against which the blocks 16 and 18 bear to provide against possible twisting of the main frame. Screws 22 secure the handle frames 12 and 14 to the cross blocks 16 and 18.

At the ends of the cross block 16 there are bearings 24 for axles of rollers 26. These rollers 26 are the upper elements of a guide through which a cable 28 (FIG. 2) passes in the direction indicated by the arrow 30.

The lower part of the guide includes other rollers 32 having axles which extend into bearings 34 in side frames 36 of an adjustable frame 40 which moves up and down to shift the rollers 32 toward and from the rollers 26 to adjust the guide for cables of different diameter.

The adjustable frame 40 has a bottom block 42 which fits against shoulders 44 of the side frames 36. The bottom block 42 is rigidly secured to the side frame 36 by screws 46.

The adjustable frame 40 is confined between the handle frames 12 and 14, as best shown in FIG. 4, and the side frames 36 of the adjustable frame straddle the lower cross block 18 of the main frame 10.

A spring 50, compressed between the lower block 18 of the main frame and the bottom block 42 of the adjustable frame, urges the adjustable frame 40 downward. A screw 54, having a winghead 56, moves the adjustable frame 40 upward against the tension of the spring 50 when the screw 54 is rotated in one direction and lets the adjustable frame 40 move downward when the screw 54 is rotated in the other direction.

the head 56 of the screw 54 has a washer or collar 60 in contact with the lower face of the bottom block 42. There is a nut block 62 secured to the top of the lower cross block 18 by screws 64 (FIG. 3), and the screw 54 threads through the nut block 62.

A knife 68 rests on a sloping face 70 (FIG. 1) of a bracket 72 and the knife is attached to the bracket 72 by a screw 74 threaded into the bracket 72. The screw 74 extends through a slot 76 in the knife 68 and this slot provides for longitudinal adjustment of the knife with respect to the screw 74. Since there is only one screw 74, the knife can be adjusted angularly about the axis of the screw 74 whenever the clamping pressure of the screw is released.

The knife bracket **72** is attached to a knife bracket support **80** (FIG. **2**) extending from one side of the main frame **10**. This knife bracket support **80** is rigidly secured to the main frame **10** by screws **82** threaded into the upper cross block **16**. A clamping screw **84** is provided for securing the knife bracket **72** to the knife bracket support **80**. This clamping screw **84** extends through a slot **86** in the knife bracket **72** so as to permit adjustment of the knife bracket **72** up and down along the knife bracket support **80**. A shallow channel with shoulders **88** (FIGS. **1** and **2**) guides the knife bracket **72** in its adjustment and also prevents the knife bracket from being displaced on its support by the cutting force against the knife when the tool is being operated. If wider adjustment of the knife positions is desired, the channel with the shoulders **88** is omitted and the knife bracket **72** is clamped against a plane face of the knife bracket support **80** by the screw **84**.

In the construction illustrated there is a plate **90** (FIGS. **1** and **3**) attached to the frame **40** by screws **92**. This plate **90** has an upper surface **94** which is preferably cylindrical, for contact with the lower side of a cable passing through the guide of the tool. This cylindrical face **94** forms part of the tool guide for the cable: and the plate **90** can be adjustable up and down on the adjustable frame **40** as a result of a slot **96** through which the clamping screws **92** extend. Ordinarily the plate **90** is adjustable so as to have the cylindrical face **94** contact with the cable when the cable is in contact with the rollers **32** of the adjustable frame **40**.

The knife **68** has two cutting edges. These include a cutting edge **100** (FIG. **1**), which will be referred to as the longitudinal cutting edge. and this edge **100** is the one which peels material from the cable **38** during relative rotary movement of the tool around the axis of the cable. A second cutting edge **102** (FIG. **2**) of the knife **68** will be referred to as the radial cutting edge since it extends in a generally radial direction for cutting off the rearward edge of the material which is being peeled or shaved from the cable by the longitudinal edge **100**.

When the knife **68** is adjusted to taper the cut material, i.e., to leave a frustoconical surface on the cut, the longitudinal edge **100** may extend to the original surface of the cable at the rearward end of the cut and the radial cutting edge **102** may not be effective. For other kinds of cuts, there may be a shoulder in the end of the cut and in this case, the radial cutting edge **102** may be essential, with certain kinds of material, in order to avoid a rough torn edge at the rearward end of the cut surface.

The cutting edges of the knife **68** are difficult to illustrate and their operation is difficult to visualize. FIG. **2** shows a top plan view of the cutting edge **100**, but FIG. **1** only shows one end of the cutting edge **100** because the rest of this cutting edge which slopes toward the left as it extends rearwardly of the plane of the paper in FIG. **1** is not visible. FIG. **6** shows a line **100** which represents the slope of the longitudinal cutting edge **100** when viewed from the top, as in FIG. **2**.

In order to help visualize the operation of the cutting edge **100**, when located along the slope shown in FIG. **6**, sectional views on the planes **7—7** through **9—9** are illustrated in FIGS. **7–9**, respectively. Although the cutting edge **100** is not set on a slope toward the axis of the cable **28**, it nevertheless makes a tapered cut to produce a frustoconical surface. For example: the cutting edge **100** in FIG. **7** is substantially lower than the top of the insulation shield **106**. it is not cutting the insulation shield because it is so far to the left of the cable axis **108** that the cable surface has curved down to the level of the knife.

Further along the cable **28**, at the sectional line **8—8**, the cutting edge **100** is further to the left in FIG. **8** and is thus in contact with a part of the cable which is higher than the level of the knife edge. Thus the part of the cutting edge **100** which is at the sectional line **8—8** cuts a thin layer of material from the cable.

As the cutting edge **100** reaches the portion of the cable which extends the highest, directly over the axis **208**, as shown in FIG. **9** the knife cuts to the greatest depth through the material surrounding the cable. In the operation illustrated, the knife **68** is adjusted to remove all of the insulation shield **106** and a thin layer of the underlying insulation **110** as insurance that all of the conducting particles are off the surface before a splicing or terminating operation.

In FIG. **2** material **122** is shown being shaved from the conductor **28** as a continuous shaving. This result is obtained with certain kinds of material and where the knife is adjusted to take a substantial cut. Where the angle of taper is small and the material is of a nature which tends to crumble, it can be removed smoothly with a sharp cutting edge but does not come off as a continuous shave.

The radical cutting edge **102** extends upward substantially at right angles to the rearward end of the cutting edge **100** but with a small radius **115** (FIG. **5**) at the juncture of the edges to permit grinding of the knife.

The use of the rollers **26** and **32** in the cable guide through the tool reduces friction and permits smoother operation of the tool since better cutting results are often obtained by moving the tool at substantially uniform speed. The supporting surface **94** which is more nearly under the cutting part of the knife **68**, has a limit surface for reducing friction, but at the same time provides, in effect, an anvil against which the thrust of the knife react. If desired, the surface **94** can be located further out from the side frame **36** so as to be more centrally located under the main thrust of the knife.

The preferred embodiment of the invention has been illustrated and described and the invention is defined in the appended claims. of different diameter, and a knife that cuts material from the cable as said cable passes through the guide, the knife having two cutting edges with the end of one cutting edge contiguous with the beginning of the other cutting edge, the first cutting edge being in a position to strip a thickness of material from the cable along a length of the cable and the other cutting edge being in position to radially cut the material to the depth of the cut made by the first cutting edge

1. A stripping tool for an electrical cable including a main frame having a guide through which the cable passes, said guide having a radially fixed portion and a radially movable portion including a an frame that slides on the fixed portion and that has two parallel rollers thereon which contact with the cable, means for adjusting the adjustable frame and for holding it in any adjusted position for accommodating the tool to cables

2. The stripping tool described in claim **1** characterized by a bracket connecting the knife to one of the portions of the frame, fastening means connecting the knife to the bracket and on which the knife is adjustable toward and from the level of the longitudinal axis of the cable, and other fastening means by which the knife bracket is connected to the frame on which the knife bracket is adjustable angularly about an axis extending in a direction having a substantial component parallel to the longitudinal axis of the cable in the guide.

3. The stripping tool described in claim **1**, characterized by the knife being in a position correlated with the guide and with the layers of material on the cable in the guide to cut from the cable, along a portion of the length of the cut, an insulation-shielding layer and a superficial portion of the outside of the insulation, the knife being at such an angle to the axis of the cable as to taper the outside circumference of cable along another portion of the length of the cut.

4. The stripping tool described in claim **1** characterized by the main frame comprising two handle frames, each of which extends for a substantially greater distance than the other on an opposite side of the tool, cross blocks between the handle frames and by which the handle frames are held parallel but spaced from one another, the handle frame being rigidly connected to the cross blocks to form a rigid structure, the adjustable frame including side frames that slide along the handle frame, as guides and including a bottom block to which said side frames are secured to constitute the adjustable frame forming a rigid U-shaped structure that straddles the lower one of the cross blocks of the main frame, axles for the parallel rollers supported by said side frames, a spring compressed

between said bottom block and a part of the main frame, and an adjusting screw extending through an opening in the bottom block and threading into threads on the lower cross block, the screw having a shoulder that thrusts the bottom block toward the guide against the pressure of the spring.

5. The stripping tool described in claim 4, characterized by the spring being a helical compression spring, and sockets in the bottom block and the lower cross block into which the ends of the spring extend for holding the spring in position, the screw extending through the open center of the helical spring and being of smaller diameter than said open center.

6. A stripping tool for an electrical cable including a main frame having a guide through which the cable passes, said guide having a radially fixed portion and a radially movable portion including an adjustable frame that slides on the fixed portion and that has two parallel rollers thereon which contact with the cable, means for adjusting the adjustable frame and for holding it in any adjusted position for accommodating the tool to cables of different diameter, a knife that cuts a layer of material from the cable as said cable passes through the guide, the knife being beyond the ends of the guide, and a support for the cable at a location opposite the location of the knife for resisting radial thrust from the knife resulting from the cutting by the knife.

7. The stripping tool described in claim 6, characterized by the support being connected with the adjustable frame and being adjustable as a unit therewith, and said support having a concave cylindrical surface with a center axis parallel to the axis of the cable and having its lowest level at a location between the extended axes of the rollers.

8. A stripping tool for stripping the semiconducting insulation shield from a high-voltage cable and for stripping a slight amount of the underlying insulation to assure that all semiconducting material has been removed from the outside of the insulation, said tool including a guide through which the cable passes longitudinally during relative rotation of the tool and cable, a knife secured to the tool and having a cutting edge extending generally lengthwise of the cable and at an angle to the axis of the cable in position to cut the insulation shield to a tapered surface extending from the insulation at the small-diameter end of the taper to the full circumference of the insulation shield at the large-diameter end of the taper extending in a direction with a substantial radial component and in position to cut the insulation shield along its circumference at the large-diameter end of the taper to prevent the insulation shield material from tearing from the circumferential area beyond the large end of the taper as the insulation shield material is stripped by the cutting edge which extends generally lengthwise of the cable and at an angle to the axis of the cable.

9. The stripping tool described in claim 8, characterized by a single knife blade, of which two cutting edges are contiguous edges in different planes.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,601,891 Dated August 31, 1971

Inventor(s) Frank P. Destito

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 21, "1" should read -- non-jacketed --; line 25, cancel "the insulation at", second occurrence. Column 4, line 5, "122" should read -- 112 --; line 24, "react" should read -- reacts --; same column 4, line 29, after "claims." the remainder of the line through line 36 inclusive should be canceled, and in column 4, line 44, after "cables" insert -- of different diameter, and a knife that cuts material from the cable as said cable passes through the guide, the knife having two cutting edges with the end of one cutting edge contiguous with the beginning of the other cutting edge, the first cutting edge being in a position to strip a thickness of material from the cable along a length of the cable and the other cutting edge being in position to radially cut the material to the dept of the cut made by the first cutting edge. --; same column 4, line 40, cancel "a"; same line 40, after "an" insert -- adjustable --.

Signed and sealed this 3rd day of October 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

ORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.