

Feb. 6, 1962

J. C. McADAM

3,020,451

RIGHT ANGLE HEAT DISSIPATING TUBE SHIELD

Filed Nov. 25, 1957

2 Sheets-Sheet 1

Fig. 1.

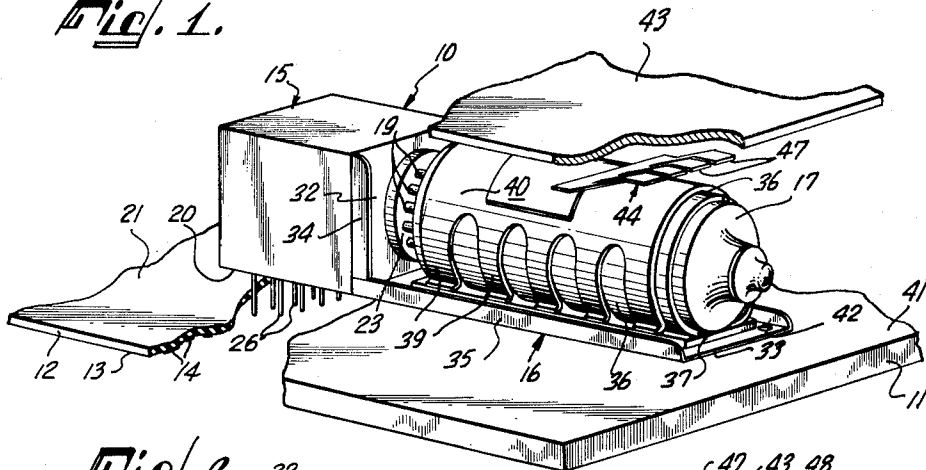


Fig. 2.

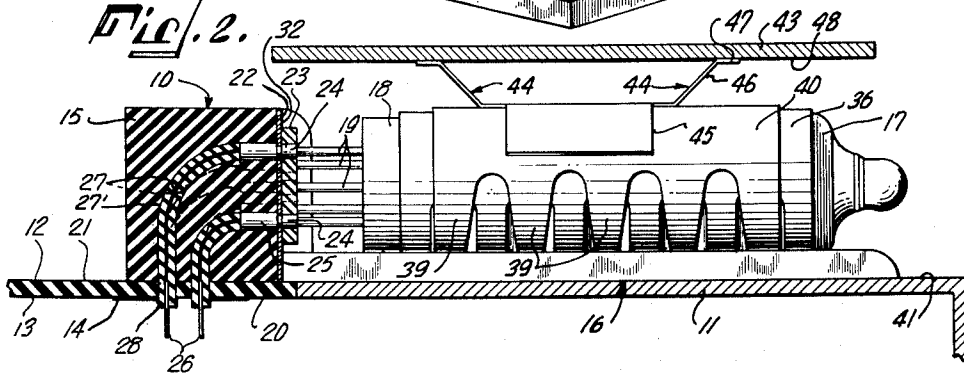
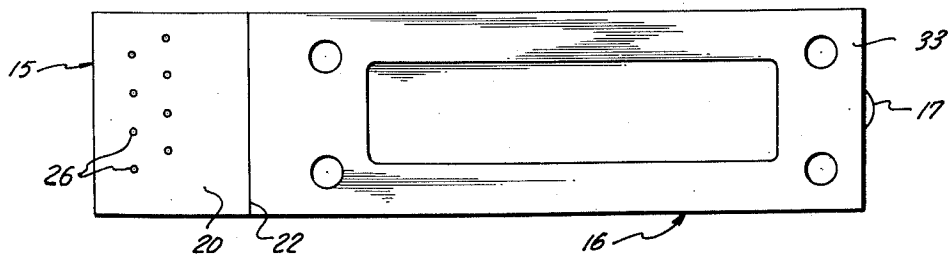


Fig. 3.



INVENTOR.

JOHN C. McADAM

BY *Vernon D. Beecher*

ATTORNEY.

Feb. 6, 1962

J. C. McADAM

3,020,451

RIGHT ANGLE HEAT DISSIPATING TUBE SHIELD

Filed Nov. 25, 1957

2 Sheets-Sheet 2

Fig. 7.

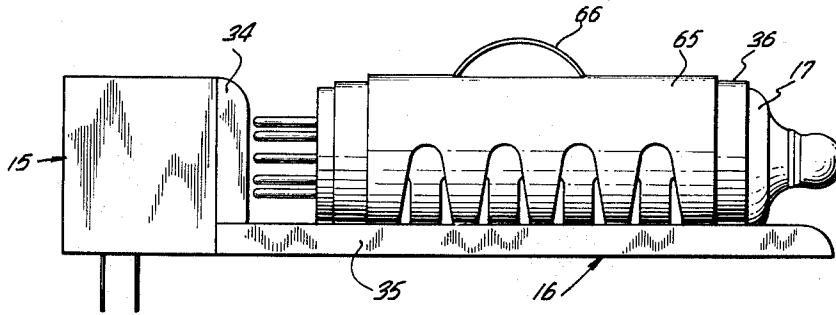


Fig. 4.

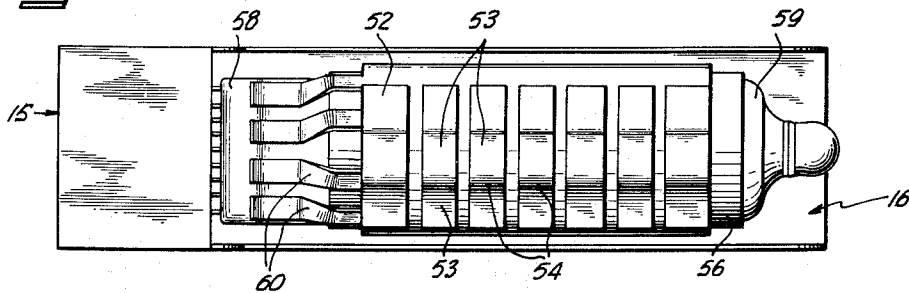


Fig. 5.

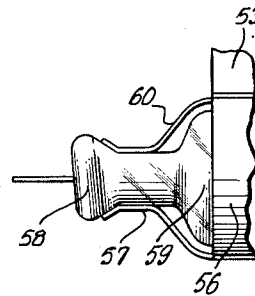
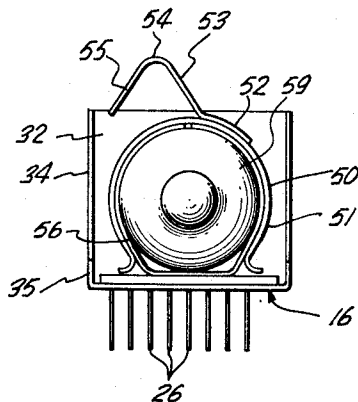


Fig. 6.

INVENTOR.

JOHN C. MC ADAM

BY *Vernon D. Beahler*

ATTORNEY

1

3,020,451

RIGHT ANGLE HEAT DISSIPATING TUBE SHIELD

John C. McAdam, Burbank, Calif., assignor to International Electronic Research Corporation, Burbank, Calif., a corporation of California

Filed Nov. 25, 1957, Ser. No. 698,565

11 Claims. (Cl. 317-101)

The invention relates to electron tube shields and has special reference to a tube shield assembly which can be laid flat upon a mounting surface so that electron tubes, sometimes called electronic tubes, can be inserted into the tube shield assembly in a direction parallel to the mounting surface and once in place be enabled to readily experience an effective dissipation of heat which may be generated during use.

During relatively recent years it has been discovered that effective dissipation of heat generated during the operation of electronic tubes has a very beneficial and desirable effect. Sundry devices have recently been designed to carry away heat from electronic tubes by different means which include sundry combinations of conduction, convection and radiation by provision of convection passages, and by a combination of both. Coupled with the necessity for carrying heat away from the electronic tube is the necessity for picking up heat uniformly over the area of the component which is usually a glass envelope and in some instances picking up heat from the base.

In constructing heat dissipating shields for electronic tubes such as those customarily identified in the trade as miniature and subminiature tubes as well as others, the more frequently practiced tube shield structure principles are sometimes not advisable. Subminiature tubes, for example, are not usually provided with a base of any substantial or rugged proportions and hence a subminiature tube is not ordinarily mounted in erected position with the provision of some auxiliary support. In fact a mounting of the tube parallel to the mounting surface is desirable in that it offers a more rugged mechanical mounting and a more efficient heat dissipation method.

Among those circumstances where these electron tubes are desirable are those wherein printed circuits are employed. Such printed circuits are customarily applied to a board of insulating material and boards of material which have found favor are such that they do not readily withstand the heat which accompanies operation of the electronic tubes which are mounted upon the printed circuit boards.

Although effective heat dissipating tube shields have been developed for use with subminiature electron tubes and components, until this time such heat dissipating tube shields have not been efficiently adaptable for use under all circumstances because to function effectively heat captured by the tube shield must ordinarily be passed to a suitable base by conduction from one metal part to another. This factor has hampered to a degree use of these shields in printed circuits where heat dissipation has been a problem. Incidentally, when heat dissipation is not a problem these shields may be applied directly to the printed circuit board to offer mechanical retention to the tube or component.

It is therefore among the objects of the invention to provide a new and improved right angle tube shield socket or base which is effective particularly for use with small electron tubes and components and which makes possible the mounting of such tubes and components in a position parallel with respect to a board or other comparable surface to which the base is attached.

Another object of the invention is to provide a new and improved tube shield assembly wherein the axis of the electron tube may be positioned at right angles to

2

the direction of pin contacts which extend outwardly from the tube shield base.

Still another object of the invention is to provide a new and improved heat dissipating tube shield assembly which is so constructed that a portion of the assembly may be attached to a heat sink, thereby to dissipate most of the heat given off by the electron tube or component, so that a socket which may be a right angle socket may be readily attached to the board on which a printed circuit is applied without prospect of damaging the board or the printed circuit by accumulation of an excess of heat in the socket.

Still another object of the invention is to provide a new and improved tube shield assembly wherein tube enveloping portions are so constructed that they may be mounted with one side permanently attached to a heat sink and wherein a secondary heat sink may be brought into contact with other sections of the heat enveloping portions thereby to augment the number of paths for heat dissipation, and materially improve the thoroughness and rapidity with which heat is conducted away from an operating tube.

Still further among the objects of the invention is to provide a new and improved right angle heat dissipating tube shield assembly especially effective for use with small components and electron tubes and which is so constructed that the tube can be mounted in a direction parallel to some appropriate mounting surface, heat dissipating portions of which can be separated from those portions readily damaged by the presence of excessive heat, the tube shield assembly being such that it can be readily applied to electron tubes when mounted thereon and which at the same time can be readily disengaged from mounted tubes should it be necessary to remove any of the tubes for replacement by new tubes.

Also included among the objects of the invention is to provide a new and improved socket, capable of being made as an angular socket with leads encased in an immediate resilient tubular cover which is in turn encased in solidified plastic material of the socket, thereby to allow some freedom of manipulation of the leads while at the same time to allow a solid immovable anchoring of the socket.

With these and other objects in view the invention consists in the construction, arrangement and combination of the various parts of the device whereby the objects contemplated are attained as hereinafter set forth, pointed out in the appended claims and illustrated in the accompanying drawings.

In the drawings:

FIGURE 1 is a perspective view of the tube shield assembly mounted upon a suitable support and in which a tube has been inserted in operable position.

FIGURE 2 is a side elevational view of the tube shield assembly of FIGURE 1 with portions shown in section.

FIGURE 3 is a bottom view of the tube shield assembly shown in FIGURE 1.

FIGURE 4 is a plan view of a modified form of the tube shield assembly.

FIGURE 5 is a right end view of the tube shield assembly illustrated in FIGURE 4.

FIGURE 6 is a fragmentary side elevational view of the butt end of a tube like that shown in FIGURE 4 and the accompanying tube shield structure.

FIGURE 7 is a side elevational view of still another modified form of the device showing the tube in withdrawn position.

In an embodiment chosen for the purpose of illustration there is shown a heat dissipating tube shield assembly indicated generally by the reference character 10 having one portion mounted upon a heat sink 11 and another portion mounted upon a board 12 of insulating material on an

underside 13 of which may be present a printed circuit 14.

More particularly the tube shield assembly consists of two important parts namely a block 15 of insulating material containing electric contacts and leads and a base 16, the primary purpose of which is to hold an electronic tube 17 in proper position. As shown the electronic tube 17 is of substantially cylindrical form and is possessed of a base 18 from which extend a number of pin contacts 19.

The block 15 is preferably of some molded dielectric material here shown as having a substantially rectangular shape. As to its various dimensions the block has a relatively flat base 20 adapted to rest flat upon an upper face 21 of the printed circuit board 12. The block has a side face 22 which in the chosen embodiment is also flat and upon which is a disc 23 in which is a series of receptacles 24. Customarily the receptacles contain clips 25 of some appropriate design which are adapted to receive and grasp the pin contacts 19 so as to make an effective electric contact therewith.

For each of the receptacles and its appropriate clip there is a pin or pin contact 26 which extends outwardly from the flat base 20 and is connected to the appropriate receptacle by means of a wire lead 27. The leads and the receptacles as well as the pins 26 and other stationary electrical conducting parts may be molded or potted in the block so that the positions will remain undisturbed during use. When mounted as shown in FIGURES 1 and 2 the pins 26 may be soldered at points 28 into the printed circuit 14.

The installation is materially improved by providing resilient casings or covers 27' for the leads 26 and potting the material of the block 15 which may be a suitable plastic insulating material around the casings, thereby to anchor the leads in a semi-flexible fashion.

The base or base plate 16 in the embodiment shown consists of two portions, namely, a block-engaging portion 32 and a portion 33. As indicated by its name the block-engaging portion is secured against the flat side face 22 of the block by some appropriate conventional means as, for example, by being confined beneath the disc 23. Flanges 34 serve to stiffen the block-engaging portion. Similarly flanges 35 stiffen the portion 33 and add a desirable degree of rigidity and serve as well by being secured in engagement with the flanges 33 to stiffen the parts or portions 32 and 33 in their assembled relationship as illustrated in FIGURES 1 and 2.

In the particular embodiment illustrated in FIGURES 1, 2 and 3 a tube-engaging envelope 36 has a lower portion 37 attached to and forming part of the portion 33 of the base. Opposite sides of the envelope are drawn around the tube 17 encircling it throughout its length and circumference and the envelope which is usually of dead metal is held in place by use of a spring clip 40. As shown the spring clip 40 has a series of fingers 39 which encircle the side and the under side of the envelope pressing against the envelope and in turn pressing the envelope into uniform engagement with the exterior area of the tube 17.

As has been previously indicated the base portion 33 of what has been initially described as the base 16 rests flat and flush with an upper surface 41 of what may be described as the primary heat sink 11. As best illustrated in FIGURE 2 the upper surface 41 of the primary heat sink extends in the same plane as the upper surface 21 of the board 12. Sundry appropriate means may be employed for fastening the base 16 to the heat sink 11, one such means being illustrated in FIGURE 1 as constituting a rivet 42.

To provide further heat conducting means for carrying heat away from the tube shield there may be provided a secondary heat sink or heat sink plate 43. In order that the secondary heat sink may be in heat conducting relationship with the tube shield resilient arms 44 may be made use of. The arms are so constructed that they form parts of an arcuate plate 45 which is soldered to the spring clip

40 and which assumes the same general degree of curvature as the spring clip. Intermediate portions 46 of the resilient arms extend obliquely outwardly away from the clip and terminate in a series of fingers 47 which are so formed that they press flat against an under side 48 of the secondary heat sink 43.

It will be apparent that there need not be a means of attachment between the fingers 47 and the secondary heat sink 43 so long as the heat sink or heat sink plate is pressed downwardly into firm engagement with the fingers.

In an assembly of the parts hereinabove described the block 15 is mounted upon the printed circuit board 12 in an appropriate location wherein the pins 26 extend through the board in proper position with respect to the printed circuit 14. Simultaneously the base 16 assumes a position in flush engagement with the upper surface 41 of the primary heat sink 11 and can then be permanently or semi-permanently fastened to the heat sink. Once mounted as described a tube 17 can be pressed into position so that its pin contacts 19 are received by the receptacles 24 in electrical engagement. This requires pushing the tube 17 endwise toward the block 15 before the envelope 36 is wrapped around the bulb portion of the tube. Once the electronic tube has been pushed into position as described, the side portions of the envelope 36 are wrapped around the bulb part of the tube. Inasmuch as this part of the device is dead metal they will not normally retain a snug position in contact with the tube. Consequently the clip 40 is applied so that the spring fingers 39 of the clip encircle the sides of the envelope and extend around and underneath thereby to force the envelope into contact with the exterior of the tube. This is readily accomplished because of the portion 33 of the base 16 being firmly secured in place in the manner previously described.

After the clip has been applied, the secondary heat sink 43 is then positioned in contact with the fingers 47. Since ordinarily a relatively large number of tubes will be similarly mounted and connected to the printed circuit, the secondary heat sink is not applied until all of the tubes have been properly mounted, at which time the secondary heat sink may be brought in contact simultaneously with the fingers 47 of all of the resilient arms 44.

Although no specific means is shown for fastening the secondary heat sink in place it will be appreciated that it is the metal substance of the secondary heat sink itself which provides for the conducting to it of heat through the resilient arms and that the heat once accumulated by the secondary heat sink can be readily dissipated. Any conventional means may be employed for fastening the secondary heat sink in the selected position and it is not requisite that the secondary heat sink be connected to the primary heat sink.

Mounted as described heat generated in the tube will be conducted first from the glass to the envelope and from the envelope to the base 16 and the primary heat sink 11. Heat is also conducted through the clip 40 and resilient arms 44 to the secondary heat sink 43. By providing these very adequate paths of heat conduction there will be a minimum and negligible amount of heat passed to the block 15 and hence to the printed circuit board.

In a second form of the device illustrated in FIGURES 4 and 5 the block 15 and base 16 may remain substantially the same. In this form, however, a spring clip 50 provided in the manner previously described with fingers 51 has a different means of conducting heat to the secondary heat sink. This comprises a sheet 52 which extends substantially throughout the length of the spring clip which has a free side cut out to provide a series of arms 53 bent as illustrated in FIGURE 5 so that an arcuate portion 54 lies in a position of potential engagement with the secondary heat sink. By having an end 55 free and removed from the clip a substantial amount of springiness is provided so that the arms can be depressed

to a considerable degree depending upon what may be an appropriate location for the secondary heat sink.

By way of example an envelope 56 in this form of the device has extensions 57 appropriate in form to the type of pressed base 58 of certain of the subminiature tubes 59. Similarly the clip 50 has extensions 60 of a form adapted to engage the opposite side of the present base 58.

In still another form of the device illustrated in FIGURE 7 the clip 63 there shown has a portion 66 thereof cut out of the top mid-portion of the clip and pressed outwardly to form a loop. The loop may be made large enough to permit being grasped by the fingers for effective removal and application of the clip 65. Where the fit of the clip around the envelope 36 may be especially tight it is possible to insert a tool such as a screw-driver through the loop in order to facilitate removal.

Although the outwardly bent portion 66 is primarily intended as a grip to facilitate removal, it can if desired be used also as a contact means to assist in conducting away heat from the clip.

There has accordingly been shown and described herein a composite heat and dissipating tube shield assembly of such construction that by making use of a right angle base or block the shield assembly readily assists in connecting small electronic tubes into printed circuits and at the same time provides for the positioning and mounting of the tubes in a suitable heat conducting envelope in such position that substantially a maximum area of the envelope is available for engagement with a heat dissipating tube sink or set of tube sinks. The arrangement permits mounting of the envelope in the closest possible relationship to the electronic tube so as to be capable of efficient transfer of heat away from the tube at a rate rapid enough that no amount of heat of a damaging sort can reach the block or the printed circuit.

While I have herein shown and described my invention in what I have conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of my invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices.

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

1. A right angle shield mount for electronic tubes comprising a block of dielectric material having a flat base, a side face at right angles to the flat base having a plurality of contact pin receptacles therein, a plurality of pins in said block extending outwardly of the flat base and a wire lead connecting each of the pins to one of said receptacles, a resilient cover for each of said leads throughout the portion thereof within the block whereby to resiliently mount the receptacles and the wires connected thereto in the block, a base plate of heat conducting material having a flat portion secured to the block at said side face and having another portion extending outwardly therefrom in the same plane as said flat base, said base plate being in electrically insulated relationship with said pins, a tube contacting envelope of dead metal attached to said other portion in heat conducting relationship and a spring clip overlying sides of said envelope whereby to hold the envelope in heat conducting relationship to the electronic tube.

2. An electronic tube and circuit assembly comprising a circuit board of dielectric material having an electric circuit thereon, said board having a plurality of sets of contact receptacles in cooperative relationship with said circuit, a heat sink plate of heat conducting metal adjacent said board, a plurality of blocks of dielectric material each having a base in engagement with said board and contact pins on said block extending into said receptacles, a face on each said block having a plurality of receptacles therein connected respectively to the pins and in electrically insulated relationship with said heat sink plate, a base plate of heat conducting metal secured to

the block and extending outwardly therefrom in a location overlying said heat sink plate, means securing said base plate in heat conducting relationship with said heat sink plate, and a tube engaging envelope secured to said base plate in heat conducting relationship, and means adapted to hold said envelope in heat conducting relationship to the respective electronic tube.

3. An electronic tube and circuit assembly comprising a circuit board of dielectric material having an electric circuit printed on the one side thereof, another side of said board having a plurality of sets of contact receptacles in cooperative relationship with said circuit, a primary heat sink plate of heat conducting metal adjacent said board, a plurality of blocks of dielectric material each having a base in engagement with said board and contact pins on said block extending into said receptacles and in electrical contact therewith, a side face on each said block having a plurality of receptacles therein connected respectively to said pins, a base plate of heat conducting metal secured to the block and extending outwardly therefrom in a location overlying said heat sink plate, and means securing said base plate in heat conducting relationship with said heat sink plate, a tube engaging envelope secured to said base plate in heat conducting relationship, and means adapted to hold said envelope in heat conducting relationship to the respective electronic tube, metallic spring contact means extending outwardly from the envelope, and a secondary heat sink plate in engagement with the spring contact means and out of engagement with the block, said secondary heat sink plate being adapted to draw off a portion of heat generated by the tube through said spring contact means.

4. An electronic tube and circuit assembly comprising a circuit board of dielectric material having a printed circuit on one side thereof, another side of said board having a plurality of sets of contact receptacles electrically connected to said printed circuit, a heat sink plate of heat conducting metal parallel to said board at a location spaced from the plane of said board, a plurality of blocks of dielectric material each having a flat base in engagement with said board and contact pins on said block extending into said receptacles, a side face on each said block having a plurality of receptacles therein connected respectively to the pins, a base plate of heat conducting metal secured to the block and extending outwardly therefrom in the same plane as said flat base and in a location overlying said heat sink plate, and means securing said base plate in heat conducting relationship with said heat sink plate comprising a tube engaging envelope of dead metal secured to said base plate in heat conducting relationship, a spring clip overlying sides of the envelope whereby to hold said envelope in heat conducting relationship to the respective electronic tube and spring contact means on the clip extending into spring pressed engagement with said heat sink plate.

5. An electronic tube and circuit assembly comprising a circuit board of dielectric material having a printed circuit on one side thereof, another side of said board having a plurality of sets of contact receptacles electrically connected to said printed circuit, a primary heat sink plate of heat conducting metal abutting said board and having an upper face in the same plane as said other side of the board, a plurality of blocks of dielectric material each having a flat base in engagement with said board and contact pins on said block extending into said receptacles, a side face on each said block having a plurality of receptacles therein connected respectively to the pins, a base plate of heat conducting metal secured to the block and extending outwardly therefrom in the same plane as said flat base and in a location overlying said heat sink plate, and means securing said base plate in heat conducting relationship with said heat sink plate, a tube engaging envelope of dead metal secured to said base plate in heat conducting relationship, a spring clip

overlying sides of the envelope whereby to hold said envelope in heat conducting relationship to the respective electronic tube, metallic spring contact means on said clip extending outwardly on a side opposite from said base plate, and a secondary heat sink plate parallel to said primary heat sink plate and in engagement with the spring contact means of each of said clips whereby to simultaneously improve the contact of the clip and the envelope with the tube and draw off a portion of heat generated by the tube through said spring contact means.

6. A shield mount for electronic tubes comprising a block of dielectric material having a base, a face, and a base plate of heat conducting metal on the block extending outwardly therefrom, a tube contacting envelope of heat conducting dead metal secured to said base plate in heat conducting relationship, a heat conducting clip encircling said envelope and forming with said envelope multiple layers of contiguous heat conducting material whereby to secure the tube in heat conducting relationship within said envelope and said clip, and a heat conducting spring contact element on the clip extending outwardly thereof to a location spaced from the clip and on a side thereof opposite from said base plate.

7. A right angle shield mount for electronic tubes comprising a block of dielectric material having a base, a side face, and a base plate of heat conducting metal on the block extending outwardly therefrom on the same side of the block as said side face, a tube contacting envelope of heat conducting dead metal secured to said base plate in heat conducting relationship, a heat conducting spring clip encircling said envelope whereby to secure the tube in heat conducting relationship within said envelope and said clip, and a plurality of heat conducting spring contact elements comprising part of the spring clip extending longitudinally thereof to a location spaced from the clip and on a side thereof opposite said base plate.

8. A shield mount for electronic tubes comprising a block of dielectric material having a base, a face and a base plate of heat conducting metal on the block extending outwardly therefrom, a tube contacting envelope of heat conducting dead metal secured to said base plate in heat conducting relationship, a heat conducting clip encircling said envelope whereby to secure the tube in heat conducting relationship within said envelope and said clip, and a finger hold on said clip comprising a portion thereof sprung outwardly from the clip forming a closed loop.

9. A right angle shield mount for electronic tubes comprising a block of dielectric material having a base, a side face, and a base plate of heat conducting metal on the block extending outwardly therefrom on the same side of the block as said side face, a tube contacting envelope of heat conducting dead metal secured to said base plate in heat conducting relationship, a heat conducting spring clip encircling said envelope whereby to secure the tube in heat conducting relationship within said en-

velope and said clip, and a finger hold on said clip comprising a portion thereof sprung outwardly from the clip forming a closed loop whereby to afford engagement by a suitable tool to enable removal of the clip from the envelope.

10. A right angle shield mount for electronic components comprising a block of dielectric material having a base, a side face having substantially a right angular relationship to said base, a plurality of pins in said block extending outwardly of said base, and substantially in right angular position relative to said base, a plurality of pin receptacles mounted in the block with open ends thereof at said side face and with longitudinal axes thereof substantially in right angular position relative to said side face, an electric wire connecting each pin to a respective one of the receptacles, and a flexible casing surrounding each wire and extending from a position of engagement with the inner end of the respective receptacle to a location along each respective wire, said block having a molded relationship around and encasing the receptacles and the respective wires whereby the receptacles are flexibly mounted at a selected location on said side face, a base plate of heat conducting material having one portion secured to the block at said side face and another portion extending outwardly of the block at a level substantially flush with said base, said base plate being in electric insulated relationship with said pins, and a component contacting envelope of heat conducting material attached to said other portion of the base plate in heat conducting relationship therewith.

11. A shield mount for an electric component adapted for engagement with heat sink means and comprising a block of dielectric material having a base, a face, and a base plate of heat conducting metal on the block extending outwardly therefrom, a component contacting envelope of heat conducting dead metal secured to said base plate in heat conducting relationship, a heat conducting clip encircling said envelope and forming with said envelope multiple layers of contiguous heat conducting material whereby to secure the component in heat conducting relationship with said envelope and said clip, and a heat conducting spring contact element on the clip extending outwardly thereof to a location spaced from the clip and at a side thereof opposite from said base plate, said spring contact element comprising a plurality of sets of finger elements, said sets having oppositely facing positions and adapted to engage a portion of said heat sink means at locations spaced from each other.

References Cited in the file of this patent

UNITED STATES PATENTS

2,633,526	Snyder	Mar. 31, 1953
2,641,635	Scal	June 9, 1953
2,808,576	Brown	Oct. 1, 1957
2,849,661	Oleson	Aug. 26, 1958
2,910,628	Keener	Oct. 27, 1959