Jan. 3, 1956 G. S. MOGILNER 2,729,732

DIELECTRIC HEATING GUN

Filed March 16, 1953 2 Sheets-Sheet 1

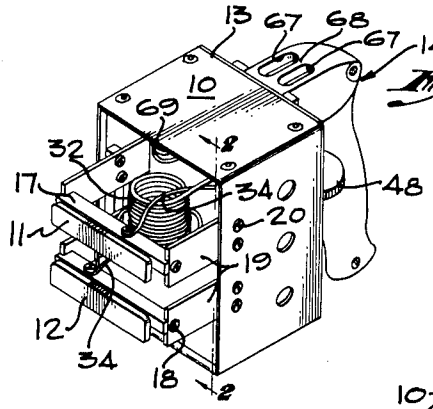
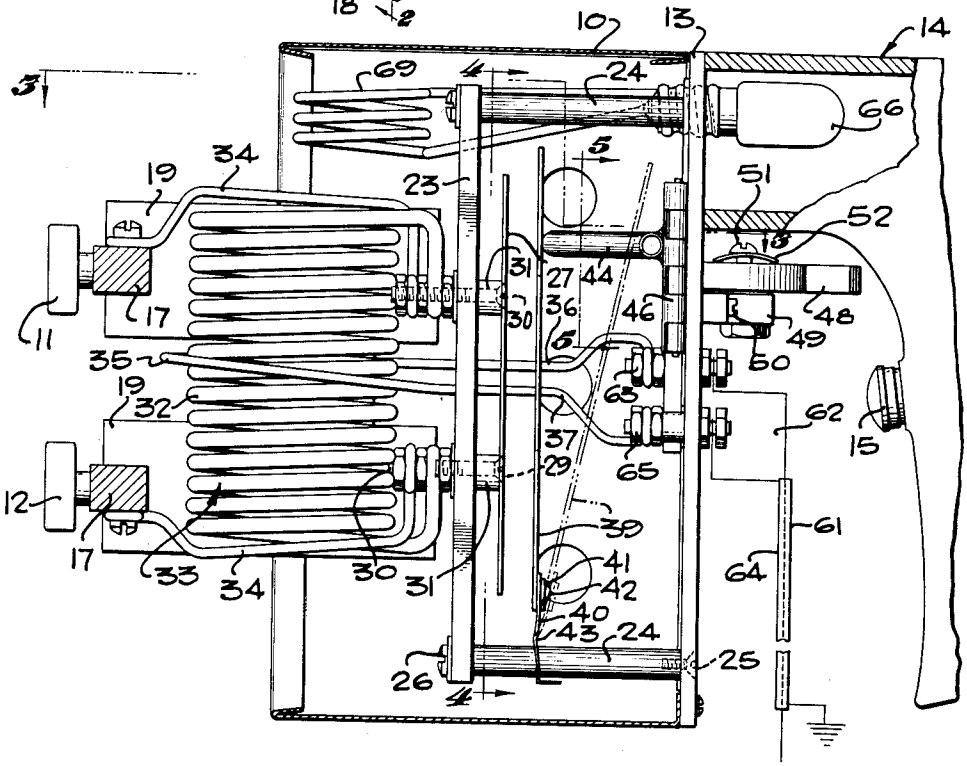


Fig. 1.

Fig. 2.



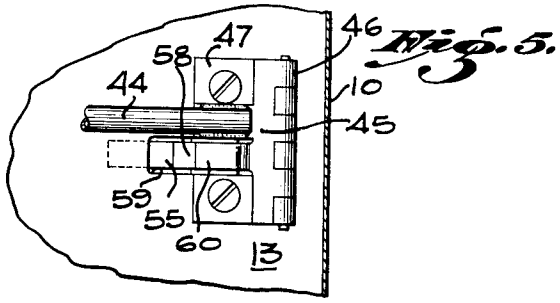


Fig. 5.

GEORGE S. MOGILNER,
INVENTOR.

BY

ATTORNEY

Jan. 3, 1956 G. S. MOGILNER 2,729,732

DIELECTRIC HEATING GUN

Filed March 16, 1953 2 Sheets-Sheet 2

Fig. 3.

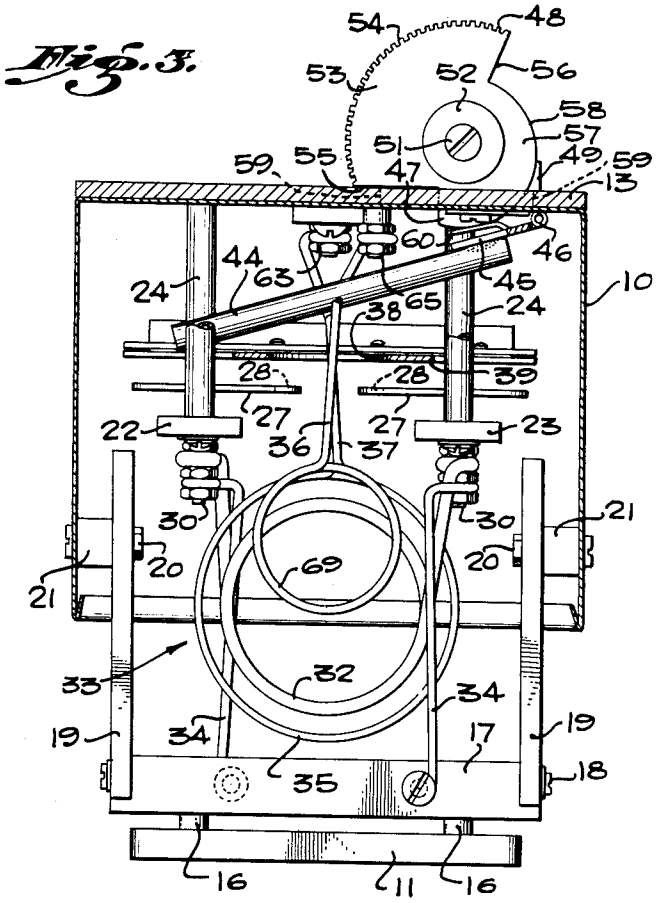
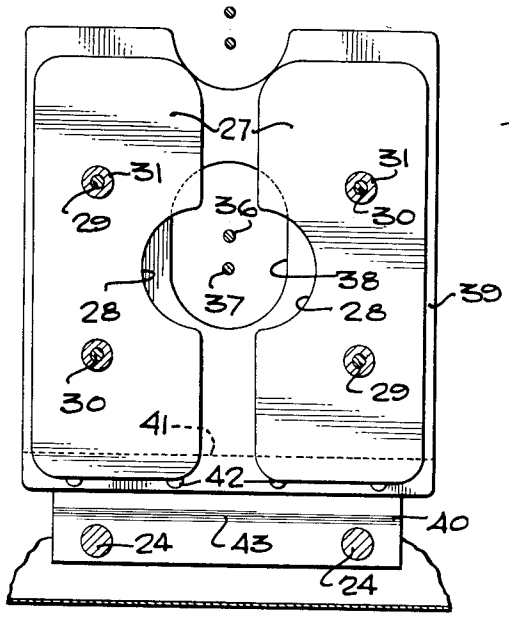


Fig. 4.



GEORGE S. MOGILNER,
INVENTOR.

BY

ATTORNEY

United States Patent Office

2,729,732

Patented Jan. 3, 1956

2,729,732

DIELECTRIC HEATING GUN

George S. Mogilner, Los Angeles, Calif.

Application March 16, 1953, Serial No. 342,354

4 Claims. (Cl. 219—10.75)

The present invention relates generally to high frequency apparatus, and is more particularly concerned with dielectric heating apparatus which is particularly adapted, among other uses, for the dielectric heating of glue used in the securing of members into intimate relationship.

The invention is especially concerned with the applicator by means of which a high-frequency electric field may be set up between suitable electrodes adapted to be applied against plywood or other dielectric materials so as to cause heating of glue for quickly setting and securing the dielectric members together.

Briefly the applicator of the present invention is in the form of a so-called "gun" which embodies spaced electrodes having connection with tuning means which may be either inductive or capacitive, but in the present instance is capacitive. The gun has a pistol grip handle by means of which the electrodes may be applied.

Energy is supplied from a suitable source to the gun through a coaxial connection cable, and novel means are provided for adjusting the tuning, such means being conveniently located with respect to the pistol grip, so that the operator may utilize a finger of the hand which engages the pistol grip for varying the tuning of the device for securing maximum power.

In utilizing a gun of this character, the environment is such that the parts for tuning the electrical circuit, particularly the condenser, is subject to the accumulation of dust, sawdust, and other foreign particles which are in the air, and as a result present a possibility of breakdown due to arcing. It is therefore one object of the invention to provide a dielectric gun in which the condenser is positioned further away from the electrodes out of an exposed position, and wherein the condenser is more fully protected by the housing of the device.

A further object is to provide a novel construction in the tuning condenser, whereby sliding contacts will be eliminated, and corona tendency with concomitant arcing will be substantially decreased to the end that greater reliability and more efficient operation may be obtained.

Still another object is to provide novel means for adjusting the condenser to vary the tuning of the device, such tuning means including a movable digitally operable member which is conveniently positioned adjacent the pistol grip handle, and so located that it is unnecessary for the operator to release his grip on the handle in order to manipulate the tuning mechanism with the same hand that grips the handle. A single hand operative gun is thus provided, and it is unnecessary as in conventional devices of this character as heretofore fabricated to utilize two hands in order to grip the handle and adjust the tuning of the device.

Still another object is to provide visually indicating means which are positioned in such a location that projecting parts around the outer surface of the housing of the device will be substantially eliminated.

Further objects of the invention will be brought out in the following part of the specification, wherein detailed description is for the purpose of fully disclosing the invention without placing limitations thereon.

Referring to the accompanying drawings, which are for illustrative purposes only:

Fig. 1 is a perspective view of dielectric heating apparatus embodying the features of the present invention;

Fig. 2 is a large vertical section through the apparatus, taken substantially on line 2—2 of Fig. 1;

Fig. 3 is a horizontal section, taken substantially on line 3—3 of Fig. 2; the view being rotated 90°;

Fig. 4 is a vertical sectional view transversely of the apparatus showing details of the condenser plates, taken substantially on line 4—4 of Fig. 2; and

Fig. 5 is a fragmentary sectional view showing details of the condenser adjusting means, taken substantially on line 5—5 of Fig. 2.

Referring generally to the drawings, for illustrative purposes, the apparatus of the present invention is disclosed in Fig. 1 as comprising in the main a rectangular box-like housing 10 of sheet metal or other suitable material. This housing is open on its forward side and supports in spaced relation from the housing a pair of spaced electrodes 11 and 12, in this instance being in the form of flat elongate metallic bars. On the opposite side of the housing, the housing is closed by a wall 13 which has secured thereto and extending outwardly therefrom a pistol grip handle, as generally indicated by the numeral 14. This handle forms a part which the operator may conveniently grip in one hand and by means of which the apparatus may be easily manipulated for positioning and holding the electrodes against the dielectric material during use. The pistol grip has mounted thereon a push button switch control 15 which is electrically connected by means (not shown) to the source of high frequency, and by means of which the energization of the source may be controlled at will.

As more clearly shown in Figs. 2 and 3, each electrode is supported by spaced pins 16 on the forward side of a metallic cross-bar 17, this cross-bar being connected at each end as by screws 18 to an insulating arm 19. The inner end of each arm 19 is secured as by bolts 20 to the associated side wall of the housing 10, a spacing bar 21 being interposed between the bar and housing wall to inwardly space the insulating arms from the wall.

Within the housing 10, at a position approximately midway between the front and back of the housing, a pair of side rails 22 and 23 of insulating material are supported in laterally spaced relation and forwardly of the wall 13 by means of spacer posts 24—24 which are secured at one end as by a screw 25 to the wall 13, and at its other end as by a screw 26 to an end of the side rail. The rails 22 and 23 provide insulating supports for the tuning elements of a tuning circuit which connects with the electrodes 11 and 12, as will hereinafter be explained.

One of the elements of the tuned circuit comprises a condenser having a pair of fixed plates 27 which are positioned with their surfaces in a common plane, and are laterally spaced apart and provided with confronting edge notches 28 as shown clearly in Fig. 4. Each plate is supported in a position parallel with one of the side rails and is secured thereto by mounting bolts 29 and 30, a spacer sleeve 31 being provided in each case to space the associated condenser plate 27 with respect to the associated side rail. In each case, the bolt 30 is made of greater length than the bolt 29 in order to serve as a terminal for the opposite ends of a secondary coil 32 of an air core transformer 33 mounted on the opposite side of the side rails 22 and 23 from the condenser plates 27. The bolts 30 therefore support

the secondary coil, which is of sufficiently large sized wire to be self-sustaining and hold its shape, and also serve to interconnect the ends of the secondary respectively with the fixed condenser plates **27**. Jumper connectors **34** interconnect each terminal bolt **30** and the associated end of the transformer secondary coil **32** with a cross-bar **17**, thus providing circuit connections with the electrodes **11** and **12**.

The transformer **33** has a single turn primary winding **35** which is positioned intermediate the ends of the secondary coil and surrounds the turns thereof in spaced relation. Connection leads are brought out from the primary winding between the confronting edges of the condenser plates **27—27**, at the position containing the notches **28**. These leads, as indicated at **36** and **37** are further carried through an opening **38** in a third associated condenser plate **39** of substantially rectangular shape, which is supported in spaced confronting overlapping relation to the fixed plates **27** and arranged for swinging movement about its lower edge in directions normal to its surface.

As shown in Figs. 2 and 4, the condenser plate **39** is secured along its bottom edge margin to one edge of a strip **40** of resilient flexible material, the upper marginal edge of which is clamped between the associated edge of the condenser plate and a retaining strip **41** secured by a series of rivets **42**. The opposite edge of the strip **40** is supported in the spacer posts **24** adjacent the housing bottom. It will be observed that the strip **40** is longitudinally deformed intermediate its edges to provide a line of bend **43** and stress the strip in such a direction as to normally bias the movement of the condenser plate **39** in a clockwise direction, as shown in Fig. 2, so that it has a tendency to move from its full line position to the dotted line position, as shown.

With the arrangement of tuning elements as described in the foregoing, it will be observed that the transformer windings are more closely positioned with respect to the electrodes **11** and **12**, while the condenser plates are positioned further back in the housing **10** so that the condenser plates will be more fully protected from dust, sawdust, dirt and other foreign matter which would tend to increase any tendency towards arcing, and moreover by utilizing a condenser construction as just described, the corona effect and concomitant arcing tendency is materially reduced so that the parts will operate at greater efficiency. Not only does the strip **40** provide a mounting for the condenser plate **39**, but it also connects this plate with the grounded side of the high frequency source by connecting the condenser plate through the metallic spacer post **24** with the wall **13**.

Unique means are provided for varying the position of the condenser plate **39** by a mechanism which is readily operable by a digit of the operator's hand which grips the pistol grip **14** of the apparatus. For this purpose, a tubular member **44** is mounted for swinging movement by connecting it at one end to the movable wing **45** of a hinge **46** which has its other wing **47** anchored to the wall **13**. The outer end of the tubular member **44** is adapted to bear against the plate **39** so as to form an abutment which may be moved to adjustably vary the position of the condenser plate.

The position of the tubular member **44** is arranged to be varied by means of a digitally operable member **48** which is rotatably supported upon a bracket **49** secured to the wall **13** as by suitable screws **50**. The member **48** is rotatably supported on a vertically extending pivot screw **51** which threadedly engages the bracket **49** and has its head portion bearing against a friction washer **52** so as to retain the member **48** against inadvertent movement from an adjusted position. As shown in Fig. 3, the member **48** has a sector shaped portion **53** bounded by a serrated edge **54** and having circumferentially spaced edges **55** and **56** adapted to abut the wall **13** and thus limit the movement of the member in opposite directions, and consequently define the limits of movement of the tubular member **44**. On the opposite side from the portion **53**, the member **48** is provided with a projection **57** having a cam edge **58**, this projection extending through an opening **59** in the wall **13** and having the cam edge in engagement with a projecting finger **60** which is integrally formed with the movable wing **45** of the hinge so that rotative movements of the member **48** will act to adjust the plate **39** of the condenser and tune the high frequency circuit connected to the electrodes so as to obtain maximum power when used with different materials and different thicknesses.

High frequency energy is supplied through a coaxial cable **61** having an inner conductor **62** which is connected through an insulated terminal **63** supported on the wall **13** with the lead **36** of the primary winding of the transformer **33**. The outer shield **64** of the coaxial cable is grounded and is connected with a connecting terminal **65** having electrical connection with the wall **13** and the lead **37** of the transformer primary winding.

A pilot lamp **66** is positioned in the upper portion of the hollow pistol grip structure for indicating the condition of energization of the apparatus. The wall of the pistol grip is provided with spaced openings or windows **67** which are separated by a lamp protective bar **68**. The lamp is energized from a tertiary coil **69** which is supported in inductively coupled relation to the transformer secondary winding coil **32**. It will be observed that with this construction, the housing **10** is devoid of projecting knobs, etc. which would possibly interfere under some conditions with the utilization of the gun.

Various modifications may suggest themselves to those skilled in the art without departing from the spirit of my invention, and, hence, I do not wish to be restricted to the specific form shown or uses mentioned, except to the extent indicated in the appended claims.

I claim:

1. In dielectric heating apparatus containing a tuned circuit: a wall member; a pair of spaced insulated electrodes supported in spaced relation to said wall member; a tuning condenser on one side of said wall member comprising a pair of plates; means supporting said plates in fixed insulated relation to said wall and laterally spaced apart with their surfaces lying substantially in the same plane; a third plate in spaced confronting relation to said pair of plates having an opening therein; a flexible member electrically connecting the third plate with said wall member and movably supporting it for swinging movement about an edge thereof in a direction normal to its surface; a transformer positioned between said condenser and said electrodes including a primary coil and a secondary coil, the secondary coil having one end electrically connected to one plate of said pair and one of said electrodes, and its other end electrically connected to the other plate of said pair and the other electrode, the primary coil having connection leads extending between said pair of plates and through said opening in the third plate; and digitally operable means mounted on said wall for moving said third plate.

2. In dielectric heating apparatus containing a tuned circuit: a wall member; a tuning condenser on one side of said wall member comprising a pair of plates; means supporting said plates in fixed insulated relation to said wall and laterally spaced apart with their surfaces lying substantially in the same plane; a third plate in spaced confronting relation to said pair of plates having an opening therein; a flexible member electrically connecting the third plate with said wall member and movably supporting it for swinging movement about an edge thereof in a direction normal to its surface; a transformer having a primary coil and a secondary coil, the secondary coil having its ends respectively connected to said pair of plates, and the primary coil having leads extending between said pair of plates and through said opening in the third plate; connection terminals for said leads supported

on said wall, one of said terminals being insulated as to the wall and the other being electrically connected thereto; and digitally operable means mounted on said wall for moving said third plate.

3. In dielectric heating apparatus containing a tuned circuit; a wall member; a tuning condenser on one side of said wall member comprising a pair of plates; means supporting said plates in fixed insulated relation to said wall and laterally spaced apart with their surfaces lying substantially in the same plane; a third plate in spaced confronting relation to said pair of plates having an opening therein; a flexible member electrically connecting the third plate with said wall member and movably supporting it for swinging movement about an edge thereof; a coil positioned on the opposite side of said pair of plates from said third plate with connection leads extending between said pair of plates and through said opening in the third plate; connection terminals for said leads supported on said wall, one of said terminals being insulated as to the wall and the other being electrically connected thereto; and digitally operable means mounted on said wall for moving said third plate.

4. In dielectric heating apparatus containing a tuned circuit: a wall member; a tuning condenser on one side of said wall member comprising a fixed plate and a movable

plate; means supporting the fixed plate in insulated relation to said wall member; a flexible resilient member electrically connecting the movable plate with said wall member and supporting the plate for swinging movement about an edge thereof in a direction normal to its surface; a pistol grip handle secured to said wall and extending from the side thereof opposite said condenser; an elongate member pivoted at one end on said wall member for swinging movement, the other end of said elongate member being positioned to abut said movable plate; and a cam adjacent the pivoted end of said elongate member operable to swingably adjust the angular position of said elongate member and vary the position of said movable plate in its swinging movement, said cam having a portion positioned for operating engagement by a digit of an operator's hand while gripping the pistol grip handle.

References Cited in the file of this patent

UNITED STATES PATENTS

1,538,472	Crosley	May 19, 1925
1,616,093	Stein	Feb. 1, 1927
1,891,283	Kilgour	Dec. 20, 1932
2,465,102	Joy	Mar. 22, 1949
2,596,636	Wright	May 13, 1952