

March 19, 1968

J. LOUGHREY

3,373,467

FURNACE WALL REPAIRING DEVICE

Filed Oct. 21, 1965

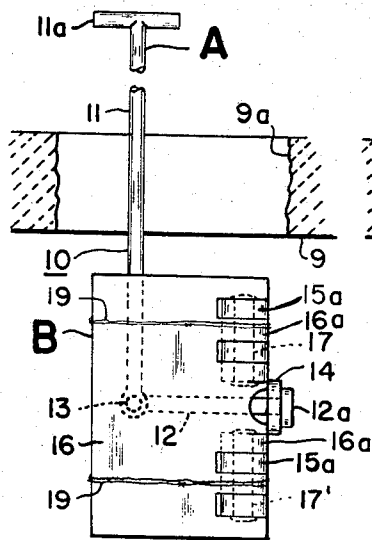


Fig. 1

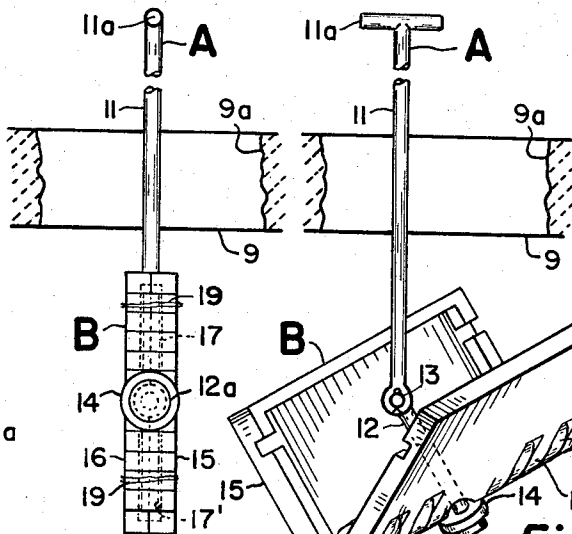


Fig. 2

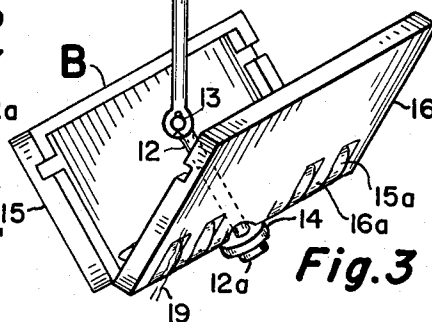


Fig. 3

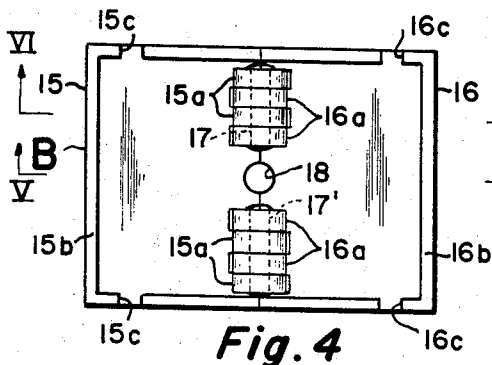


Fig. 4

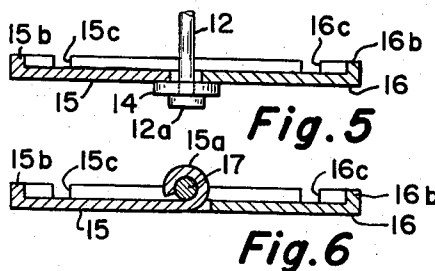


Fig. 5



Fig. 6

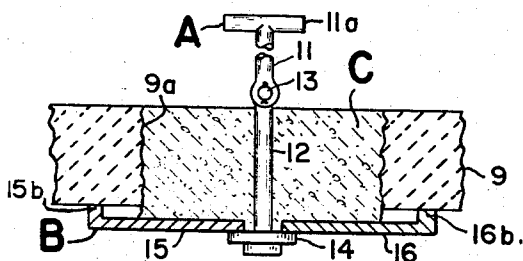


Fig. 7

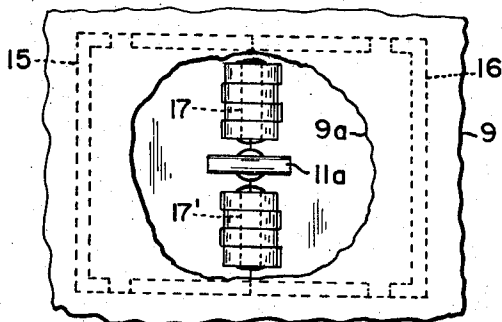


Fig. 8

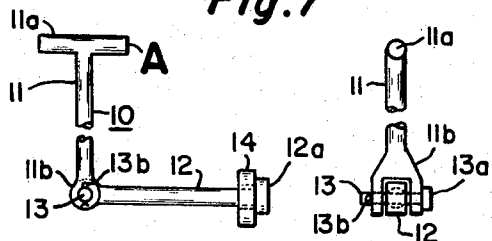


Fig. 9

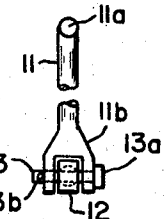


Fig. 10

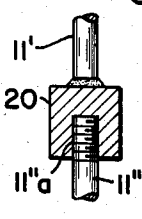


Fig. 11

INVENTOR.
Joseph Loughrey
BY Green, McCallister & Miller

HIS ATTORNEYS

1

3,373,467

FURNACE WALL REPAIRING DEVICE

Joseph Loughrey, 1550 Beverly Place,
Pittsburgh, Pa. 15206

Filed Oct. 21, 1965, Ser. No. 499,164

15 Claims. (Cl. 25—118)

ABSTRACT OF THE DISCLOSURE

A repair device is provided for facilitating cementing and closing a hole in a furnace wall or roof. The device has a pair of elongated, hinged, plate sections that are carried in a folded relation by a two-part suspension arm assembly for guided insertion endwise through the hole that is to be repaired. The folded plates are released after insertion in the furnace by the destruction of a binding string or cord and are spread-apart about the suspension arm assembly. The spread plates are pulled up beneath the hole to provide support for the cement during the repair operation, and an upper arm of the arm assembly is disconnected from a lower arm after the completion of the patching operation, in order that the upper arm may be reused for a second operation. The plates in their endwise-folded relation define a guide slot for positively guiding them into the hole in the furnace through the agency of the suspension arm assembly, and contain the lower arm of the assembly until the means retaining them in their folded relation is released. A swinging-opening action of the plates about a pivot connection to the suspension arm assembly does not become effective until the plates are to be opened beneath the hole in the furnace.

This invention relates to a furnace patching or repairing device and particularly, to a manipulator device that may be inserted through a hole or open portion of a furnace wall for quickly repairing burnt-out or damaged portions thereof.

There has been a need for a practical and inexpensive patching device for refractory furnace walls, such as for roof or side walls that are used in metal melting and refining furnaces, glass furnaces, etc. Such a device should make possible a quick, efficient and effective repair job, without completely cooling-down the furnace and particularly, in such a manner as to minimize down time as to the furnace operation. I have been able to meet this problem by a relatively simple form of device which can be inserted in a folded-up relation within the hole that is to be repaired and that will then spread-out so as to cover the inside of the hole and retain such a spread-out position until suitable patching cement or refractory material is filled in the hole and solidified.

It has thus been an object of my invention to devise a new and improved furnace wall patching or repairing device;

Another object has been to devise a manipulator device which may be inserted by a workman from the outside within a burnt-out portion of a refractory furnace wall and employed in such a manner as to quickly repair the burnt-out portion within a few minutes of down time and without the necessity of cooling down the furnace;

A further object of my invention has been to provide a furnace wall repair device which can be safely and effectively used by a workman during a short period in which the furnace heat is shut-off, so as to enable the quick cementing of the hole and immediate reapplication of the heat, and within a minimized down time;

These and other objects of my invention will appear to those skilled in the art from the following description and the illustrated embodiments, in which:

FIGURE 1 is a fragmental side view in elevation and

2

partial section, showing a device of my invention preliminarily inserted in a folded relation within a hole in a furnace wall;

FIGURE 2 is an end view of the device on the scale of and taken at 90° with respect to FIGURE 1, showing the relationship of the parts during its introduction or insertion into a furnace;

FIGURE 3 is a vertical view on the scale of FIGURE 1, showing a second step in the utilization of a device of my invention in which plate members of the device have been released from a tied-together relationship and are free to turn, rotate or swing within the furnace ready to close-off the opening from the inside thereof;

FIGURE 4 is a top plan view of the device of FIGURES 1, 2 and 3 on the same scale as such figures and showing its plate members in horizontal or spread-out or final relation for closing-off the inside of the hole;

FIGURES 5 and 6 are sectional views in elevation on the scale of and respectively taken along the lines V—V and VI—VI of FIGURE 4;

FIGURE 7 is a side section in elevation on the same scale as and taken in the same direction as FIGURE 1, showing the device of my invention in its final position and also showing how a hole in the furnace wall is repaired or sealed-off at such time;

FIGURE 8 is a top plan view on the scale of FIGURE 7 and also showing my illustrated device in its final closing-off position with respect to the hole in the furnace roof, with edges of its plate members overlapping inner wall portions of the roof adjacent the hole to close it off, so that sealing-off cement material may be employed in the manner indicated in FIGURE 7;

FIGURE 9 is a side view in elevation of an arm assembly of my illustrated device in the position of FIGURE 1;

FIGURE 10 is a fragmental end view in elevation on the same scale as and taken at right angles to FIGURE 9; and

FIGURE 11 is a slightly enlarged vertical fragment in elevation and partial section, taken in the same direction as FIGURE 10 and illustrating a modification of the arm structure of FIGURES 9 and 10.

In FIGURES 1, 2 and 3, I have shown a typical refractory furnace side wall or roof 9 having a burnt-out open portion or hole 9a therein which is to be repaired by filling it with a suitable mortar or cement C (see FIGURE 7). In order to accomplish this object, my device 10 is provided with an arm part or manipulator assembly A having a longitudinally extending manipulating arm means 11 and a connecting means 12, and provided with a closure plate part or assembly B having a pair of foldable plate members 15 and 16. The closure plate assembly B may be provided with a furnace heat-sensitive latching or other means for releasing its foldable parts 15 and 16 from an endwise-aligned folded relation with the arm means 11 after the assembly B has been inserted into the furnace. A simple approach is to wind some suitable temporary material, such as string 19, to hold its pair of plate members 15 and 16 in a folded or closed-up relation with each other, see FIGURES 1 and 2.

The arm or manipulator assembly A includes a longitudinally-extending, relatively long, rod-like, primary member or manipulating arm 11 which may be of metal and which is provided with a handle 11a at its upper end. The rod or arm member 11 is of sufficient length so that a workman may stand on the framework on the outside of the furnace and manipulate the device without being too close to furnace heat issuing from the opening 9a. The lower or forward end of the arm member 11 has, as shown particularly in FIGURES 9 and 10, a bifurcated or hinge portion 11b to receive a pivot pin 13 which extends through an upper or back end of a shorter length, rod-like,

secondary connecting member or arm 12. The pivot pin 13 may be provided with a head portion 13a at one end and a cotter pin or other removable means 13b at its other end, so as to retain it in position during the operation of the device but, at the same time, permit the primary rod or arm 11 to be detached from the lower or secondary rod or connecting arm 12 of the device after a repair operation has been accomplished. The lower or secondary member 12, at its lower or forward end, is provided with a head or enlarged boss portion 12a on which it carries a washer-like element or member 14 that is adapted to abut against and carry or support the plate assembly B.

The plate assembly B employs a pair of similar plate-like members 15 and 16 which may be of metal construction. The member 15 has, as shown particularly in FIGURES 4 and 6, cut-out portions along its inner edge so as to leave hinge tabs 15a which are turned-in to provide hinge leaves or eyelets. In like manner, the plate member 16 has turned-in inner edge tabs 16a which are staggered with respect to the tabs 15a so as to make a complementary fit therewith. In other words, the inner edges of the plate members 15 and 16 have hinge tabs 15a and 16a and cutout portions that are staggered with respect to each other so as to, in combination, form a pair of hinges, see particularly FIGURE 4. The hinges are formed in such a manner that they retain or support the plate members 15 and 16 in a horizontal, transverse or flat spread relation after they have, for example, been released by the burning-off of the string 19 by the furnace heat.

A headed hinge pin 17 is inserted through the eyelets of the cooperating hinge tabs 15a and 16a of one cooperating pair, and a second headed hinge pin 17' is inserted through the eyelets of the second pair of tabs 15a and 16a to provide a second hinge part that is spaced-apart centrally with respect to the other hinge part. The central portion of the same inner edges of the plate members 15 and 16 is cut-out to define a circular opening or hole portion 18 therein between the hinge pairs, through which the secondary lower rod or connecting member 12 is adapted to be removably inserted and manipulated.

As shown particularly in FIGURES 3 to 7, inclusive, the plate members 15 and 16 have flange or rim edge portions 15b and 16b projecting upwardly from their upper or inner faces. The plate members 15, 16 are also provided with opposite pairs of transversely-aligned side slots or holes 15c and 16c in their respective rims 15b and 16b. It will be noted from FIGURES 1 and 2 that when the plate members 15 and 16 of the assembly B are in their closed or folded relation with each other, the primary rod or manipulating means 11 projects through one cooperating set of side slots 15c, 16c to carry and support the assembly B in endwise alignment therewith.

The tying means 19 is quickly burnt-off after the insertion step of FIGURE 1 and, as a result, the plate members 15 and 16 are free to open and swing from the endwise position of FIGURE 1 through 90°, see FIGURE 3, about the pivot pin 13 and their hinge pairs to a transverse position with respect to the manipulator means 11. That is, the construction B is so balanced (off-balanced in the endwise position of FIGURE 1) that it will normally swing or pivot to the positions of FIGURE 3 and FIGURE 4 when the means 19 is released by the furnace heat. At such time, the arm 11 is then pulled upwardly so that the transversely spread or opened-out plates 15 and 16 are moved into abutment with adjacent peripheral edge portions of the holes 9a in the furnace wall 9 in the manner shown in FIGURES 7 and 8. Cement or mortar C may be then quickly filled in the hole and will be held in place by the plate assembly B until a "setting" of the cement has been accomplished.

I have found that it only takes a few minutes, for example, about three or four, for the cement or mortar C to "set" under the conditions of furnace heat. At this time, the primary rod member 11 may be disconnected by re-

moving the cotter pin 13b and the pin 13 to leave the secondary rod 12 and the plate assembly B in the wall. Of course, the metal parts which are exposed beneath or from the inside of the wall will melt away from the wall after a period of operation of the furnace. Although this is advantageous in most cases, I also contemplate using a high temperature resistant metal construction for the parts 12, 15 and 16 which will better withstand the heat and thus remain in place or at least remain in place for a longer period of time.

If desired, as shown in FIGURE 11, the upper or primary rod or arm member may be made in two parts 11' and 11'' and connected by an internally-threaded socket 20 extending from the upper part 11' and by a threaded end portion 11a'' extending from the lower part 11''. In this manner, the pivot joint represented by the pin 13 may remain in place and, if desired, have a lower position within the open portion 9a of the furnace wall.

In an open hearth furnace, the heating may be maintained and the blowers turned off during the patching operation. Ordinarily a plate assembly B having a spread dimension of about 14 to 17 inches square has been found to be a practical size for the average size hole. Although a larger size assembly may be provided for larger holes, I have also found it practical to employ two or more devices for larger holes, or for a burnt out course of refractory blocks or tile members. Best results are accomplished by repairing the burnt out holes before they become too large, although there is, for example, a greater tendency to form larger holes in oxygen blow vessels or furnaces than in open hearth or glass furnaces.

It will be noted from the figures of the drawings that the upper primary, operating arm or rod-like member 11 is adapted to extend through a pair of cooperating slots 15c and 16c of the foldable plate members 15 and 16 when the plate member assembly B is in its upwardly-closed or folded relation. As illustrated, the slots 15c and 16c extend through portions of the rims 15b and 16b in a spaced relation from the mid-located connecting edge portions or hinge means and at narrower side edges of the plate members 15 and 16. In this connection, it will be noted that the plate members 15 and 16 have relatively shorter length side edges at right angles to the hinge means than parallel to the hinge means, such that when the members are in their upwardly-closed or folded relation of FIGURES 1 and 2, the assembly B has a greater endwise than transverse length in its supported position. On the other hand, when the plate members 15 or 16 are in their outwardly-spread substantially transversely-planar relation of FIGURE 4, the combined length of the shorter length sides of the two members 15 and 16 provides an overall length that is at least equal to and may be greater than the length of the other side edges of the assembly B.

When the assembly B is in its upwardly-folded relation, the rims 15b and 16b are in an abutting relation to define a spacing or chamber between the opposed upper faces of the members 15 and 16 and within which the arm members 11 and 12 extend. The positioning of the lower secondary or connecting arm member 12 and its length is such that, as shown particularly in FIGURES 1 and 3, the swingable or pivotal connection 13 and the back end of the member 12 lie in substantial alignment with the cooperating slots 15c and 16c when the assembly B is in its folded-up relation. As a result, the assembly B may be supported, as shown in FIGURE 1, with the members 11 and 12 in a right-angular relationship and with the side walls of one cooperating pair of the slots 15c and 16c in holding engagement with the upper member 11. This assures a retention of the folded assembly in an endwise-aligned relation with the member 11 during the insertion of the assembly B within the furnace hole or opening 9a and particularly, in view of the fact that the assembly B is, in effect, retained or held together by the releasable means as 19 in its folded-up relation. When the means 19 releases the foldable members 15 and 16, see FIGURE

3, they tend to spread-apart and swing towards an open balanced position that is perpendicular to their off-balanced position of FIGURE 1. The release of the arm member 11 from the walls of the pair of cooperating slots 15c and 16c also permits the assembly B to swing about the swing or pivot pin 13, until the arm member 12 attains a substantial endwise-aligned extending relation with the member 11, see FIGURE 7. It will be noted that the hinge means is constructed to restrict the outward spread of the plate members 15 and 16 to a substantially planar relation, and that the central positioning of the connecting member serves to reinforce such planar spread relation of the plate members.

Although for the purpose of illustration, I have shown a preferred embodiment of my invention, it will be apparent to those skilled in the art that various modifications and changes may be made without departing from its spirit and scope as indicated by the appended claims.

What I claim is:

1. An improved repair device for insertion within a hole in the refractory lining of a furnace construction for facilitating filling and sealing-off the hole with cementitious material which comprises, a plate assembly of foldable parts, manipulating arm means cooperating with said plate assembly for inserting and supporting said plate assembly within the furnace, means cooperating with said plate assembly for retaining its said parts in a folded relation during its insertion in the hole and for releasing said parts after its insertion in the hole, means connecting said plate assembly to said arm means in an off-balanced relation for swinging movement from a substantially endwise-aligned relation to a transverse relation with respect thereto after said plate assembly has been released by said cooperating means, said plate assembly having hinge means mounted substantially centrally thereof for swinging its said foldable parts to a transverse spread relation within the furnace after said parts have been released by said cooperating means, and said arm means being constructed to support said plate assembly in its transverse spread relation and, in cooperation with the inner side of the furnace wall, in a closing-off position with respect to the hole.

2. An improved device as defined in claim 1 wherein said arm means has removably-connected portions whereby said plate assembly may be released after completion of the sealing-off operation.

3. An improved device as defined in claim 1 wherein means removably-connects said arm means with said connecting means.

4. An improved device as defined in claim 1 wherein means removably-connects said connecting means to said plate assembly.

5. An improved device as defined in claim 1 wherein means pivotally connects said connecting means between said arm means and said plate assembly.

6. An improved device as defined in claim 5 wherein said hinge means is in the form of edgewise-connecting portions on said foldable parts.

7. An improved device as defined in claim 5 wherein said pivotally connecting means comprises, a bifurcated portion on a forward end of said arm means, and a removable pivot pin extending through said bifurcated portion and a back end of said connecting means.

8. An improved device as defined in claim 5 wherein, said foldable plates have rim edge portions along their upper sides that are adapted to abut with each other when said plates are in their folded relation, and said rim edge portions have slots therein to by-pass said arm means therethrough when said plates are in their folded relation.

9. An improved device as defined in claim 5 wherein, said connecting means and said arm means are in the form of rod-like members, said pivotally connecting means is positioned between said rod-like members, and the rod-like member of said connecting means extends

centrally through said plate assembly and has projecting means to carry said plate assembly thereon.

10. An improved repair device for insertion within a hole in the refractory lining of a furnace construction for facilitating filling and sealing-off the hole with cementitious material which comprises, a plate assembly having a pair of centrally foldable plate-like parts, each of said plate-like parts having a greater longitudinal than transverse dimension and being foldable upwardly towards each other along common longitudinal connecting edges therebetween, each of said plate-like parts having upwardly-projecting rim portions on its upper face along three of its side edges excluding its connecting edge, said rim portions having slots, said plate-like parts being foldable upwardly towards each other about said connecting edges until their rim portions are in abutment with each other to define an open spacing along the upper opposed faces of said plate-like parts, a manipulator assembly for carrying and supporting said plate assembly, said plate assembly having a centrally-disposed hole therethrough adjacent the connecting edges between said plate-like members, said manipulator assembly having a longitudinally-extending rod-like operating member and a shorter-length longitudinally-extending rod-like connecting member, said connecting member at its forward end extending through the hole in said plate assembly and having projecting means on its forward end for abutting a bottom side of said plate assembly adjacent the hole therein for carrying said plate assembly, a swingable connecting means between a back end of said connecting member and a forward end of said operating member; said connecting member extending upwardly from the hole in and along the upper side of said plate assembly, when said plate-like parts are in their upwardly-folded relation, a distance substantially corresponding to an aligned position with a cooperating pair of said slots, so that said operating member may pivot about said swingable connecting means and extend upwardly through the cooperating pair of said slots; releasable means retaining said plate-like parts in their upwardly-folded relation with each other and with said operating member extending through the cooperating pair of said slots during an insertion of said plate assembly through the hole into the furnace, said operating member suspending said plate assembly in an endwise-aligned relation when said retaining means is retaining said plate-like parts in their folded relation; said plate-like parts being balanced to, when released by said retaining means from their folded relation, fall downwardly-outwardly into a substantially planar outwardly-spread position on said connecting member, while said connecting member swings about said swingable connecting means to an endwise-aligned relation with said operating member to carry said plate assembly in its outwardly-spread position.

11. An improved device as defined in claim 10 wherein, said connecting member has a sufficient length to position said swingable connecting means above the hole in the lining of the furnace when said plate assembly is in its outwardly-spread position and has been moved upwardly by said operating member into abutment with the underside of the lining to close-off the hole therein.

12. An improved device as defined in claim 10 wherein, said connecting edges are in the form of a pair of spaced-apart hinges along adjacent edges of said plate-like parts, and said hole extends through said plate-like parts centrally between said pair of hinges.

13. An improved device as defined in claim 10 wherein said swingable connecting means comprises, a bifurcated portion on the forward end of said operating member, a pivot opening through a back end portion of said connecting member, and a removable pivot pin extending through said pivot opening and said bifurcated means.

14. An improved device as defined in claim 13 wherein said operating member has a pair of threadably-connected portions, so that said operating member may be disconnected from said connecting member after the hole in the

lining of the furnace has been sealed-off with cementitious material.

15. An improved repair device for insertion within a hole in the refractory lining of a furnace construction for facilitating sealing-off the hole with cementitious material which comprises, a plate assembly having a pair of centrally-foldable plate parts, said plate parts having means for folding them upwardly towards each other along common connecting edges therebetween, said plate parts having projecting portions thereon for defining an enclosed chamber between their upper faces when they are in an upwardly folded position with respect to each other, slot means extending at substantially right angles to said folding means endwise through said projection portions into the enclosed chamber defined between the upper faces of said plate parts in their folded position, a manipulator assembly for carrying and supporting said plate assembly, said manipulator assembly having a longitudinally-extending operating member and a shorter-length longitudinally-extending connecting member, a pivot joint between said operating member and said connecting member, said connecting member being connected to said plate assembly adjacent said hinge means in a carrying relation with respect thereto, means for releasably-retaining said plate parts in their folded position with respect to each other during the insertion of said plate assembly within the hole of the furnace, said connecting member extending within the enclosed chamber and said operating member extending at an angle from said pivot joint from within said

enclosed chamber outwardly through said slot means to support said plate assembly in its folded position during its insertion within the furnace, and said operating and connecting members being constructed to swing about said pivot joint when said retaining means has released said plate parts within the furnace to substantially endwise-align with each other and carry said plate members in an outwardly-spread relation beneath the hole in the furnace.

References Cited

UNITED STATES PATENTS

503,079	8/1893	Gowen	114—227
868,574	10/1907	Maihama	114—227
1,153,796	9/1915	Jupp	114—227
1,249,422	12/1917	Kook	114—227
1,901,391	3/1933	Forberg	114—227 X
2,220,085	11/1940	Dirschel	114—227
2,476,601	7/1949	Harper	114—227
2,638,774	5/1953	Wieman	249—83 X
3,012,299	12/1961	Demaison	249—83 X
3,094,964	6/1963	Witten et al.	114—227
3,325,955	6/1967	Haut	52—514

FOREIGN PATENTS

47,919	5/1911	Austria.
338,364	6/1959	Switzerland.

WILLIAM J. STEPHENSON, *Primary Examiner.*