June 30, 1942. E. L. CRANDELL 2,288,268

ELECTROSTATIC HEATING SYSTEM

Filed May 1, 1941

Fig. 1.

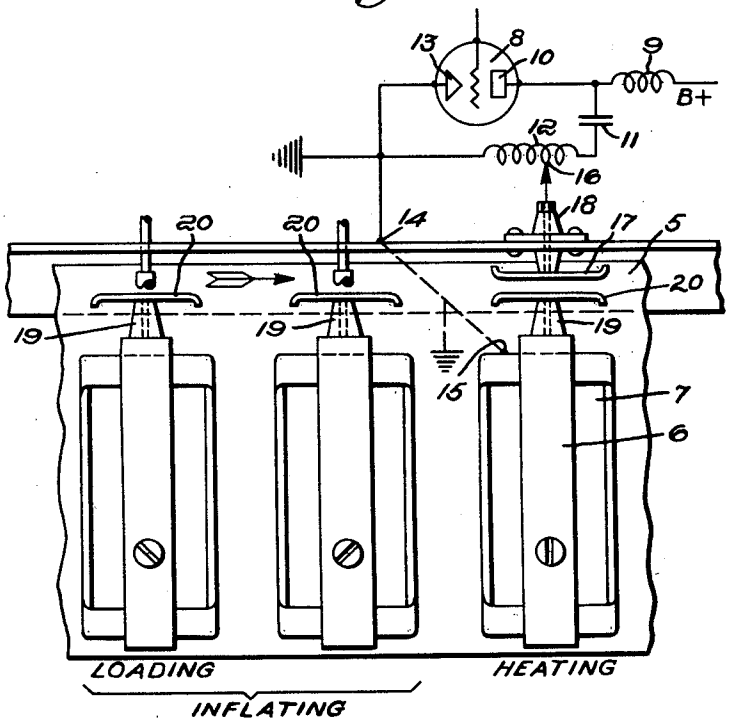


Fig. 2.

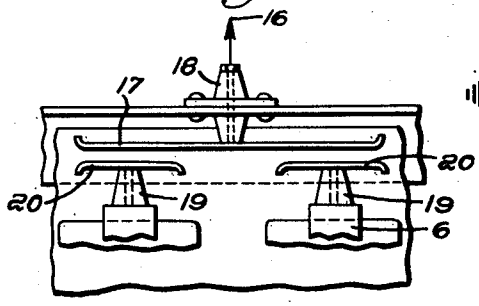
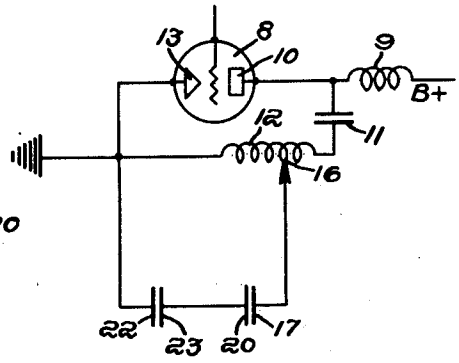


Fig. 3.



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ELECTROSTATIC HEATING SYSTEM

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6 Claims. (Cl. 219—47)

This invention relates to the cementing together of adjacent parts of an article of manufacture through the application of heat derived from an electric field, and relates more particularly to the application of high frequency electrostatic fields to a conveyor system for heating the adhesive between adjacent parts of moving articles.

It has been proposed heretofore, to utilize high frequency electrostatic energy for heating the adhesive between adjacent parts of an article of manufacture for cementing the parts together. The Pitman Patent No. 2,087,480 and the Smith Patent No. 2,109,323 disclose the cementing of shoe parts together through the use of such energy.

This invention provides features which are useful for the application of high frequency electrostatic fields to loads moving on a conveyor in mass production.

One feature of the invention resides in coupling the load circuits on a moving conveyor by capacity coupling. A stationary plate type member is connected to the anode circuit of a vacuum tube oscillator and a plurality of similar plate type members are mounted on the conveyor and connected to the load circuits, and are so arranged that during movement of the conveyor they pass in parallel alignment with, and relatively close to, the stationary member so that the air therebetween forms the dielectric of a coupling condenser.

Another feature of the invention resides in utilizing the load circuits described in the foregoing as capacities connected in series with the above described work coupling capacities and the anode circuits of vacuum tube oscillators.

Utilizing these features, the wiring is simplified; the sparks which result from brush and commutator contacts are eliminated so that the device may be used in atmospheres where explosive gases may be present, and the usual variations in the capacities of the load circuits during the heating cycles do not affect the electric current flow from the oscillator to the work circuits.

An object of the invention is to simplify the application of high frequency electrostatic fields tc moving work circuits.

A more definite object of the invention is to eliminate brush and commutator connections and inductive couplings for electrically connecting oscillator output circuits to the load circuits of a conveyor system.

The invention will now be described with reference to the drawing, of which:

Fig. 1 is a diagrammatic view of one embodiment of the invention illustrating the capacitive coupling of an oscillator to the individual shoe circuits of a conveyor system;

Fig. 2 is a diagrammatic view of an alternative arrangement, illustrating two shoe circuits capacitively coupled simultaneously to one oscillator circuit, and

Fig. 3 is a circuit schematic illustrating the relation of a work coupling capacity and of a shoe circuit capacity to the anode circuit of an oscillator.

The details of the conveyor indicated generally by **5**; its associated presses **6**; the inflatable pads **7**, and the shoes supported thereon are fully disclosed in said Smith patent.

The power triode **8** is shown connected in a standard single ended oscillator circuit comprising the r. f. choke **9** supplying high voltage direct current from a suitable rectifier source, to the anode **10** of the tube. The anode **10** is connected through the blocking condenser **11** to one end of the oscillator tank coil **12**, the other end of the tank coil being connected to the cathode **13** of the tube and to ground. The circuit is grounded to the casing of the conveyor at **14** and to the jack frame of the presses **6** at **15**.

The tap **16** on the coil **12** is connected to the stationary coupling plate **17** which is mounted to the stationary frame of the conveyor by the insulator **18**. Each of the presses **6** of Fig. 1 has mounted thereon by means of an insulator **19**, the plate **20** which is arranged parallel to and relatively closely spaced from the plate **17** when in alignment therewith.

As the presses **6** are moved by the conveyor **5** and stopped in the heating positions as described in said Smith patent, the energy from the oscillator anode circuit is conducted to the electrodes in the press through the capacity coupling of the spaced plates **17** and **20** forming the plates of a condenser.

The electrodes of the shoe circuit may be the electrode **22** which may be similar to the lower electrode **22** of said Smith patent, and the electrode **23** which may be similar to the upper electrode **23** of said Smith patent.

As illustrated by Fig. 3, the shoe circuit electrodes **22** and **23** form a capacity which is connected in series with a capacity formed by the load coupling plates **17** and **20**. The capacity of the shoe circuit changes during the heating cycle but the only effect of this capacity change

as is obvious from Fig. 3, is to change slightly the frequency of the oscillator. However, no substantial current change occurs with the result that the field between the electrodes remains substantially constant throughout the heating cycle.

Fig. 2 illustrates an arrangement in which the stationary coupling plate 17 is made long enough to align simultaneously with two variable coupling plates 20. With this arrangement, two shoe circuits are simultaneously coupled to the oscillator circuit so that two shoe assemblies may be heated at the same time. Otherwise, the embodiment of Fig. 2 is similar to that of Fig. 1. Of course when two shoe circuits are coupled at the same time to the oscillator circuit, the capacity between the electrodes 22 and 23 of Fig. 3 would be doubled.

While the invention has been described in connection with the manufacture of shoes, it is believed to have utility in other fields involving the application of high frequency electrode energy to moving load circuits. It should be understood therefore that the scope of the invention is limited only as indicated by the appended claims.

What is claimed is:

1. An electric heating system comprising an oscillator; a conveyor including a plurality of pairs of work circuit electrodes arranged to be advanced in succession for coupling to said oscillator; a stationary plate connected to one side of said oscillator; means for grounding the other side of said oscillator and one electrode of each of said pairs to said conveyor, and a plurality of movable plates connected to the other electrodes of said pairs and arranged to be advanced with their associated electrodes in substantially parallel alignment with said stationary plate to capacitively couple their associated electrodes to said one side of said oscillator.

2. An electric heating system comprising an oscillator; a plurality of pairs of work circuit electrodes arranged to be advanced in succession for coupling to said oscillator; means for grounding one side of the output circuit of said oscillator and one of the electrodes of each of said pairs; a stationary plate connected to the other side of said circuit, and movable plates connected to the other electrodes of each of said pairs and arranged to be advanced with their respective electrodes, in parallel alignment with said stationary plate for capacitively coupling said other electrodes to said other side of said circuit.

3. An electric heating system comprising an oscillator; a plurality of work circuits arranged to be moved in succession for coupling to said oscillator; said circuits including electrodes, and means including means for connecting two of said electrodes in parallel, for coupling pairs of said circuits in succession to said oscillator.

4. An electric heating system comprising an oscillator; a conveyor including a plurality of pairs of work circuit electrodes arranged to be advanced in succession for coupling to said oscillator; a stationary plate connected to one side of said oscillator; means for grounding the other side of said oscillator and one electrode of each of said pairs to said conveyor, and a plurality of movable plates connected to the other electrodes of said pairs and arranged to be advanced with their associated electrodes in substantially parallel alignment with said stationary plate to capacitively couple their associated electrodes to said one side of said oscillator, said stationary plate having sufficient length to align simultaneously pairs of said movable plates for coupling simultaneously two of said pairs of electrodes to said oscillator.

5. A shoe cementing system comprising an oscillator; a conveyor having a casing and including a plurality of shoe presses having jack frames; pairs of electrodes carried by said presses, a stationary plate connected to one side of said oscillator; means for grounding one side of said oscillator to said casing and one of each of said pairs of electrodes to its associated jack frame and to said casing, and a plurality of movable plates connected to the other electrodes of said pairs and arranged to be advanced with their associated electrodes in substantially parallel alignment with said stationary plate to capacitively couple their associated electrodes to said one side of said oscillator.

6. A shoe cementing system comprising an oscillator; a conveyor having a casing and including a plurality of shoe presses having jack frames; pairs of electrodes carried by said presses, a stationary plate connected to one side of said oscillator; means for grounding one side of said oscillator to said casing and one of each of said pairs of electrodes to its associated jack frame and to said casing, and a plurality of movable plates connected to the other electrodes of said pairs and arranged to be advanced with their associated electrodes in substantially parallel alignment with said stationary plate to capacitively couple their associated electrodes to said one side of said oscillator, said stationary plate having sufficient length to align simultaneously pairs of said movable plates for coupling simultaneously two of said pairs of electrodes to said oscillator.

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