Jan. 6, 1931. T. E. MURRAY, JR., ET AL 1,788,201

MACHINE FOR MAKING RADIATORS AND OTHER STRUCTURES

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Fig. 1.

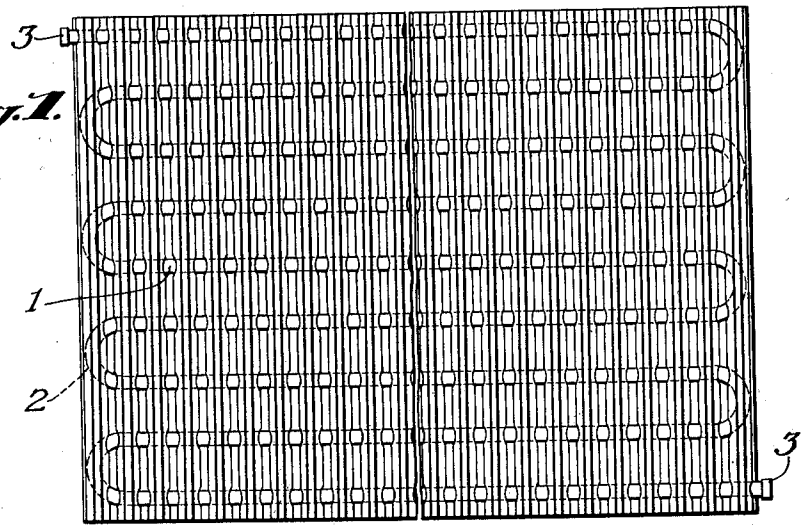


Fig. 2.

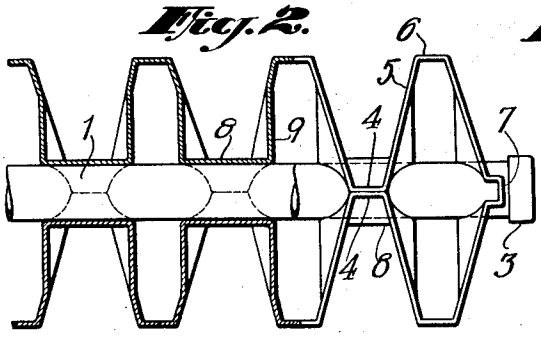


Fig. 3.

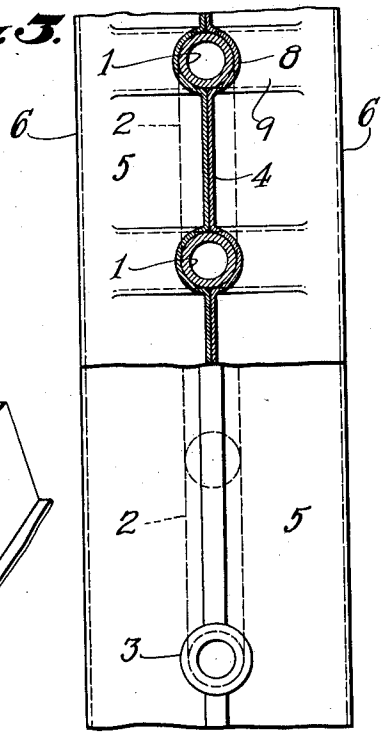
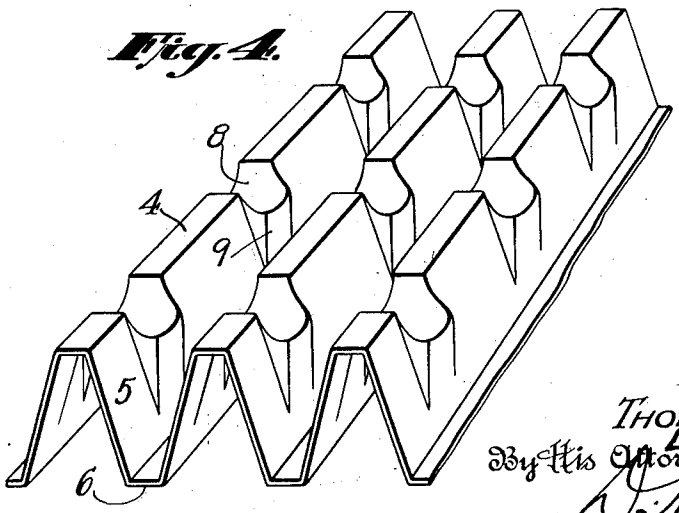


Fig. 4.



Inventors:
THOMAS E. MURRAY, JR.
LEROY H. HOFFER
By His Attorney
D. Anthony Mina

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MACHINE FOR MAKING RADIATORS AND OTHER STRUCTURES

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Fig. 5.

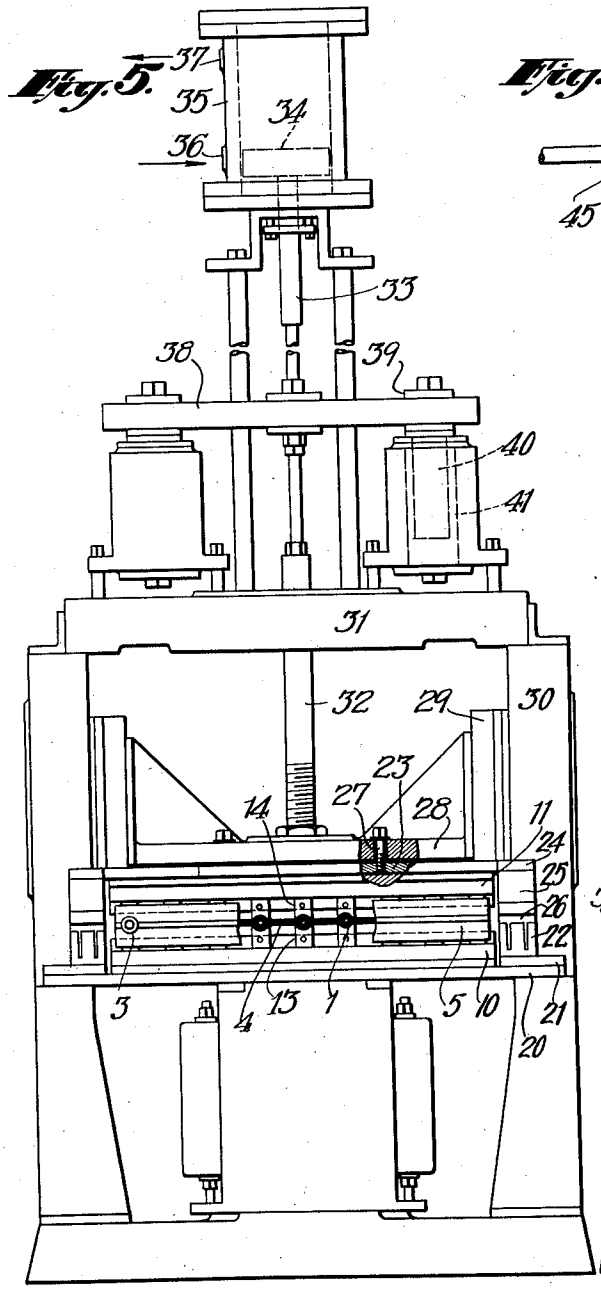
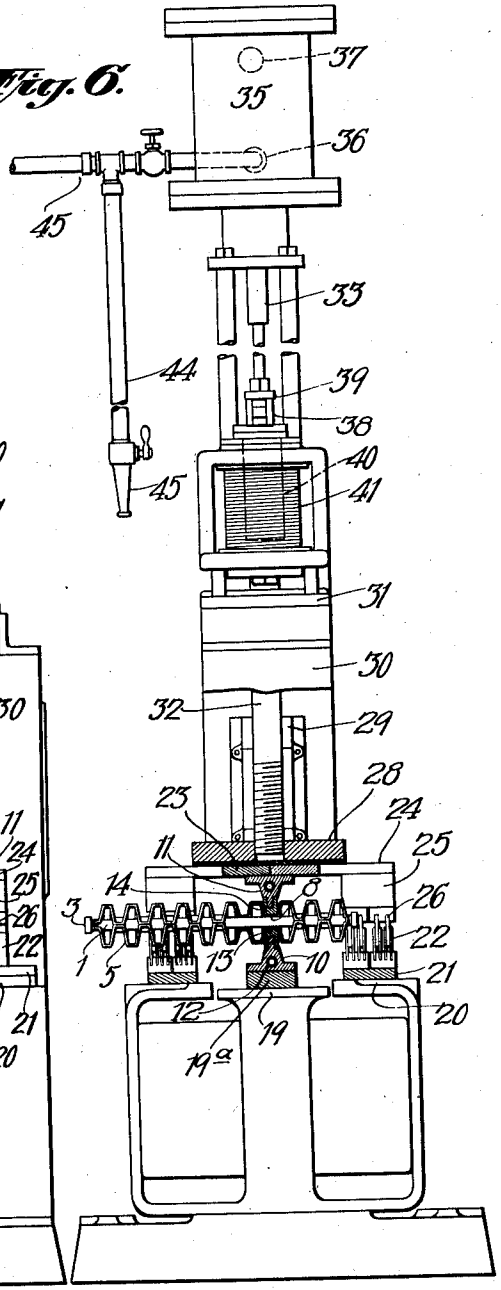


Fig. 6.



Inventors
THOMAS E. MURRAY JR.
LEROY H. HOFFER
By their Attorney
D. Anthony Usina

Jan. 6, 1931. T. E. MURRAY, JR., ET AL 1,788,201

MACHINE FOR MAKING RADIATORS AND OTHER STRUCTURES

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Fig. 7.

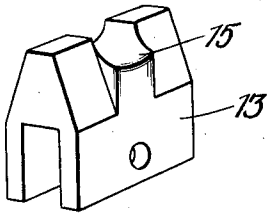


Fig. 8.

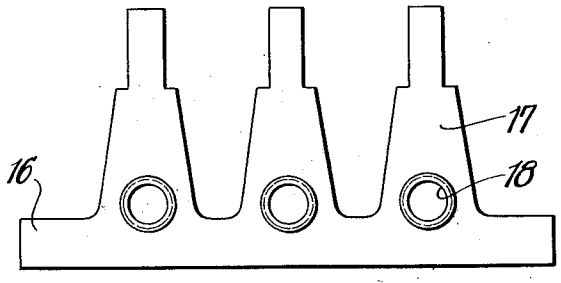


Fig. 9.

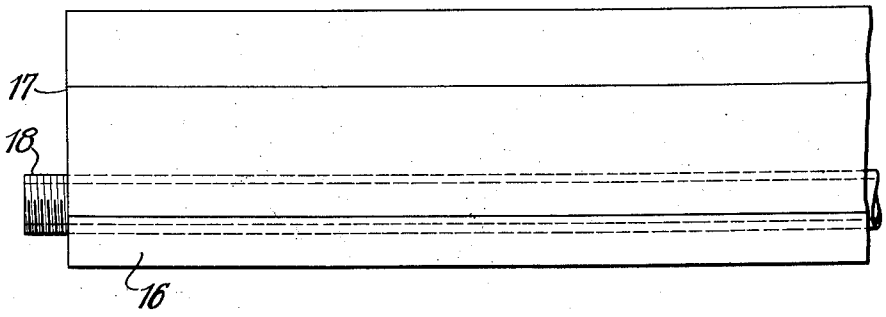
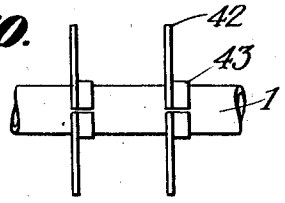


Fig. 10.



Inventors
THOMAS E. MURRAY Jr.
LE ROY H. HOFFER
By Their Attorneys
D. Anthony Usina

Patented Jan. 6, 1931 1,788,201

UNITED STATES PATENT OFFICE

THOMAS E. MURRAY, JR., AND LE ROY H. HOFFER, OF BROOKLYN, NEW YORK, ASSIGNORS, BY DIRECT AND MESNE ASSIGNMENTS, TO METROPOLITAN ENGINEERING COMPANY, A CORPORATION OF NEW YORK

MACHINE FOR MAKING RADIATORS AND OTHER STRUCTURES

Application filed February 27, 1926. Serial No. 91,023.

Our invention aims to provide means for forming and uniting the parts of a certain type of radiators and other structures. The accompanying drawings illustrate embodiments of the invention.

Fig. 1 is a side elevation of a radiator;

Fig. 2 is a partial plan and partial section of the same;

Fig. 3 is a partial end elevation and partial section of the same;

Fig. 4 is a perspective view of a portion of the radiating structure;

Fig. 5 is a side elevation of the machine for applying the radiating structure to the tubular vessel which carries the heating medium;

Fig. 6 is an end elevation of the same partly broken away;

Fig. 7 is a perspective of a detail;

Fig. 8 is an end elevation, and Fig. 9 is a side elevation of an alternative electrode.

Fig. 10 is a side elevation illustrating a different style of radiator.

Referring first to Figs. 1 to 4, the vessel which carries the steam, hot water or other heating medium is in the form of a number of parallel lengths 1 of tubing connected at alternate ends by bends 2. The tubing is enclosed in the radiating structure except in the projecting ends which carry couplings 3. These pipe ends may be at opposite ends of the radiator as illustrated, or both at the same end, and the number of lengths of piping may be varied as well as the arrangement and method of connecting up the different lengths. The pipes may be of wrought iron or steel or copper or brass or other suitable metal and may be substituted by vessels of other shapes.

The radiating structure is made of sheet metal, preferably thin sheets of copper corrugated in the horizontal plane and embracing the pipes or other vessels at the opposite sides with a good contact so as to absorb heat efficiently therefrom; the corrugated form serving to provide flues through which the air ascends as it is heated. In the plan view, Fig. 2, it will be seen that the radiating structure has narrow longitudinal portions 4 connected by oppositely inclined outwardly extending parts or plates 5 with narrow longitudinally extending parts 6. These parts may be at various angles and of various dimensions and may be curves merging into one another instead of the straight lines shown. The parts at opposite sides of the radiator may be made of a single sheet of metal extending over the end of the radiator as at 7 so as to provide an attractive smooth finish at the end. The same principle may be applied at both ends, using separate plates which overlap or meet at an intermediate point.

The inner portions 4 of the radiating structure are brought into contact from opposite sides so as to embrace the pipe around its entire circumference as shown in Fig. 3; though it is not essential that they completely surround the pipe and meet at the center. In order to embrace the pipe the parts 4 are pressed out to the rounded shape shown at 8, Fig. 4, the metal at the same time spreading laterally as at 9, so as to increase the contact surface lengthwise of the pipe, and to bring the opposite corrugated plates close together without flattening the pipe.

In building the radiator the pipe is bent in an ordinary bending machine and the sheets of metal are corrugated and stamped to form the recessed portions 8 in any usual and suitable corrugating and stamping machines and are then assembled and brought to the machine shown in Figs. 5 and 6. Before assembling, solder, tin or similar material is preferably applied to the recesses 8 for uniting the sheets to the pipe at these points. Instead of soldering the parts, however, they may be welded together, or brazed or otherwise united by heat and necessary pressure.

The machine is designed to solder or otherwise unite the parts, acting in one operation on all the joints along one of the plates 4 (nine joints on each side where there are nine lengths of pipe as in the case illustrated). There are two oppositely placed electrodes 10 and 11 made of cast copper with embedded wrought iron pipes 12 which carry cooling fluid for preventing distortion by overheating. These electrodes carry pressing blocks

or bars 13 and 14 shaped to embrace the recessed portions of the radiator and press them around and against the pipe. A view of one of said blocks, 13, is illustrated in Fig. 7 having a recess 15 in its operative face for the purpose stated. The two opposed blocks are identical. The upper electrode being lifted, the assembled radiator parts are introduced to bring the first open corrugation on the under side resting on the lower electrode or shaping blocks 13. The upper electrode is then lowered to press the parts together and to pass a current between the electrodes and through the work sufficiently to melt the solder or to weld the parts together and a short heavy pressure is applied to complete the union. The upper electrode is then lifted and the work shifted to bring the next line of joints over the lower electrode, whereupon the previous operations are repeated. In this way each line of joints in succession is made.

A number of lines of joints may be made at once by using what may be called multiple electrodes. Such a bottom electrode is shown at 16 in Figs. 8 and 9 with three projecting portions 17 each carrying a separate cooling pipe 18 and each adapted to carry a separate set of pressing blocks. A correspondingly shaped upper electrode will be used so as to make three lines of joints at once. The same principle may be applied to the making of all the joints for a complete radiator at one operation where the radiator is small enough or the machine large enough and of sufficient power mechanically and electrically.

The machine comprises a combination of features which make it particularly useful for this class of work and for similar soldering, brazing and welding work. The bottom electrode is mounted on the inner arm or terminal 19 of the secondary of a transformer of the ordinary welding type, the opposite terminals 20 of which carry conducting plates 21 with pairs of upright contact blades 22. The upper electrode is carried on a pair of longitudinal bus bars 23 which at their ends have lateral extensions 24 carrying on their under side blocks 25 having downwardly extending contact bars 26 registering with the contacts 22. When the upper electrode is lifted sufficiently to insert the work or to shift it from one line of joints to the next the contacts 26 and 22 are separated from each other and the circuit is broken. When the upper electrode is lowered, the circuit is closed through the work and the latter is heated as above described. The upper electrode and the bars 23 are united as by bolts 27 (Fig. 5) to a crosshead 28 having at its end guides 29 sliding in ways on the end posts 30 of the frame, which are united at the top by a cross brace 31. The crosshead 28 is carried on the lower end of a rod 32 which passes upward through the cross brace 31 and is suspended from the lower end of a plunger 33 which is connected to the piston 34 in a cylinder 35 with ports 36 and 37 for connection to air pipes or similar operating fluid.

At an intermediate point in the rod 32 it is connected to crossbars 38 which at their ends are connected to the cores 40 of powerful solenoids 41. The coils of these solenoids are connected to a source of supply through a suitable switch, not necessary to illustrate. It will be understood also that the admission of relief of the air pressure are controlled by the usual or suitable valves.

The air cylinder is used chiefly for lifting the upper electrode. When the work is in place the electrode may be lowered by merely relieving the air pressure on the under side of the piston, allowing the parts to descend by their weight. Pneumatic pressure may be applied to the top of the piston to force the electrode down. But in the final operation, the circuit of the solenoids is closed and this gives a quick powerful action such as is necessary to effect the take-up almost instantaneously. Where solder is used it is important that the take-up should occur quickly and fully as soon as the solder becomes fluid. An air cylinder and a solenoid or other electro-magnet form a very efficient combination for securing the long stroke and the short powerful take-up.

We have illustrated the machine as applying the radiating structure to circular pipes of comparatively small diameter which have sufficient strength to resist the pressure without being materially distorted. By suitably modifying the shape of the pressing blocks 13 and 14 the machine may be used for applying corrugated plates or the like to conduits or vessels of other shaps and sizes; such, for example, as the rectangular or lenticular vessels described in the co-pending applications of Thomas E. Murray, No. 725,559 filed July 12, 1924 and No. 43,444, filed July 14, 1925. Where the wall of the pipe or vessel is so thin or is so shaped as to be distorted by the pressure, a mandrel may be inserted of copper, steel or other material which will support the vessel against collapsing and will at the same time conduct heat and current.

The machine is adapted for applying to the vessel, not only the corrugated plates above described, but also radiating structures of other shapes; such for example as are shown in Fig. 10. Here for example are shown separate fins 42 applied to a pipe 1. The fins are provided with flanges 43 having curved faces bearing on the pipe at opposite sides and soldered or welded to the pipe at opposite sides by suitably shaped pressing blocks analogous to the blocks 13 and 14 of Fig. 6.

The contact blades 22 and 26 carry the current to the bus bars 23 which distribute

the current evenly to the several pressing blocks 14, the contacts being arranged to do this as the blocks come together about the work. It is not necessary to maintain the current while the parts are being pressed together. The blocks may be heated beforehand, by the electric current or otherwise, and then brought into engagement with the work; whereupon they will give up heat sufficient to melt the solder and unite the parts firmly. In fact it is only necessary to apply the solder or tin to the surface, to press the parts together in such a way as to prevent distortion, and during such pressure, to apply sufficient heat to melt the solder or tin.

It is advantageous to chill or cool the solder promptly. This can be done by blowing air through the pipe or vessel. The machine is provided for this purpose with a flexible hose 44 connected to the air pressure pipe 45. After each soldering operation, or a certain number of such operations, the workman will insert the nozzle 46 into the end of the pipe 1 and blow air through it. This hardens the solder and quickly cools the entire structure to a working temperature. Instead of connecting the hose to the pressure pipe, it may be connected to the exhaust port 37 of the air cylinder, to blow air whenever the upper electrode is lifted.

It is preferable to use for the pressing blocks 13 and 14 metal of a higher resistance than that of the electrodes 10 and 11 so as to get an increased heating effect. This is important where the joints are close together on a pipe. In extreme cases, for example where the corrugations are only half an inch apart or the joints spaced a half inch between centers, it is advisable to solder all the joints at once in order to prevent the heat from one operation melting the solder from the joint previously made.

The same conditions may be taken care of by leaving an air passage between the inside edges of the corrugations, the flat portions 4 of Fig. 2. This gives us an extra radiating surface to carry off the heat rapidly. The spacing between the parts 4 may be varied by varying the depth of the depressions 8.

In a co-pending application of Thomas E. Murray, No. 96,699, filed March 23, 1926, there is described a radiator in which an electric resistance heating element of cylindrical shape is combined with a radiating structure of corrugated plates in the same way as the steam pipes illustrated.

Radiators of the type described are not claimed in the present application, being covered in prior applications, particularly those of Thomas E. Murray, No. 709,080, filed April 26, 1924; Thomas E. Murray, No. 42,903, filed July 11, 1925 and Thomas E. Murray, Jr. No. 48,929, filed August 8, 1925.

The product is referred to as a radiator, but it will be understood that structures made on the same principle may be used not only for transferring heat or cold from the vessel to the air or other surrounding medium, but equally for transferring heat or cold from the surrounding medium through the radiating structure to the fluid within the vessel, as in the case of condensers in refrigerating plants, for example. And in either case the medium within the vessel may be admitted at one end and discharged at the other, or may be admitted and discharged through the same end as in the so-called "one-pipe" radiators. And the invention may be applied to the making of various other structures where parts are to be soldered, brazed, welded or otherwise united by heat and pressure.

No claim is made herein to the described combination of a fluid pressure motor and a solenoid; this being claimed in a co-pending application of Holmes No. 127,202, filed August 5, 1926.

It is not always necessary to weld or solder the plates of the radiating structure to the heating element directly. The plates 4 may be welded or soldered together at points above and below the heating elements so as to clamp the latter firmly between the plates, the electrodes in that case bearing on the intermediate portions of the plates 4 but not on the rounded portions 8 which embrace the tubes.

In some cases a radiating structure is applied to only one side of the heating elements, a strap being passed around the other side and its ends welded to the part 4 of the radiating structure. In other cases, where the radiating structure is applied to both sides of the pipe, additional overlying straps may be made to embrace the parts 8, being welded together above and below such points. Our present machine is adapted to the production of radiators of these and various other designs analogous to that illustrated.

No claim is made herein to the method described, such claims being presented in a divisional application.

Various modifications may be made by those skilled in the art without departing from the invention as defined in the following claims.

What we claim is:

1. A machine for uniting to a heating element of a radiator pieces of sheet metal having recessed portions fitting about said heating element, said machine including in combination a pair of opposed electrodes elongated to extend over a line of joints to be made between the sheet metal and different sections of the heating element, pressing devices carried by the electrodes shaped to engage the work at each joint in the line between the heating elements and about the heating elements, means for moving the opposed electrodes and pressing devices toward

each other to force the sheet metal pieces into close contact with the several sections of the heating element and with opposite sheet metal between the sections of heating element and means for passing a current between the electrodes and through the work to fix the parts of the latter in place.

2. A machine for uniting to a tubular element of a radiator pieces of sheet metal of extended surface for conducting the heat from said tube and transmitting it to the air, said machine including in combination means for uniting the parts by heat and pressure in a succession of operations at different points and means for passing a cooling medium through the tube to cool the work after each such operation.

3. A machine for uniting two opposite corrugated sheets to an interposed heating element extending transversely across the corrugations, said machine including in combination opposed electrodes adapted to enter the grooves in the outer faces of the two sheets and to press the inner surfaces of such grooves into close contact with the heating element and the inner surfaces of opposed plates into contact between said grooves, means for passing a current between the electrodes and through the work and thereby fixing the parts of the latter in place and means for separating the electrodes to permit the shifting of the work laterally to bring the next grooves in the outer faces of the corrugated sheets into alignment with the electrodes.

In witness whereof, we have hereunto signed our names.

THOMAS E. MURRAY, JR.
LE ROY H. HOFFER.