Sept. 2, 1958 M. SIEGEL 2,850,609

APPARATUS FOR TREATING FUSIBLE MATERIAL

Filed March 16, 1956

FIG. 1

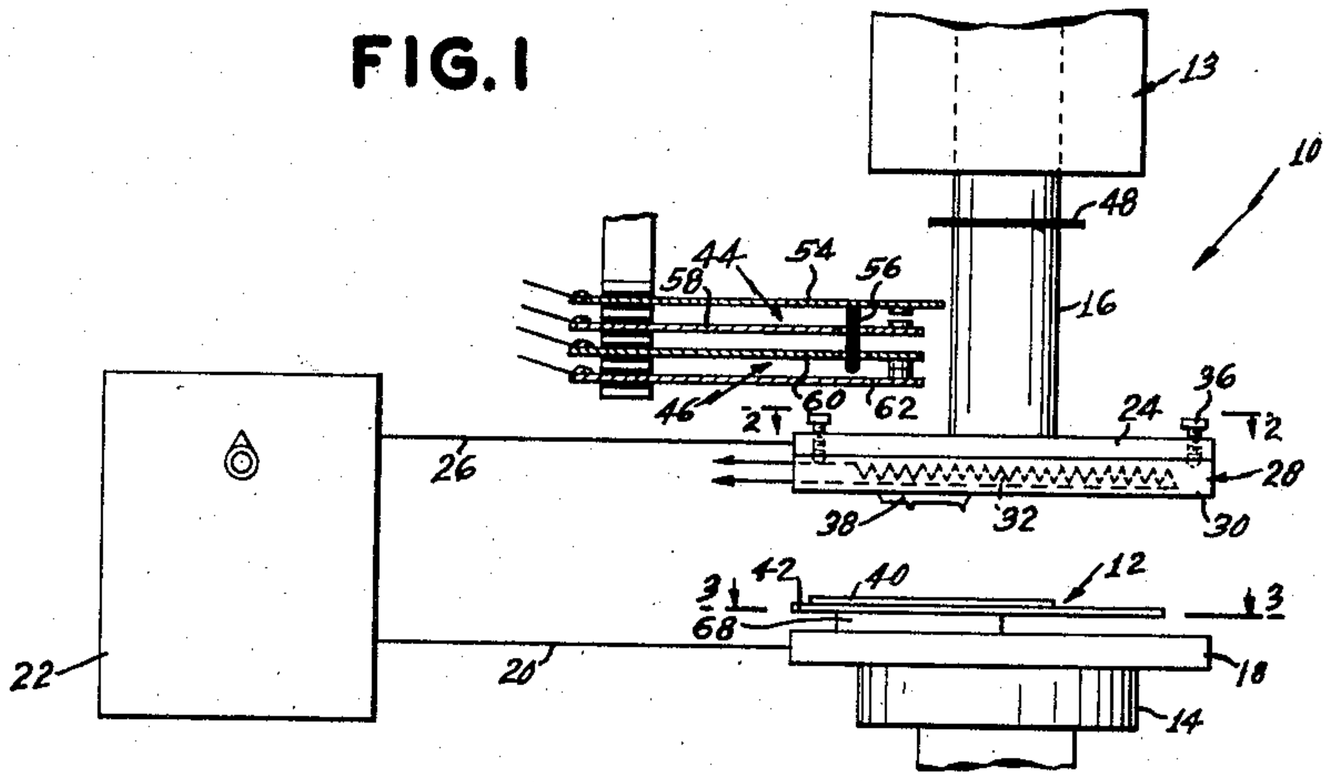


FIG. 2

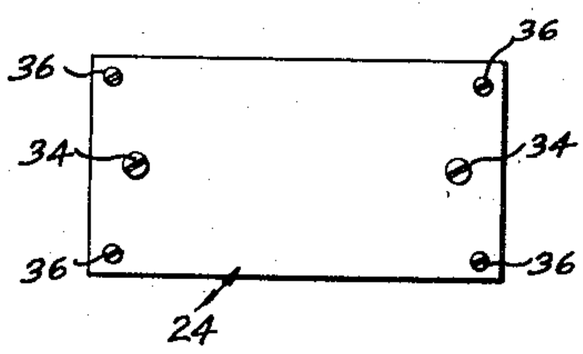


FIG. 3

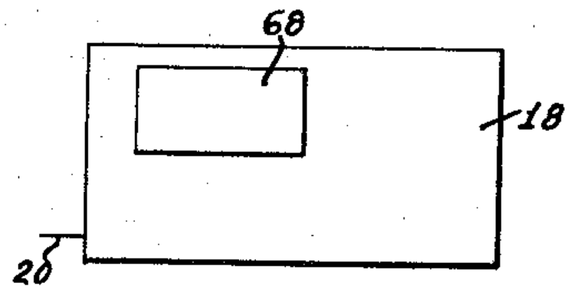


FIG. 4

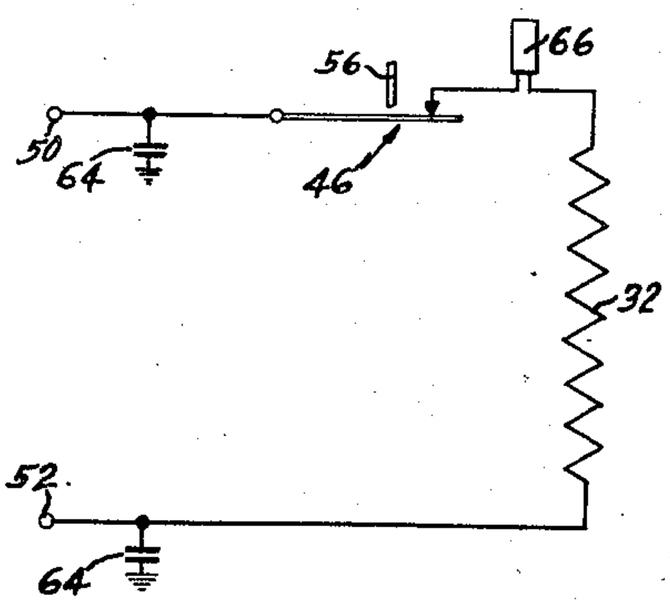
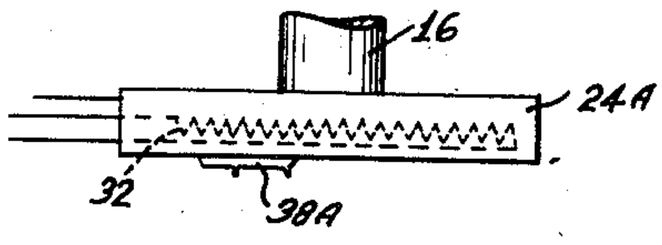


FIG. 5



INVENTOR.
Martin Siegel
BY Edwin Lavergne
Harry Cole
ATTORNEYS

United States Patent Office

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APPARATUS FOR TREATING FUSIBLE MATERIAL

Martin Siegel, Roslyn, N. Y., assignor to Aristocrat Leather Products, Inc., New York, N. Y., a corporation of New Jersey

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2 Claims. (Cl. 219—10.47)

The present invention relates, in general, to the treatment of fusible materials and, in particular, to an improved apparatus and methods therefor.

It is well known in the art to seal, emboss or otherwise treat fusible or thermoplastic materials through the use of an externally heated die or through the use of high frequency energy for generating heat within the material itself. While it is frequently more desirable to use the latter, or "electronic heating" apparatus for treating thermoplastic materials, said apparatus nevertheless has the disadvantage, when compared with the use of a directly heated or externally heated die, that the power requirement for high frequency dielectric heating is very much greater than the power requirement for the external heating of the die or of the thermoplastic material.

Therefore, the primary object of the present invention is to obviate the foregoing disadvantages of the prior art and yet to retain the advantages inherent in the use of internally generated heat for sealing, embossing or otherwise treating fusible materials.

Another object is the provision of means and methods for reducing the power required for electronic heating operations.

Another object is to increase the capacity of electronic heating devices or to reduce the operating cycles thereof without the necessity of increasing the power requirements thereof.

A further object is the provision of means and methods for reducing the dissipation or transfer of the heat generated in fusible material by an electronic heating apparatus.

The above and other objects, features and advantages of the present invention will be more fully understood from the following description considered in connection with the accompanying illustrative drawings.

Referring now to the drawings in detail, which illustrate the best modes presently preferred for practicing the invention:

Fig. 1 is a side view of an electronic heating apparatus pursuant to the present invention, illustrated more-or-less in schematic fashion, a portion thereof being shown in section for purposes of illustration;

Fig. 2 is a plan view taken on the line 2—2 of Fig. 1;

Fig. 3 is a plan view taken on the line 3—3 of Fig. 1;

Fig. 4 is a wiring diagram; and

Fig. 5 is a fragmentary view similar to Fig. 1, illustrating a modification.

Referring now to Figs. 1 to 4 in detail, there is illustrated an electronic heating apparatus **10**, pursuant to the present invention, for heating fusible or thermoplastic material, generally indicated by the reference numeral **12**. As here shown, provision is made for a press **13** constituted by a stationary support **14** and a vertically reciprocable ram **16**. The support **14** mounts a base plate **18** which is connected as by the conductor **20**, to a high frequency electric generator **22**.

The ram **16** mounts a plate **24**, which is suitably electrically insulated therefrom and which is connected, as

by the conductor **26** to the high frequency generator **22**. The plates **18** and **24** constitute the electrodes of a high frequency or dielectric heating apparatus, the power thereto being supplied by the high frequency current generator **22**.

Pursuant to the present invention, the electrode **24** is provided with an external heating means **28**. As here shown, the external heating means **28** is constituted by a die carrier casing **30** provided with an electric heater coil or resistance element **32**. The casing **30** is suitably secured to the electrode plate **24**, as by the screws **34—34**. Provision is also made in the electrode plate **24** for the leveling screws **36** which abut against the casing **30** for adjusting the latter to register the die **38** with the work **12**.

The casing **30**, at its undersurface, mounts or carries the die **38** which is heated by the heater **32**. Die **38** may be of any type suitable for its intended use and purpose. For example and not by way of limitation, the die **38** may be an embossing die for embossing the work **12**, or it may be a sealing die where portions of the work **12** are to be sealed together, or it may be a combined embossing and sealing die, or the die **38** may have provision to form a tear seal in the work, as in Patent No. 2,710,046 dated June 7, 1955, issued to George Markus and Martin Siegel, and assigned to the assignee hereof. In this connection, it will be noted that, as here shown, the work **12** may be constituted by the sheets **40** and **42** of thermoplastic material and, as indicated, the apparatus **10** may be utilized to seal said sheets together, to emboss the upper one of the sheets, to form a tear seal in the upper sheet **40**, or for any combination of these processes, all depending upon the particular type of die **38** which is being used in the apparatus.

Provision is made for a pair of switches **44** and **46** which are operated by an insulation cam member **48** provided on the ram **16**, during the downward travel of the ram for engaging the die **38** with the work **12**. The switch **44** is a normally open switch in the energizing circuit for the generator **22**, and operates when closed to turn on the generator **22**, this occurring when the ram **16** has moved the die **38** into engagement with the work **12**. The switch **46** is a normally closed switch in circuit with the electric resistance heating element **32**, as best seen in Fig. 4. The switch **46** completes the energizing circuit between the heater **32** and its electric power source, indicated at **50—52**.

The upper leaf **54** of the switch **44** is provided with a rod **56** of insulation material which passes through an aperture in the lower leaf **58** of the switch **44** and through an aperture in the upper leaf **60** of the switch **46**. Consequently, it will be noted that, in the retracted position of the ram **16**, as illustrated, the generator **22** is inoperative since its On-Off switch **44** is open, and the energizing circuit for the heating element **32** is closed by the switch **46** for heating the die **38**. When the ram **16** moves downwardly to bring the die **38** into engagement with the work **12**, the insulated cam **48** engages the upper leaf **54** of the generator starting switch **44**, to close the latter switch, and urges the rod **56** against the lower leaf **62** of the heating element switch **46**, for opening the latter switch to de-energize the heating element. Therefore, it will be apparent that, in the retracted condition of the ram **16**, the die **38** is being heated by the external heating source constituted by the resistance element **32** and the high frequency generator is inoperative. When the die **38** engages the work **12**, the energizing circuit for the external heating element is interrupted and the energizing circuit for the high frequency heating apparatus is completed. The high frequency generator **22** being turned on, power is supplied to the electrodes **24** and **18**, and heat is generated, by dielectric action, in the work **12** disposed between the electrodes, in the usual manner.

Heretofore, in the case of dielectric heating of work disposed between the electrodes of a high frequency heating apparatus, much of the heat generated within the work was dissipated or transferred into the ambient atmosphere and, through the associated unheated die, into the metallic parts of the press mounting the electrodes of the heating device. However, pursuant to the present invention it will be noted that the die **38**, casing **30**, and the electrode **24** are all heated by the electric heating element **32**, before the start of the dielectric heating operation by the closing of the switch **44**, so as to provide heated parts and a heated area about the work **12** when the die engages the work and the electrodes are energized. I have found that the heated die and other heated parts minimize or reduce the transfer of the internally generated heat from the work into the adjacent metallic parts of the press **13** and the heated area about the work **12**, resulting from the positioning of the heated parts adjacent the work, materially reduces the loss or dissipation of the internally generated heat into the ambient atmosphere. As a result of the reduction in the heat loss or heat transfer from the work **12**, many advantages may be derived from the use of the dielectric heating apparatus of the present invention. For example, the present apparatus requires less power than a conventional dielectric heating apparatus of the same capacity. In the alternative, for the same amount of power as heretofore used in a conventional dielectric heating apparatus of the same capacity, the capacity of the present apparatus can be materially increased by adding additional dies thereto for simultaneously treating additional work. Consequently, the output of a dielectric heating apparatus can be increased without increasing the power required therefor. In addition, I have found that by retaining the same amount of power heretofore required for a dielectric heater of the same capacity, it is possible to greatly reduce the time required for a particular operation. For example, and not by way of limitation, I have found that the time required for a particular embossing operation has ben reduced from approximately six seconds to approximately one and a half seconds, without increasing the radio frequency power supplied to the dielectric heating apparatus, by the use of the external heating means **28** of the present invention. Consequently, it will be apparent that the time cycle of the apparatus **10** is greatly reduced as compared with a similar apparatus of the same capacity and using the same amount of radio frequency energy but not provided with the external heating means **28**.

In order to further reduce the possibility of the dissipation or transfer of the internally generated heat within the work **12**, a layer **68** of insulating material may be provided on the electrode plate **18** and the work **12** may be mounted on the insulating layer **68** as illustrated in Fig. 1. This will reduce the heat transfer to the support **14**.

In order to eliminate the possibility of feeding radio frequency energy into the A. C. mains used to supply the electric heater **32**, the wiring circuit thereof may be provided with the radio frequency filter condensers **64—64**, as illustrated in Fig. 4. In addition, provision may be made in said wiring circuit for a thermostat **66** so as to interrupt the energizing circuit for the heater **32** above a predetermined temperature.

Referring now to the modification illustrated in Fig. 5, it will be noted that the electric heating device **32** may be directly incorporated into the electrode **24A** so as to eliminate the necessity for a separate casing **30** for the heater illustrated in Fig. 1, the die **38A** being carried by the electrode **24A**. In all other respects the apparatus illustrated in Fig. 5 functions and operates in the same manner as that illustrated in Fig. 1.

The terms die or die means, as used in the appended claims, includes, without limitation, a sealing die, a cutting die, an embossing die, a die to form a tear edge, or any combination thereof.

While I have shown and described the preferred embodiments of my invention, it will be understood that various changes may be made in the idea or principles of the invention within the scope of the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. Apparatus of the character described comprising a generator of high frequency electric energy, a base constituted by a first electrode connected to said generator, a second electrode connected to said generator and mounted on a ram for reciprocation relative to said base for generating heat within material mounted by said base, said second electrode having provision to mount a die for said material, a heater for heating the die, cam means mounted on said ram for reciprocal movement therewith, switch means disposed in the path of said cam means, said switch means comprising a normally open start switch for said generator and a normally closed switch in circuit between said external heater and an energizing source therefor, the downward movement of said cam means causing engagement thereof with said switch means whereby to close said start switch and open said external heater switch when said second electrode has moved to said base.

2. Apparatus of the character described comprising a generator of high frequency electric energy, a base constituted by a first electrode connected to said generator, a second electrode connected to said generator and mounted on a ram for reciprocation relative to said base for generating heat within material mounted by said base, said second electrode having provision to mount a die for said material, a heater for heating said die, cam means mounted on said ram for reciprocal movement therewith, switch means disposed in the path of said cam means, the downward movement of said cam means causing engagement thereof with said switch means to activate said high frequency energy source and deactivate said die heater when said electrodes are moved toward each other.

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