United States Patent

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[72] Inventor **Ross F. Morrone**
Trenton, N.J.

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[73] Assignee **Spectra Instruments, Inc.**
Trenton, N.J.

[54] **CABLE-STRIPPING EQUIPMENT**
7 Claims, 11 Drawing Figs.

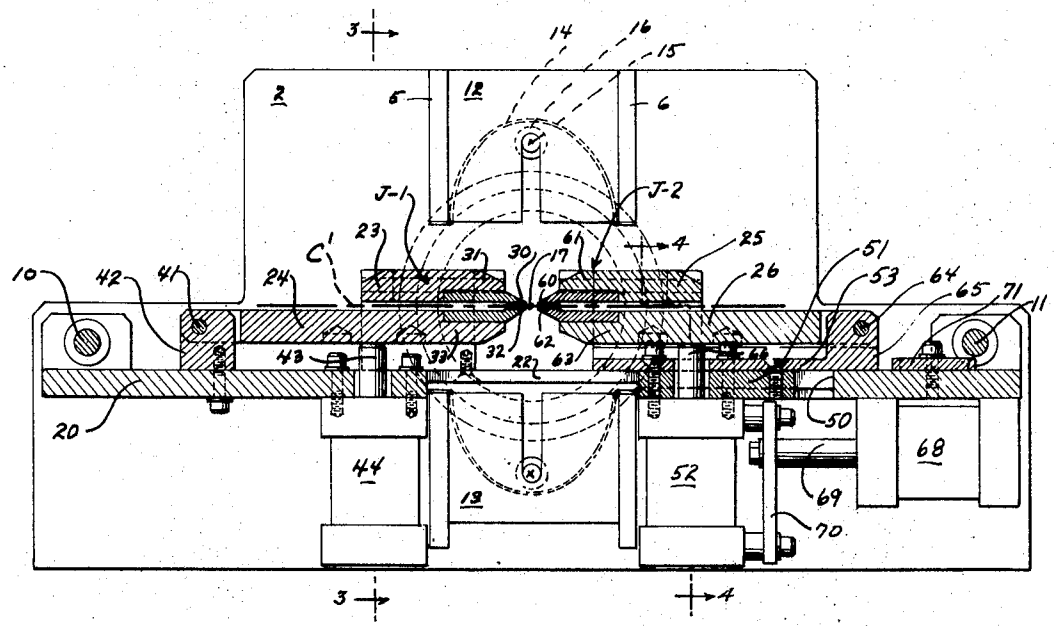
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[51] **Int. Cl.** **H02g 1/12**
[50] **Field of Search** ..... 219/201, 347, 350; 228/18; 140/2; 15/3, 4; 81/9.51; 29/81 F, 630 A; 134/1, 5, 19; 83/DIG. 1; 313/113, 114

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Primary Examiner—Leon G. Machlin
Attorney—Frederick J. Olsson

ABSTRACT: Equipment for removing insulating plastic from flat cable conductors including means to form a linelike area of infrared energy on the cable surface to vaporize the plastic thereof, jaw means to shield plastic which is to remain on the cable from the infrared and means to pull plastic along the conductors to expose the same for the soldering operation.



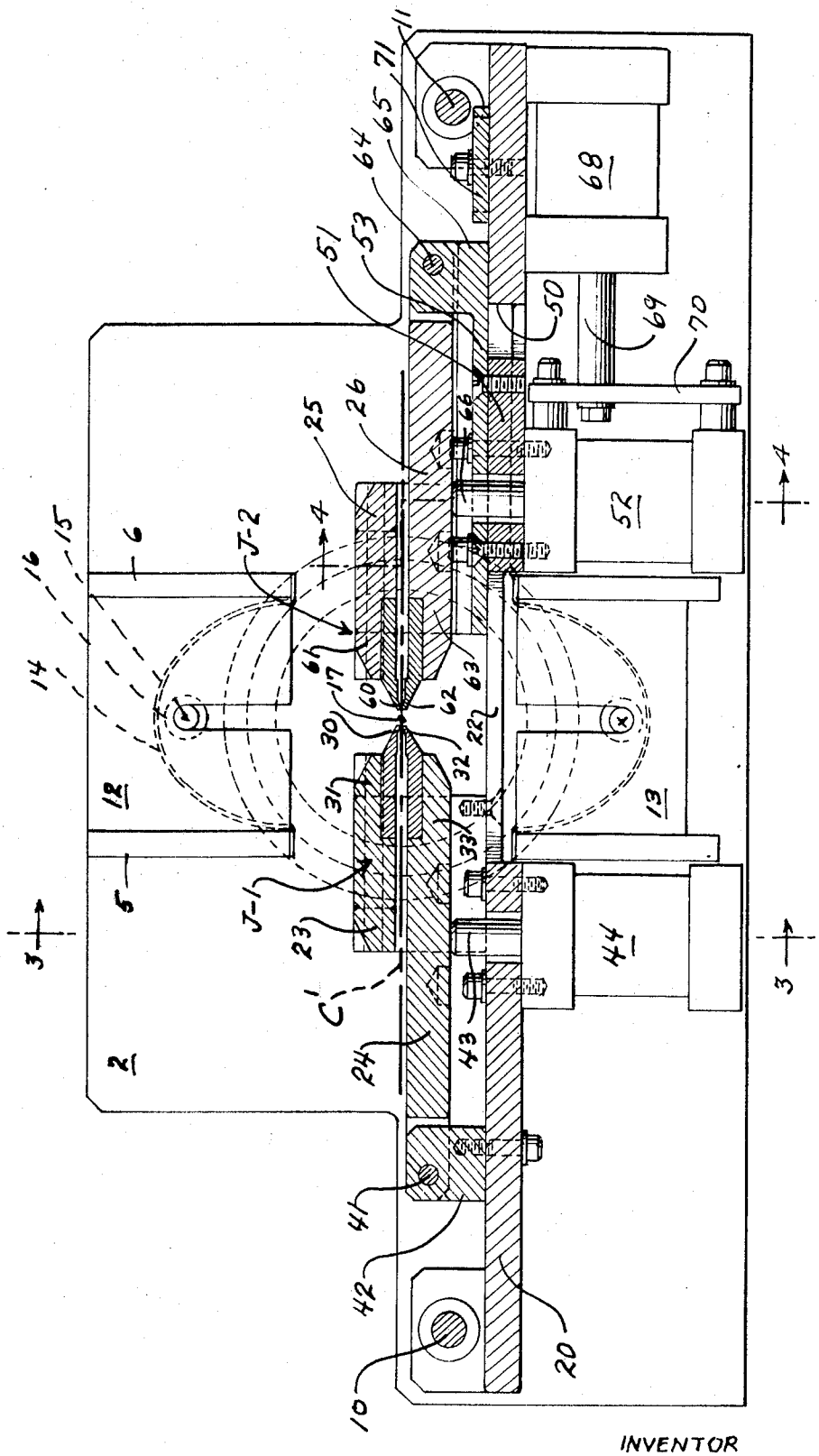
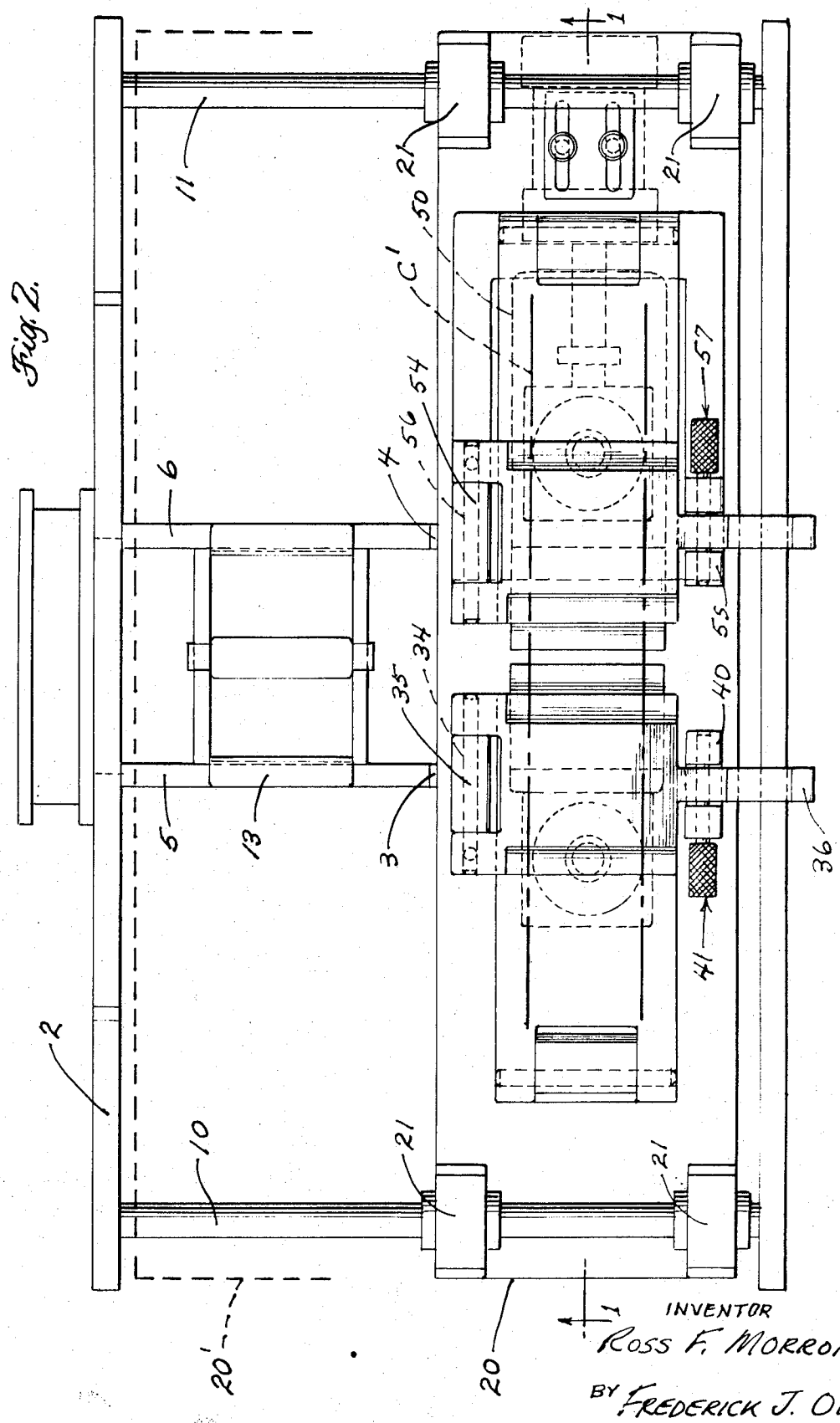


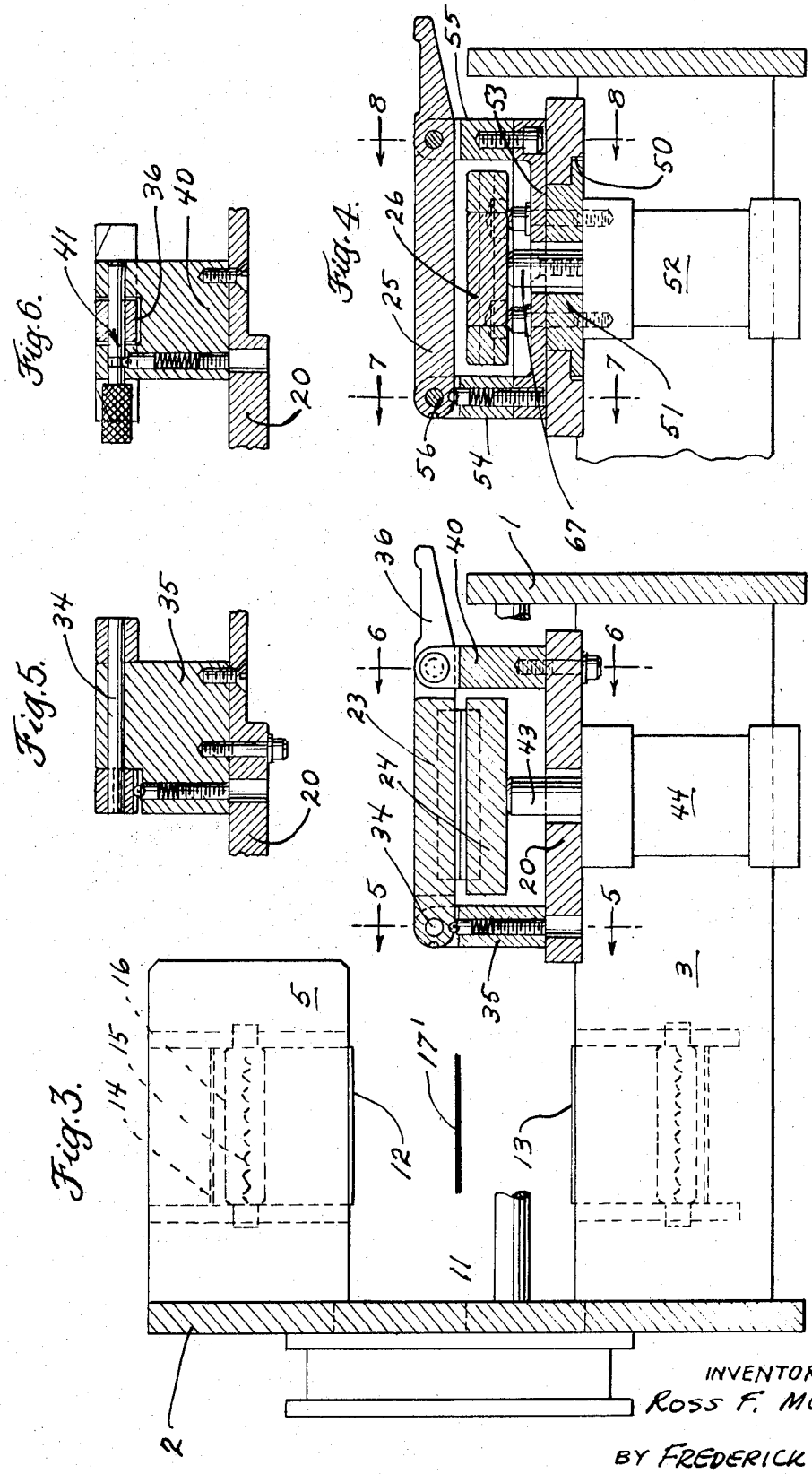
Fig. 1.

INVENTOR
ROSS F. MORRONE
BY FREDERICK J. OLSSON
ATTORNEY

Fig. 2.



INVENTOR
ROSS F. MORRONE
BY FREDERICK J. OLSSON
ATTORNEY



INVENTOR
ROSS F. MORRONG
BY FREDERICK J. OLSSON
ATTORNEY

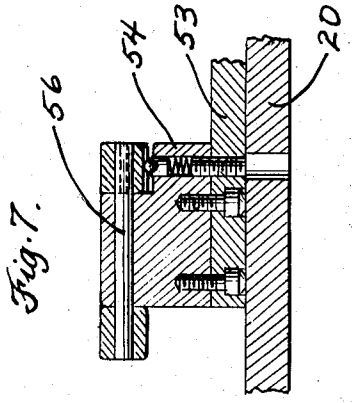


Fig. 7.

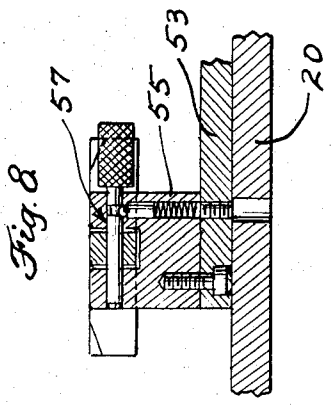


Fig. 8

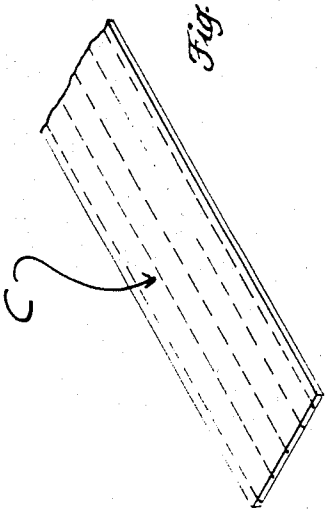


Fig. 11.

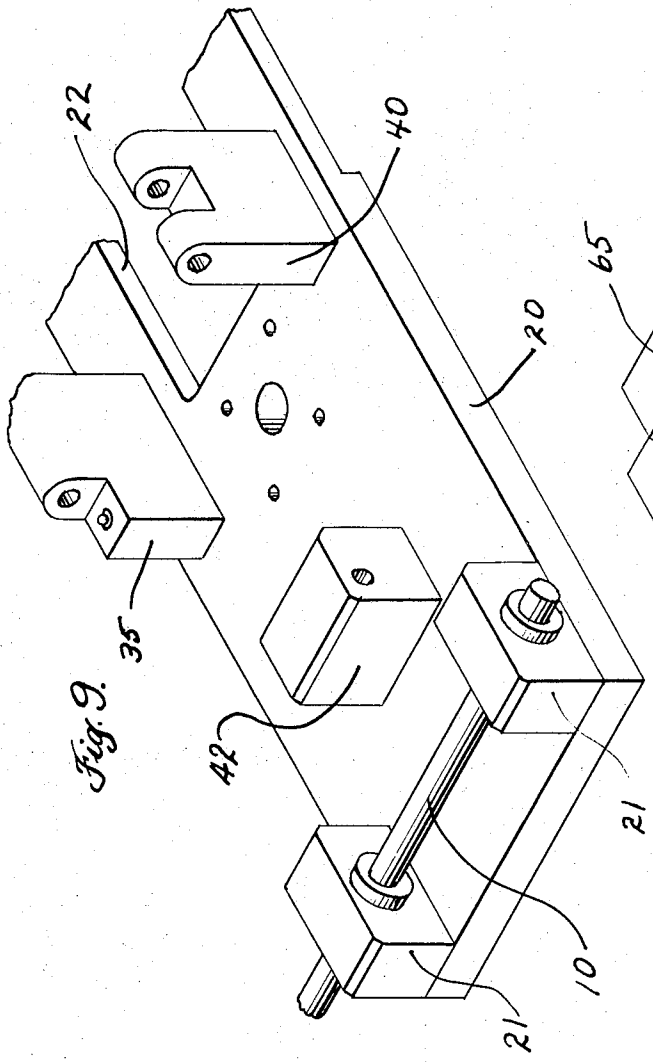


Fig. 9.

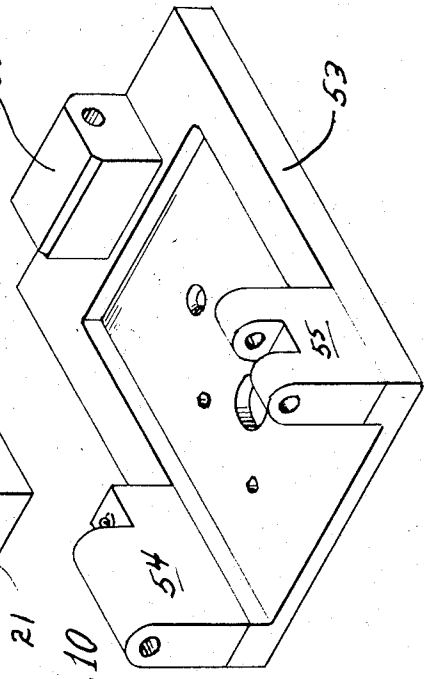


Fig. 10

INVENTOR
ROSS F. MORRONE
BY FREDERICK J. OLSSON
ATTORNEY

CABLE-STRIPPING EQUIPMENT

This invention relates to equipment for removing insulating material, usually plastic, from flat, flexible electrical cables either at the end of the cable or at a section intermediate the ends in a manner to condition the conductors of the cable for soldering.

The primary object of the invention is to provide the kind of equipment in question which is of relatively simplified construction and mode of operation and which can rapidly, positively and with consistently high quality result remove insulating plastic from flat cables to condition the same for soldering an achievement which heretofore was, for all practical purposes, impossible.

Another object of the invention is to provide equipment of the kind in question having a relatively simplified construction and mode of operation which ideally suits the same for automation.

The invention will be described below in connection with the following drawings wherein:

FIG. 1 is a sectional elevational view of equipment embodying the invention, the section being taken approximately on the line 1—1 of FIG. 2.

FIG. 2 is a plan view of FIG. 1.

FIG. 3 is a cross section taken approximately on the lines 3—3 of FIG. 1.

FIG. 4 is a fragmentary cross section taken approximately on the line 4—4 of FIG. 1.

FIG. 5 is a fragmentary cross section taken on the line 5—5 of FIG. 3.

FIG. 6 is a fragmentary cross section taken on the line 6—6 of FIG. 5.

FIG. 7 is a fragmentary cross section taken on the line 7—7 of FIG. 4.

FIG. 8 is a fragmentary cross section taken on the line 8—8 of FIG. 4.

FIG. 9 is a fragmentary isometric view of a portion of the main structure of the equipment.

FIG. 10 is an isometric view of the slider adapted to be slidably mounted on the base plate of FIG. 9; and

FIG. 11 is a diagrammatic view of a piece of flat cable.

The term "flat cable" as used herein is meant to include the conventionally known types normally referred to as etched, laminated and ribbon. Such cable normally includes plastic insulation which will vaporize at high temperature and which contains infrared absorbing material or is capable of having such material applied to the same.

First, I will describe the main framework of the equipment.

As noted in FIGS. 1 and 2, the front bracket 1 and the rear bracket 2 are joined together as by the intermediate brackets 3 and 4. Toward the top of the bracket 2 are the cantilever brackets 5 and 6. Side rails 10 and 11 are connected between the brackets 1 and 2. The cantilever brackets 5 and 6 mount an infrared energy means in the form of a lamp 12 and the intermediate brackets 3 and 4 carry an identical lamp 13.

The lamp 12 includes the eliptical reflector 14 together with the tungsten filament 15 within the quartz-iodine envelope 16. As best noted in FIG. 3 the reflector, filament and envelope are elongated. The filament is placed at one of the focal points of the reflector 14. The infrared energy is focused at the other focal point in a confined linelike area indicated in FIG. 1 by the dot 17 and in FIG. 3 by the heavy line 17'. The lamp 13 is of identical construction and focuses the infrared energy in the area indicated at 17 and 17'.

A base 20 is provided with pairs of bearing blocks 21 which respectively mount the base on the rails 10 and 11. The base can be reciprocated back and forth along the rails from the full line position shown in FIG. 2 to a position toward the rear of the machine indicated by the dotted lines 20'. The position shown by the full lines is for loading and unloading flat cable and the position shown by the dotted lines is for performing the stripping operation as will be explained hereinafter.

To accommodate the infrared energy from the bottom lamp 13 the base 20 is provided with a centrally located cutout section 22 as shown in FIG. 9.

With the basic framework as described above in mind it is pointed out that the machine is equipped with pairs of jaws between which the cable to be worked can be inserted, brought into a position with respect to the infrared lamps for the heating operation and then the jaws manipulated to move the plastic on the conductors as to expose or condition the same for subsequent soldering.

With reference to FIGS. 1 and 2 there are a pair of jaws on the left-hand side indicated at J–1 and a pair of jaws on the right-hand side indicated at J–2. The pairs of jaws are arranged side-by-side and spaced from one another and the energy area 17 is located between the jaws.

Each pair of jaws can assume an open position wherein flat cable such as the cable C shown in FIG. 11 can be threaded between the jaws in a manner indicated generally by the heavy dot and dash lines C' in FIGS. 1 and 2. After the cable is threaded through the jaws the same can be closed up so that the cable is tightly engaged. When the base is moved toward the rear of the machine, the jaws will hold the cable within the range of the infrared lamps so that the energy from the top lamp 12 will be focused in a linelike or small rectangular area on the top surface of the cable while the energy of the bottom lamp 13 will be focused in a similar pattern on the bottom surface of the cable. The right hand jaws are movable to the right for purposes of moving the plastic and exposing the conductors of the cable as will be explained later. In the position shown in FIG. 1, the jaws are spaced about one-eighth inch apart.

The pair of jaws J–1 on the left-hand side of the machine are indicated respectively on 23 and 24 and jaws J–2 on the right-hand side are respectively indicated at 25 and 26.

The construction and mounting of the jaws 23 and 24 will first be described particularly with reference to FIGS. 1, 3, 5 and 6.

The upper jaw 23 comprises a gripper section 30 and a shield section 31. The lower jaw 24 includes the gripper 32 and the shield section 33.

The purpose of the grippers is to engage and hold a flat cable as will be later described. The purpose of the heat shield section is to absorb or reflect the infrared energy from the lamps away from the plastic which is to remain on the cable while permitting exposure of the plastic which is to be removed.

The shield section 31 of the upper jaw 23 is connected with the shaft 34 (FIG. 3) disposed in the upright post 35 connected with the base member 20. The forward end of the shield section 31 has an extension 36 adapted to fit into the yoke 40 mounted on the base 20. The detent locking mechanism 41 (FIG. 6) retains the extension 36 firmly in the yoke 40. If the detent locking mechanism 41 is removed, the jaw 23 can be swung upwardly about the shaft 34.

Referring now to the lower jaw 24 it will be seen that the shield section 24 is connected with a shaft 41 supported by the block 24 on the base 20. The lower jaw 24 can be swung about the shaft 41. Normally the lower jaw bears on the plunger 43 of the solenoid 44 connected to the base 20. The upper and lower limits of motion of the lower jaw are determined by the stroke of the plunger 43. When the solenoid is deenergized the plunger 43 moves down and the weight of the jaw 24 causes the same to follow the plunger. When the solenoid is energized the plunger moves up into the position shown in FIG. 1.

It will be apparent that the jaws 23 and 24 comprise a pair of movable grippers which are disposed one above the other and which have an open position (lower jaw 24 down) where a flat cable can be threaded between the grippers and a closed position wherein the lower gripper 32 is moved upwardly against the cable and grips it firmly against the upper gripper 30.

As best seen in FIGS. 1 and 4 the right-hand side of the base has a slot 50 within which is disposed guide 51. On the bottom of the guide is a solenoid 52. Connected with the top of the guide and also bearing on the top surface of the base is a slider 53. The structure of the slider 53 is best indicated in FIG. 10. The slider 53 carries the posts 54 and 55 which are identical to the posts 35 and 40.

The upper arm 25 is pivotally mounted on the post 54 and as by the shaft 56 (see FIG. 7) and is connected with the yoke 55 by detent mechanism 57 (FIG. 8). The upper arm 25 carries the gripper 60 and the shield section 61 which function and serve the same purpose as the corresponding gripper 30 and shield 31.

The bottom jaw 26 has the gripper 62 and the shield section 63. The shield section 63 is pivotally connected by shaft 64 to the pivot block 65 mounted on the slider 53. The plunger 66 of solenoid 52 controls the up and down movement of the lower jaw 26 similarly as solenoid 44 controls jaw 24.

The slider 53 is adapted to move the jaws 25 and 26 with respect to the jaws 23 and 24 for the purpose of moving insulation over the conductor. This is done by the double action solenoid 68, the plunger 69 of which is fixedly connected to the solenoid 52 by bracket 70. By appropriately energizing the double acting solenoid 68 the jaws 25 and 26 are moved up to the position shown by the full lines or to the left. The position of the slider 53 on the left is determined by the left-hand stroke of the plunger 69 of solenoid 68. The position of the slider 53 on the right is determined by the adjustable stop 71. In most instances the total motion of the slider can be in the range of about 1 inch.

The general mode of operation of the equipment will next be described.

First of all the solenoid 68 is energized to move the jaws 25 and 26 t the left or in the position as shown in FIG. 1. This may be termed the "heat" position. Also, the solenoids 44 and 26 in the down position so that the jaws are in open position. The base 20 occupies the load-unload position.

Assume that a cable is to be worked so as to strip insulation from one end. With the machine in the condition as described above, the cable is threaded between the jaws 23 and 24 with little more than approximately one-half an inch extending between the jaws 25 and 26. At this time the solenoids 44 and 52 are energized to move the lower jaws 24 and 26 upwardly to grip the cable firm against the upper jaws. The base 20 is then pushed into the work position.

At this time the infrared lamps 12 and 13 (or one lamp) are energized. The infrared causes the plastic insulation on the cable to vaporize. The lamps are then turned off and while there is sufficient heat between the plastic and the conductors in the section of the cable enclosed within the jaws 25 and 26 the solenoid 68 is energized to pull the jaws 25 and 26 to the right so as to strip the right-hand section of the insulation away from the conductors. Movement of the jaws to the right (as determined by the stop 71) may be termed the "strip" position.

The sequence of energizing of the solenoids 44, 52, 68 and of the lamps 12 and 13 is easily accomplished by conventional timing mechanism so that the machine is essentially automatic in operation except for the loading and unloading of the cable.

Where it is desired to strip out a center section of a cable the machine is operated as follows.

With the solenoid 68 energized to move the jaws 25 and 26 into the heat position as shown in FIG. 1 and with the solenoids 44 and 52 energized to open the jaws, the cable is threaded through the jaws until the desired portion of the same is located in the small space between the right- and left-hand sets of jaws. At this time the solenoids 44 and 52 are energized to lock the cable in position and then the base is moved to bring the assembly within the range of the infrared lamps. The lamps are turned on so that the energy vaporizes the plastic on the insulation within the area indicated at 17. The solenoid 68 is then energized to move the jaws 25 and 26 to the right to the strip position. This pulls the insulation to the right with the same simply piling up in a small ball on the right-hand side. The conductors are exposed to condition the center section for a subsequent soldering operation.

In certain instances it is desirable to load the cable by placing the same flat down on the lower jaws 24 and 26. For this purpose, the detent mechanisms 41 and 57 holding the upper jaws are released so that the upper jaws 23 and 25 can be tilted upwardly and the cable then placed down on the jaws 24 and 26. Usually in this situation the solenoids 44 and 52 are energized to hold the lower jaws in the up position. After inserting the cable the machine is operated in the manner described.

In certain types of cable stripping it is highly desirable to remove as much of the vaporized residue as possible. In such instances the machine can be operated as follows.

With the equipment in the load-unload position and with the jaws J-1 and J-2 open, the cable is threaded between the jaws and then the left-hand jaws J-1 are closed while the right-hand jaws J-2 remain open. The assembly is moved to the work position and the infrared turned on to vaporize a small linelike section of plastic. The right-hand jaws then are moved in until they are substantially in engagement with the left-hand jaws and then closed down on the cable. The jaws are then moved to the right to strip away the insulation.

One of the particular advantages of the equipment is its use in connection with the stripping of shielded cable. For example, in stripping off an end section of the shielded cable, the machine is operated as follows. First, the insulating plastic on both sides of the cable is stripped in the manner described above preferably by using both infrared lamps. The cable is then removed from the machine and the layers of the copper foil on each side of the cable are pulled back toward the main body of the cable. The cable is reinserted and the inner layers of insulating plastic covering the conductors are removed in the manner described above. Thus, the shielded cable conductors are ready for soldering and the foil is in condition for connection to the grounding system.

I claim:

1. Equipment for removing insulating plastic from the conductors of flat cable comprising:

a base;

a first upper horizontally extending jaw mounted on said base;

a first lower horizontally extending jaw below said first jaw and pivotally connected with said base for movement in a vertical direction as between an open position wherein a flat cable is insertable between the jaws and a closed position wherein a flat cable is gripped between the jaws;

means on said base for causing said vertical movement of said first lower jaw;

a slider slidably mounted on said base for reciprocating motion toward and away from said first jaws;

a second upper horizontally extending jaw mounted on said slider for movement therewith;

a second lower horizontally extending jaw pivotally mounted on said slider below said second upper jaw and movable in a vertical direction as between an open position wherein a flat cable is insertable between the second jaws and a closed position wherein a flat cable is gripped between the second jaws;

means on said slider for moving the second lower jaw vertically, said first jaws being located beside, but spaced from said second jaws; mechanism on said base for moving said slider and the jaws thereon toward and away from said first jaws; and

infrared energy means constructed to focus the energy in a linelike fashion in the space between said first and second jaws.

2. Equipment for stripping plastic from the conductors of flat cable comprising:

an elongated, horizontally oriented base extending in a direction along a main axis which is the axis along which a cable to be worked extends, the base having a centrally located cutout section;

a pair of infrared lamps respectively mounted above and below the base and respectively arranged to focus the infrared energy into a horizontally extending linelike area, the area being of discrete length so as to extend across and beyond the flat cable worked by the equipment;

means supporting said base to reciprocate as between a load-unload position for the loading and unloading of cable and wherein the base is spaced away from the lamps

in a direction transverse said main axis and an operating position for working the cable wherein the base is disposed between the lamps and the cutout is over the lower lamp so that infrared energy can radiate therethrough;

a first pair of jaws, each jaw having a cable-shielding portion and a cable-gripping portion, both portions being of substantial transverse width so as to extend across the width of the cable worked by the equipment and the shielding portion extending in a direction along said main axis;

means mounting the first pair of jaws on said base on one side of said lamps for relative movement in a vertical direction as between an open position wherein a cable is insertable between or removable from the first jaws and a closed position wherein the cable is gripped between the gripping portions of the first jaws and the means mounting the first jaws on the base so that the gripper portions are adjacent to and extending along said linelike area when the base is in the operating position so that a cable gripped thereby has a portion within said linelike area and exposed to said infrared energy;

means on said base for causing said relative vertical motion of the first jaws;

a slider mounted on said base for reciprocating motion generally in a direction along said main axis;

a second pair of jaws, each jaw having a cable-shielding portion and a cable-gripping portion, both portions being of substantial transverse width so as to extend across the width of the cable worked by the equipment and the shielding portion extending in a direction along said main axis;

means mounting the second pair of jaws on said slider on the opposite side of said lamps for relative movement in a vertical direction as between an open position wherein a cable is insertable between or removable from the second jaws and a closed position wherein the cable is gripped between the gripping portions of the second jaws;

means on said slider for causing said relative vertical motion on the second jaws; and

means on the base to cause the slider to reciprocate in a direction along said main axis as between a heat position and a strip position, in the heat position the grippers of the second jaws being closely adjacent the grippers of the first jaws and also adjacent to and extending along said linelike area and in the strip position the second jaws being substantially spaced from said first jaws.

3. A construction in accordance with claim 2 wherein the means mounting the upper jaw of the first pair on the base and the means mounting the upper jaw of the second pair on the slide each respectively include a pivot mechanism whose axis extends in a direction generally along said main axis and provides for its jaw to tilt upwardly away from the corresponding lower jaw.

4. A construction in accordance with claim 2 wherein the means mounting the lower jaw of the first pair on the base and means mounting the lower jaw of the second pair on the slider each respectively include a pivot mechanism whose axis extends in a direction generally transverse said main axis and provides said relative vertical motion of the jaws.

5. A construction in accordance with claim 2 wherein each respective means for causing the relative vertical movement of the first and second jaws is a solenoid having a plunger contacting the underside of its associated lower jaw, the solenoid when energized causing the plunger to lift the lower jaw and when deenergized permitting the weight of the lower jaw to move the jaw and plunger downwardly.

6. Equipment for stripping plastic from the conductors of flat cable comprising:

an elongated base extending in a direction along a main axis which is the axis along which a cable to be worked extends;

a pair of infrared lamps mounted in facing relationship with one another and respectively arranged to focus the infrared energy into a linelike area, the area being of discrete length so as to extend across and beyond the flat cable worked by the equipment;

means supporting said base to reciprocate as between a load-unload position for the loading and unloading of cable and wherein the base is spaced away from the lamps in a direction transverse said main axis and an operating position for working the cable wherein the base is disposed between the lamps;

a first pair of jaws, each jaw including a gripping portion;

means mounting the first pair of jaws on said base on one side of said lamps for relative movement as between an open position wherein a cable is insertable between or removable from the first jaws and a closed position wherein the cable is gripped between the gripping portions of the first jaws,

means on said base for causing said relative movement of the first jaws;

a slider mounted on said base for reciprocating motion generally in a direction along said main axis;

a second pair of jaws, each jaw including a gripping portion;

means mounting the second pair of jaws on said slider on the opposite side of said lamps for relative movement as between an open position wherein a cable is insertable between or removable from the second jaws and a closed position wherein the cable is gripped between the gripping portions of the second jaws;

means on said slider for causing said relative movement of the second jaws;

said jaws supporting a cable inserted therebetween so that when the base is in the operating position a portion of the cable is within said linelike area and exposed to said infrared energy; and

means on the base to cause the slider to reciprocate in a direction along said main axis as between a heat position and a strip position, in the heat position the grippers of the second jaws being closely adjacent the grippers of the first jaws and in the strip position the second jaws being substantially spaced from said first jaws.

7. A construction in accordance with claim 6 further including means for shielding cable inserted between said jaws from said infrared energy, the shielding means being disposed to shield portions of the cable outside of said linelike area.

* * * * *