

Nov. 26, 1940.

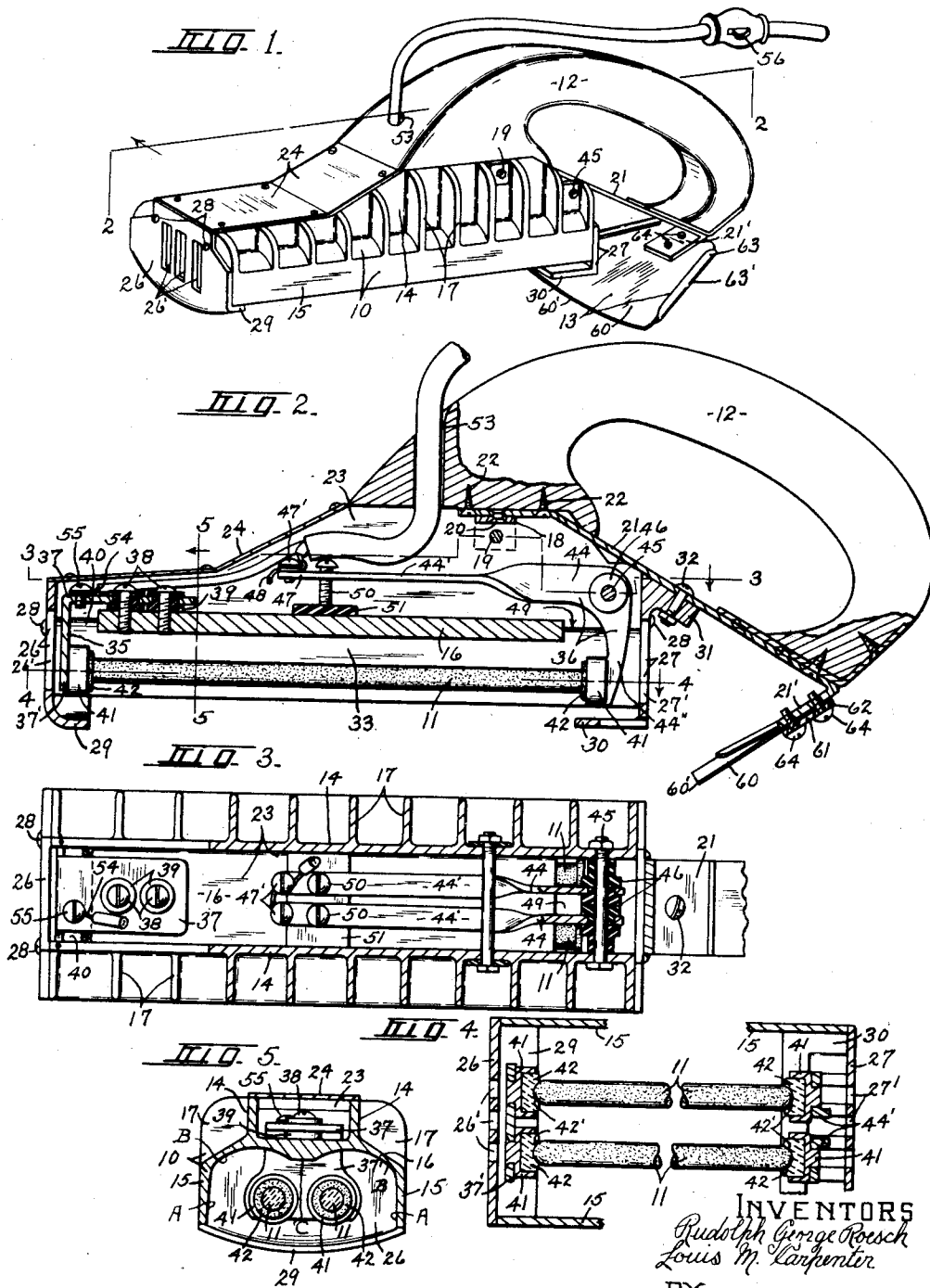
R. G. ROESCH ET AL

2,223,331

ELECTRIC HEATING DEVICE

Filed May 3, 1938

2 Sheets-Sheet 1



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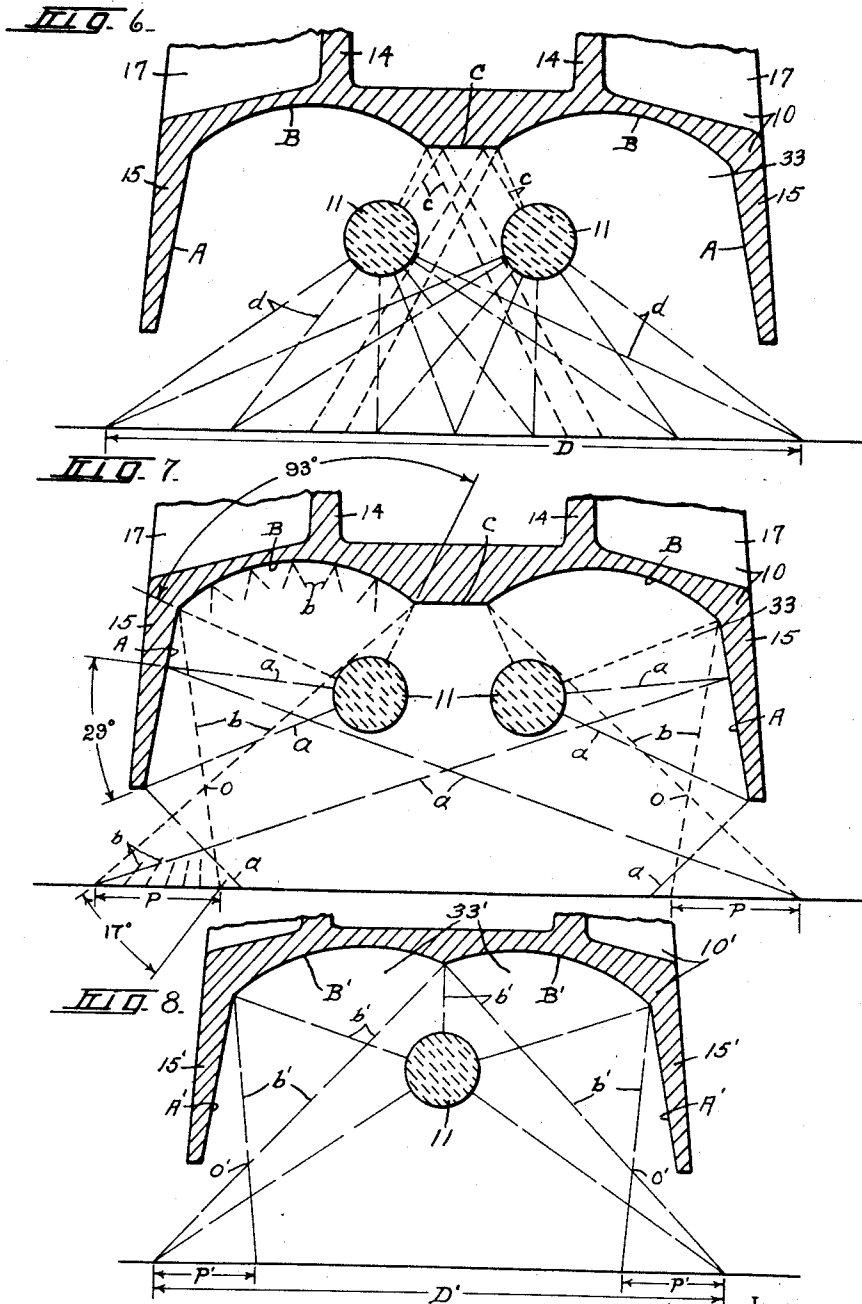
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UNITED STATES PATENT OFFICE

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ELECTRIC HEATING DEVICE

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Application May 3, 1938, Serial No. 205,760

10 Claims. (Cl. 219—29)

This invention relates to electric heating devices adapted to generate radiant heat and direct that heat to a desired place of utilization.

The principal object of our invention is to provide an electric heating device adapted to generate radiant heat and apply that heat by direct radiation and by reflection to an adjacent surface to be heated with a predetermined distribution such as to secure substantially uniform heating of said surface.

Our invention is particularly applicable to heaters for such uses as drying or baking paint, varnish or lacquer on large surfaces by moving a relatively small heating device constructed in accordance with our invention over the surface to be treated in close proximity thereto, or for softening paint, varnish or other coating material previously applied and dried on a surface and then scraping such softened material from the coated surface as the heater is moved thereover. The description herein is concerned primarily with devices of the latter character, for convenience termed paint removers, but it will be understood by those skilled in the art that our heating device is applicable to many other uses.

Other electric paint removers for the general purpose mentioned above have been heretofore produced, but, so far as we are aware, not one of these prior devices has been commercially practicable. This has usually been the result of the excessive amount of time required to soften the paint or other coating material, due either to an insufficient amount of heat being produced or to inefficient application of the heat produced to the coating material or to both of these reasons, or to speedy failure of the heating elements under the conditions of use.

Among the objects of this invention are to produce an electric paint remover which is rapid and efficient in operation; easy, simple, and economical to use; light and durable in construction; and which may be used with a maximum degree of safety as regards both the operator and the coated surface.

In carrying out the above mentioned objects, we preferably employ two silicon carbide resistance heating elements of cylindrical or rod shape, such as are sold by Globar Corporation, Niagara Falls, New York, under the trade-mark "Globar." These Globars are practical for continued operation at temperatures considerably above the range of commercial wire resistors, and are manufactured under United States Letters Patent Nos. 1,787,749; 1,906,853; 1,918,317 and others. These Globars or like heating elements are mounted upon a suitable frame or support having reflecting surfaces adjacent said heating elements arranged most efficaciously to direct or reflect heat rays radiated from the heating elements onto the surface to be heated. Fur-

thermore, we have provided a suitable scraper so connected with the supporting means or frame that a coating softened by the action of the heat radiated from the heating elements may be quickly and easily removed from the coated surface as the frame is moved longitudinally over said surface during the softening operation.

An electric heating device according to our invention as applied to a paint remover is illustrated in the accompanying drawings, wherein: Figure 1 is a perspective view of a paint remover embodying the various features of this invention.

Figure 2 is a longitudinal vertical sectional view taken substantially on line 2—2, Figure 1.

Figure 3 is a longitudinal horizontal sectional view taken substantially in the plane of line 3—3, Figure 2.

Figure 4 is a detail horizontal sectional view taken on line 4—4, Figure 2, with portions of the heating elements and the supporting frame therefor broken away.

Figure 5 is a vertical transverse sectional view taken on line 5—5, Figure 2.

Figure 6 is a transverse sectional view of the supporting frame or case similar to Figure 6, but on an enlarged scale illustrating diagrammatically the path of the heat rays radiated by the lower or outer portions of the heating elements.

Figure 7 is a view similar to Figure 6 illustrating how the heat rays radiated by the upper or inner portions of the heating elements are reflected by the inner surfaces of the case or frame to apply said heat rays most efficaciously to the surface to be heated.

Figure 8 is a view similar to Figure 7 illustrating a modified form of case or frame which is adapted more particularly to a heating device having but one heating element.

The paint remover illustrated in the drawings comprises primarily a supporting frame or case 10, a pair of electrical heating elements or resistors 11, carried by the case or frame, a handle 12 for said case or frame and a scraper 13 connected with the handle 12 at the rear of the frame 10.

The frame or case 10 is preferably composed of aluminum or other materials having suitable heat conducting and reflecting properties. The frame 10 is shown provided with upper and lower side walls 14 and 15, respectively, which extend longitudinally of the frame and a middle wall or partition 16 extending transversely of the frame between the side walls 14 and 15.

The upper side walls 14 are, as illustrated more particularly in Figure 5, spaced from each other a less distance than the lower side walls 15, and heat radiating fins 17 of which may be formed integral with the upper side walls 14 and middle wall 16 are arranged in spaced re-

lation to each other along the outside of the frame or case 10 for maintaining the upper portion of the frame or case cool. The handle 12, which may be composed of wood, Bakelite or other suitable heat-insulating material, is secured to the upper rear portions of the side walls 14 by means of a bar 18 which extends transversely of the side walls 14 and handle 12 and has the ends thereof secured to the side walls 14 by a bolt 19. The bar 18 is secured by rivets 20 or their equivalents to a supporting plate 21 arranged to extend across the lower face of the handle 12 and which is secured to said handle by screws 22, as shown in Figure 2. The width of the front portion of the handle 12 is substantially equal to the distance between the upper side walls 14, thereby forming a covered space or chamber 23 between the side walls 14 at the rear portion thereof. The front portion of the chamber 23 is enclosed by a cover plate 24 secured to the outer or upper edges of the side walls 14.

The front and rear ends of the chamber 23 are enclosed by end plates 26 and 27 secured to the front and rear ends, respectively, of the side walls 14 by screws 28. These plates extend downward across the adjacent ends of the middle wall 16 and the lower side walls 15 and then inward toward each other in a plane a short distance below the lower edge of the side walls. The front end plate 26 has its lower inwardly extending portion 29 curved downwardly from the sides toward the center, thereby providing an arcuate shoe for supporting the front end of the frame 10 as said frame is moved longitudinally across the coated surface, and serving as a guard for the front ends of the heating elements 11. The lower inwardly extending end portion 30 of the rear end plate 27, while it may form a supporting shoe for the rear end of the frame where no scraper is employed, is intended more particularly, in the present instance, to provide a guard for the rear ends of the heating elements 11 and the supporting means therefor as is more clearly shown in Figure 2.

The end plates 26 and 27 may, as shown, be provided with vertically disposed slots 26' and 27', respectively, for providing air passages through said plates to the interior of the case or frame 10 for ventilating or cooling purposes. The rear plate 27 is provided with a rearwardly extending lug or boss 31 to which is secured the handle supporting plate 21 by means of a screw or bolt 32.

The heating elements 11 are arranged in the chamber 23 formed in the case 10 between the side walls 15 and beneath the middle wall 16. These heating elements are preferably cylindrical rods or bars composed of non-metallic conducting material, such, for example, as silicon carbide or graphite or the like, and we prefer to use the Globars described above, which are capable of operating at temperatures considerably above the range of commercial wire resistors such as nickel chrome alloy and chromium iron alloys, that is, at temperatures above 1,000 degrees or 1,100 degrees F., which is the upper limit of metallic resistors now in general use. The Globars preferably employed will produce temperatures of upwards of 1,700 degrees F. However, where lower temperatures will suffice for the purpose at hand, we may employ cylindrical or equivalent forms wound spirally with conventional resistance wire in lieu of the non-metallic heating rods 11, and

such wire wound heating elements would function to distribute the heat as hereinafter described.

As shown in Figures 4 and 5, we preferably use two of these heating elements 11, which are arranged in substantially parallel spaced relation with each other longitudinally of the frame 10 intermediate the side walls 15. The heating elements or resistors 11 are releasably clamped between mounting units 35 and 36 associated with the front and rear ends, respectively, of said elements. The mounting unit 35 for supporting front ends of the heating elements 11 may, as shown, comprise a terminal plate 37 composed of stainless steel or other suitable material. This plate is substantially L-shaped in longitudinal section and has one leg positioned in the chamber 23 over the front end of the middle wall 16 and is secured to said wall by screws 38 and suitable insulating washers or members 39 composed of any suitable non-conducting refractory material. The other leg 37' of the plate 37 extends downwardly through an opening 40 provided in the wall 16 adjacent the end plate 26 and into the chamber 33. The lower or outer end of the leg 37' is provided with a pair of sockets 41 which may be connected in any suitable manner to the leg 37'. Mounted in these sockets 41 are disc seats 42 composed of suitable electrical conducting refractory material and which have the outer faces thereof each provided with a concave recess 42' for supportingly receiving the front end of the respective heating elements 11 therein.

There are two of the mounting units 36 for supporting the rear ends of the heating elements 11, one for each element. Each of these mounting units 36 comprises a terminal lever 44 in the form of a bell-crank. Each of these levers is rotatably mounted upon a bolt 45 that extends transversely through the chamber 23 adjacent the rear end thereof and is secured in the side walls 14, as shown in Figures 2 and 3. Each of the levers 44 is mounted in insulated spaced relation to the bolt 45 by suitable bushings 46 composed of suitable heat resisting insulating material. One arm 44' of each lever 44 extends forwardly from the bolt 45 through the chamber 23 to within a short distance of the end terminal plate 47 and has secured thereto a terminal screw 47' for connecting an electric wire 48 to the corresponding lever. The other arm 44'' of each lever 44 extends downward or outward from the bolt 45 through an opening 49 provided in the middle wall 16 adjacent the rear end plate 27, and into the chamber 33. The lower or outer end of each arm 44'' has fixedly connected therewith in any suitable manner a socket 41 which in turn supports a disc seat 42, these parts being the same in construction and function as those provided in the front mounting unit 35.

It will now be understood that the terminal plate 37 is a relatively rigid member while each of the terminal levers 44 is mounted to swing into and out of engagement with a respective heating element 11 for releasably clamping said element between said lever and the front terminal plate 37. In order that each lever 44 may be maintained in clamping relation with the respective heating element, I have provided a screw 50 mounted in the front end of the lever arm 44' and which is adapted to engage a rest plate 51 composed of suitable insulating material and mounted in the chamber 23 upon the middle wall 16

16. It will be observed that by rotating the screw 50, the arm 44' may be moved outward away from the wall 16 which in turn will produce movement of the arm 44' inward toward the front end plate 28 and securely clamp the heating element associated therewith in operative position in the chamber 33.

The electric wire 48 may, as shown more particularly in Figure 2, be extended from the terminal screws 47' connected with the levers 36 rearward in the chamber 23 and then upward through a suitable opening 53 provided in the front end portion of the handle 12 to be connected with one side of a suitable source of potential, not shown. The other side of said source of potential may be connected with the terminal plate 37 by a suitable wire 54 which may be connected with the terminal plate 37 by a suitable terminal screw 55. This wire 54 may extend rearward from the screw 55 through the chamber 23 and outward through the opening 53 provided in the handle 12. A suitable switch 56 may, as indicated in Figure 1, be associated with the wires 48 and 54 for opening and closing the electric circuit for the heating elements 11.

The seat members 42 should be constructed of a material that has comparatively high electrical conductivity and will withstand very high temperatures up to substantially 2,500 degrees F. Furthermore, these members should have considerable mechanical strength and should be such that rapid heating and cooling will not affect them. The Globars or other heating elements 11 are preferably so constructed that short portions at the ends thereof are better electrical conductors than the central portions, so that the extremely high temperatures of the central portions of the elements are not produced at the ends thereof. This considerably reduces the possibility of the sockets 41 and the adjacent portions of the terminal members 37 and 44 being injured by the high temperatures in the chamber 33.

In order that the heat produced by the central portion of the Globars or heating elements 11 may be most efficaciously directed outward from the chamber 33 onto the surface to be heated, I have provided the upper and side portions of the chamber 33 with specially shaped reflecting surfaces A, B and C. These surfaces A, B and C should be smooth, and may, if desired, be highly polished. It should be noted that the frame or case 10 is so made that the chamber 33, before assembly of the mounting units 35 and 36 and the end plates 26 and 27, is in effect an open channel. The surfaces A, B and C may, therefore, easily be ground and polished or otherwise finished before assembly of the completed device by the use of suitable grinding, polishing and buffing wheels.

The reflecting surface C, as illustrated more particularly in Figures 6 and 7, is a relatively narrow substantially flat surface which is arranged midway between the side walls 15 in a plane above the heating elements 11. The heat rays radiating upward or inward from the heating elements 11 upon coming in contact with the surface C are reflected downward or outward. Most of these rays, however, pass outward near the center of the chamber 33, as indicated by the broken lines c, Figure 6, owing to the form and position of the surface C with respect to the heating elements. These rays c unite with the heat rays, represented by the lines d in Figure 6, radiating downward or outward directly from the

heating elements, and are directed at the central portion of the effective heating zone D produced externally of the chamber 33.

The surfaces B are formed arcuate in cross section and extend from the longitudinal sides of the central surface C to the side surfaces A provided on the side walls 15. The side surfaces A are substantially flat and extend downward or outward from the sides of the arcuate surfaces B in slightly outward diverging planes.

The arcuate surfaces B are so curved and positioned with respect to the heating elements 11 that the greater portion of the heat rays radiated upward or inward from the heating elements will be reflected downward or outward in converging directions as illustrated by the broken lines b, Figure 7. The focal centers O of these rays b are in substantially the plane of the lower or outer longitudinal edges of the lower side walls 15 and are spaced a short distance inward from the adjacent reflecting surfaces A. It will therefore be seen that these heat rays b will produce areas P extending along the outer longitudinal edges of the effective heating zone D. The addition of these rays b to the heat rays d radiated directly downward or outward from the heating elements 11 and to the rays a reflected from the surfaces A will, obviously, increase the amount of heat to which the corresponding areas of the surface to be heated are subjected to a corresponding extent. This increased heat applied to the areas P over that applied to the remaining or central portion of the effective heating zone D, is of course provided along both longitudinal sides of the effective heating zone and will compensate for the more rapid cooling of these portions of the surface being heated caused by the greater loss of heat along the outer edges of the heating zone. This will maintain a substantially uniform degree of effective heat throughout the area of the heating zone and produce a maximum effective action of the heat rays upon the surface being heated.

It will therefore be understood that we have provided an effective heating zone of maximum area and uniformity. Moreover, the reflecting surfaces A, B and C of the case or frame 10 are highly efficient in reflecting radiant heat, particularly if made of aluminum as preferred, and, therefore, reduce to a minimum the number of heat rays penetrating or permeating the frame material and causing excessive heating of said frame. This not only maintains the frame at a relatively cool temperature but also produces maximum efficiency of the device by reducing the heat losses to a minimum.

The case or frame structure illustrated in Figure 8 is adapted more particularly to be used with one heating element. This structure may conveniently be somewhat less in width than the structure illustrated in Figures 1 to 6, inclusive, in which case the width of the effective heating zone D' is correspondingly reduced. In the structure shown in Figure 8 the single Globar or heating element 11 may be constructed and mounted in the same manner as each of the heating elements 11 shown in the remaining figures of the drawings. In this instance the walls of the chamber 33' of the frame or case 10' are provided with side reflecting surfaces A' on the inner surfaces of the side walls 15'. The arcuate reflecting surfaces B' are arranged with the adjacent longitudinal sides thereof in contact with each other so that the center substantially

flat reflecting surface C, shown in Figures 6 and 7, is eliminated. These arcuate surfaces B' are constructed and arranged in substantially the same relation to the heating elements 11 as the surfaces B shown in the remaining figures of the drawings.

In other words, the arcuate surfaces B' are adapted to direct or reflect the heat rays radiating upward from the heating element downward between the heating element and the adjacent side wall 15' in converging directions. The focal centers O' thereof are arranged in substantially the plane of the lower edges of the side walls 15'. These rays b' produce hotter areas P' extending longitudinally of the case or frame 10, which compensate for the additional loss of heat along both sides of the heating zone D' and maintain a substantially uniform temperature throughout the area of said heating zone.

While the reflecting surfaces A, B and C or A' and B' are shown integral with the case 10 or 10', it will be understood that these reflecting surfaces may comprise separate members that may be secured in a case or frame in any suitable manner.

In order that paint or other coating material being softened by the heat rays radiating from the heating elements may be quickly and easily removed from the coated surface as the heating device is being moved over said surface to effect softening of the coating material, we have provided the hereinbefore mentioned scraper 13 associated with the handle 12. This scraper may be of any conventional or desired type, but we prefer to employ a scraper such as is disclosed and claimed in our copending application Serial No. 175,858, filed November 22, 1937. The scraper 13 is of such a type, and comprises a thin, resilient, flexible blade 60 composed of steel, brass or other suitable material. This blade 60 is normally flat, but is mounted in a holder 61 in such manner as to maintain the blade in a curved position. The holder 61 is a relatively rigid member composed of sheet metal formed with a central body portion 62, which is adapted to extend transversely across the rear end of the blade 60. The side portions 63 of body 62 of the holder are bent upon each other to form guide grooves 63' for slidably receiving the longitudinal edges of the scraper blade. The blade 60 in this instance is mounted over the body portion 62 of the holder between said portion and the downward and forward extending plate 21' preferably formed integral with the rear end of the supporting plate 21. The blade 60 and the holder 61 are releasably secured to the plate extension 21' by screws 64.

The sides 63 of the holder 61 are arranged to extend from the rear end of the scraper blade 60 to within a short distance of the front or cutting edge thereof. Furthermore, the sides 63 of the holder 61 are spaced apart a distance slightly less than the normal width of the scraper blade 60 so that when the blade is mounted in the grooves 63' it will be maintained slightly concavo-convex in cross section. In other words, the lower cutting edge of the blade is maintained curved to conform in contour to that of a concave surface. By reason of this construction, when pressure is applied to the blade 60 through the medium of the handle 12 the cutting edge 60' of said blade will readily flex upward or downward from the normal curved position thereof as the contour of the surface varies, and thereby conform to the contour of the sur-

face being scraped, within reasonable limits, whether that surface be concave or convex.

Although we have shown and described a particular form of our invention, we do not wish to be limited to the exact details of the construction shown or to the specific arrangement of the parts thereof, as various changes may be made therein without departing from the spirit of the invention as set forth in the appended claims.

We claim:

1. An electric paint remover comprising a case having an elongated chamber therein open at one side, a resistor constituting a concentrated source of radiant heat supported in said chamber longitudinally thereof and in spaced relation thereto, said chamber being provided with reflecting surfaces of a material having high radiant heat reflecting and heat conducting properties of the order of those of aluminum, said reflecting surfaces being so constructed and arranged that heat rays radiated from the inner portion of said resistor will be reflected outward through said open side of the chamber to provide a heating zone exterior of the case having portions of greater concentration of heat rays along the outer longitudinal edges only thereof for softening a coating material on a surface to be treated, and a handle secured to said case.
2. An electric paint remover comprising a case having an elongated chamber therein open at one side, a resistor constituting a concentrated source of radiant heat supported in said chamber longitudinally thereof and in spaced relation thereto, said chamber being provided with reflecting surfaces of a material having high radiant heat reflecting and heat conducting properties of the order of those of aluminum, said reflecting surfaces being so constructed and arranged that heat rays radiated from the inner portion of said resistor will be reflected outward through said open side of the chamber to provide a heating zone exterior of the case having portions of greater concentration of heat rays along the outer longitudinal edges only thereof for softening a coating material on a surface to be treated, a handle secured to said case, a shoe at the front end of said case adapted to slide along the surface to be treated, and a scraper blade at the rear end of said case for scraping the softened material from the coated surface as said case is moved longitudinally over said surface by said handle.
3. An electric paint remover comprising a member made of a material having high radiant heat reflecting and heat conducting properties of the order of those of aluminum, said member forming an elongated chamber open at its lower side, integral heat-dissipating fins on the upper side of said member, a self-sustaining resistor rod constituting a concentrated source of radiant heat supported at its ends in said chamber longitudinally thereof and in spaced relation thereto, the supporting means for said rod ends including arms extending to the upper side of said member and insulatedly supported therefrom, means for connecting electrical conductors to said arms for supplying current to said resistor rod, the walls of said chamber being reflecting surfaces so constructed and arranged that heat rays radiated from the inner portion of said resistor will be reflected outward through said open side of the chamber to provide a heating zone exterior of the chamber for softening a coating ma-

material on a surface to be treated, and a handle secured to the upper side of said member.

4. An electric paint remover as claimed in claim 3 in which the ends of said resistor rod have higher electrical conductivity and operate at a lower temperature than the central portion thereof.

5. An electric paint remover comprising a member made of a material having high radiant heat reflecting and heat conducting properties of the order of those of aluminum, said member forming an elongated chamber open at its lower side, integral heat-dissipating fins on the upper side of said member, a self-sustaining resistor rod constituting a concentrated source of radiant heat supported at its ends in said chamber longitudinally thereof and in spaced relation thereto, the supporting means for said rod ends including arms extending to the upper side of said member and insulatedly supported therefrom, means for connecting electrical conductors to said arms for supplying current to said resistor rod, the walls of said chamber being reflecting surfaces so constructed and arranged that heat rays radiated from the inner portion of said resistor will be reflected outward through said open side of the chamber to provide a heating zone exterior of the chamber for softening a coating material on a surface to be treated, a handle secured to the upper side of said member, a shoe secured to the front end of said member adapted to slide along the surface to be treated, and a scraper blade at the rear end of said member for scraping the softened material from the coated surface as said member is moved longitudinally over said surface by said handle.

6. In an electric heating device, a case having an elongated chamber therein open at one side, and an electric heating means constituting a concentrated source of radiant heat mounted in said chamber longitudinally thereof and in spaced relation thereto, said chamber having interior reflecting surfaces to provide an elongated heating zone exterior of the chamber, said reflecting surfaces including an arcuate surface so constructed and arranged with respect to said heating means that heat rays radiated inward from the heating means are reflected in converging directions by said arcuate surface outward through said open side of the chamber, and the focal centers of said converging heat rays being adjacent one longitudinal edge of the heating zone whereby the side area of said zone at said longitudinal edge thereof receives an additional amount of heat.

7. In an electric heating device, a case having an elongated chamber therein open at one side, and an elongated electric heating element constituting a concentrated source of radiant heat mounted in said chamber longitudinally thereof and in spaced relation thereto, said chamber having interior reflecting surfaces to provide an elongated heating zone exterior of the chamber, said reflecting surfaces including two arcuate surfaces so constructed and arranged with respect to said heating element that heat rays radiated inward from the heating element are reflected in converging directions by each of said arcuate surfaces outward through said open side of the chamber and with the group of rays from each surface diverging with respect to the group of rays from the other surface, and the focal centers of said converging rays of each group being adjacent an opposite one of the longitudinal edges of the heating zone whereby the side areas

of said zone receive more heat than the intermediate area thereof.

8. In an electric heating device, a case having an elongated chamber therein open at one side, and a pair of elongated electric heating elements constituting concentrated sources of radiant heat mounted in said chamber longitudinally thereof and in spaced relation thereto and in spaced substantially parallel relation with each other, said chamber having interior reflecting surfaces to provide an elongated heating zone exterior of the chamber, said reflecting surfaces including two arcuate surfaces one adjacent each heating element, said arcuate surfaces being so constructed and arranged with respect to said heating elements that heat rays radiated inward from the heating elements are reflected in converging directions by each of said arcuate surfaces outward through said open side of the chamber and with the group of rays from each surface diverging with respect to the group of rays from the other surface, and the focal centers of said converging rays of each group being adjacent an opposite one of the longitudinal edges of the heating zone whereby the side areas of said zone receive more heat than the intermediate area thereof.

9. In an electric heating device, a case having an elongated chamber therein open at one side, and an elongated self-sustaining resistor supported in said chamber longitudinally thereof and in spaced relation thereto, said chamber having interior reflecting surfaces to provide an elongated heating zone exterior of the chamber, said reflecting surfaces including a pair of arcuate surfaces arranged at the inner side thereof in spaced relation to and at opposite sides of said resistor for reflecting rays in converging directions outward between said resistor and the adjacent side of the case through the open side of the chamber and with the group of rays from each arcuate surface diverging with respect to the group of rays from the other surface, and the focal centers of said converging rays of each group being substantially in the plane of the open side of the chamber and in a line adjacent the corresponding side of the case whereby the side areas of said zone receive more heat than the intermediate area thereof.

10. In an electric heating device, a case having an elongated chamber therein open at one side, and a pair of elongated self-sustaining resistors supported in said chamber longitudinally thereof and in spaced relation thereto and in substantially parallel relation with each other, said chamber having interior reflecting surfaces to provide an elongated heating zone exterior of the chamber, said reflecting surfaces including two arcuate surfaces one adjacent each resistor, said arcuate surfaces being so constructed and arranged with respect to said resistors that heat rays radiated inward from said resistors are reflected in converging directions by each of said surfaces outward through said open side of the chamber and with the group of rays from each arcuate surface diverging with respect to the group of rays from the other surface, and the focal centers of said converging rays of each group being adjacent the corresponding side of the case and substantially in the plane of the open side of the chamber whereby the side areas of said heating zone receive more heat than the intermediate area thereof.

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