Dec. 2, 1947. H. D. STERICK ET AL 2,432,047

HEAT SCREEN

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Fig. 1.

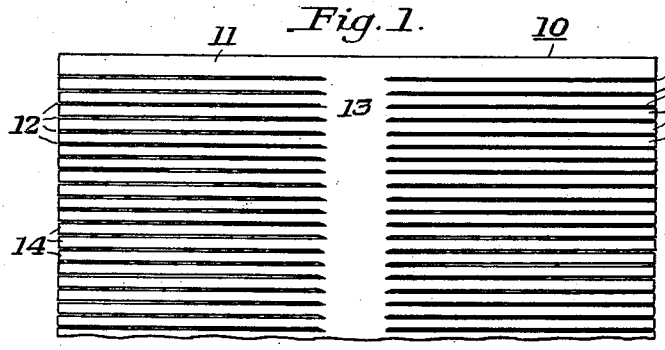


Fig. 2.

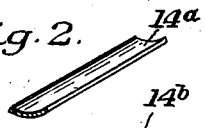


Fig. 2a

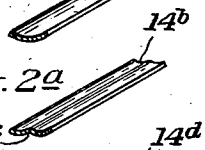


Fig. 2b.

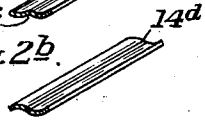


Fig. 3.

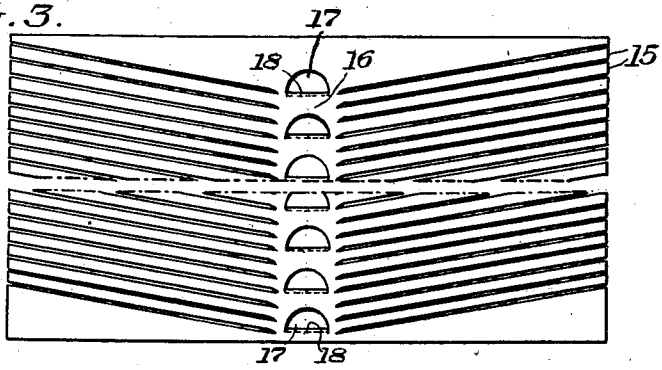


Fig. 4.

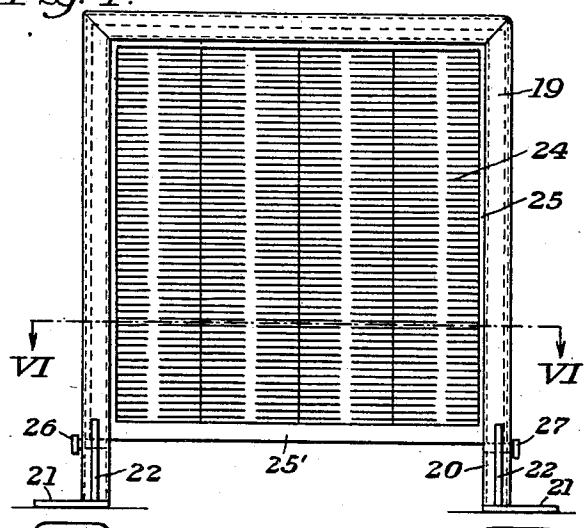


Fig. 5.

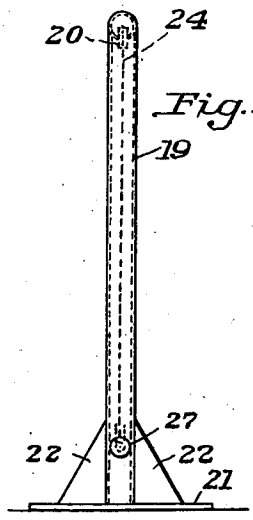
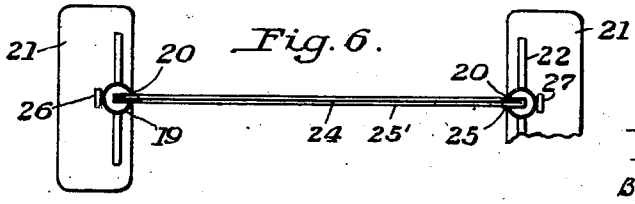


Fig. 6.



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Fig. 7.

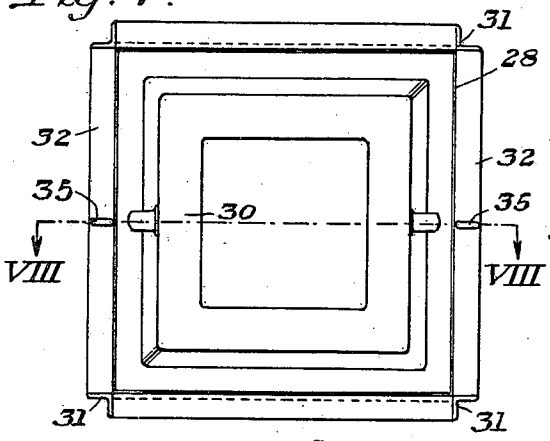


Fig. 9.

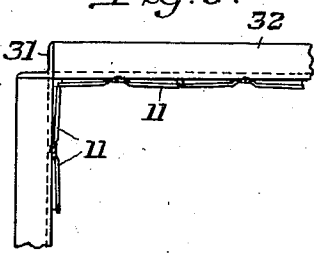


Fig. 10.

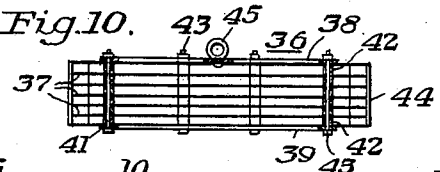


Fig. 11.

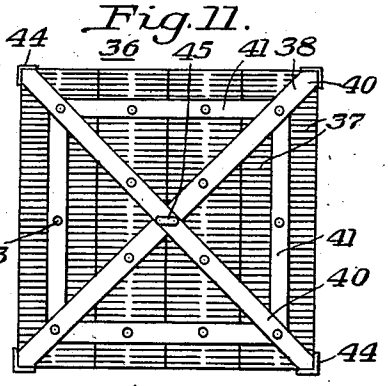


Fig. 8

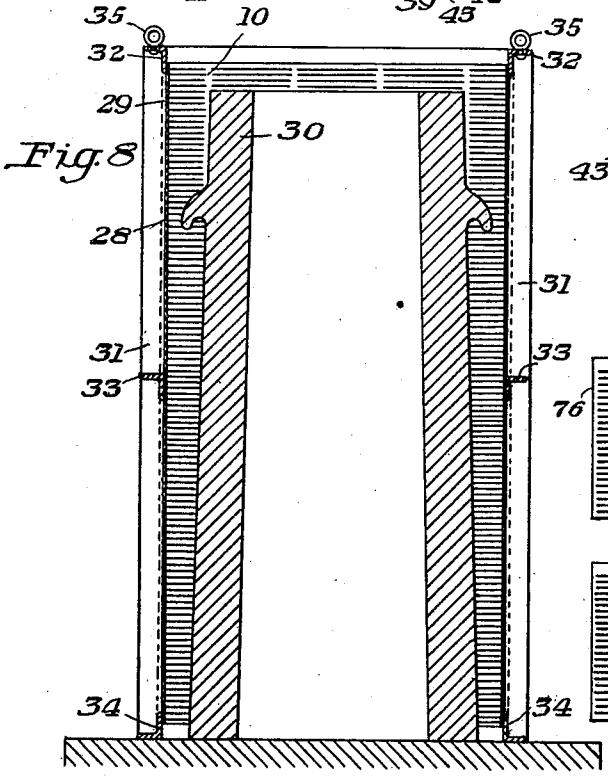


Fig. 18.

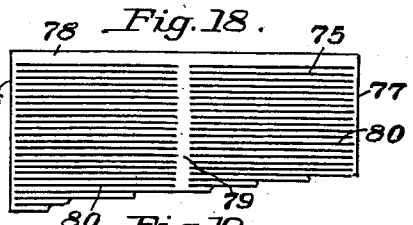
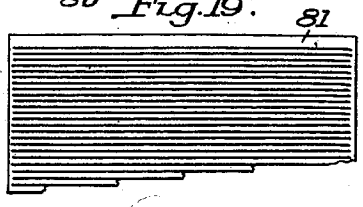


Fig. 19.



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Fig. 12.

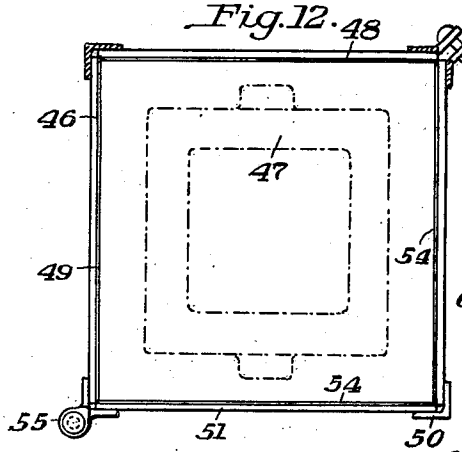


Fig. 14.

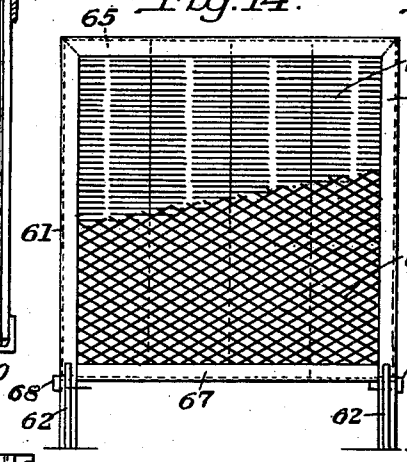


Fig. 15.

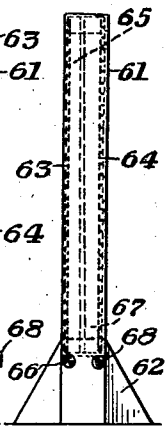


Fig. 13.

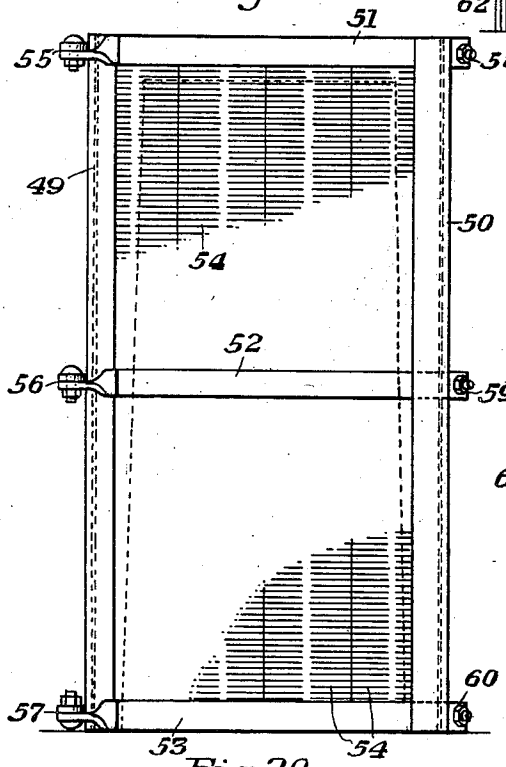


Fig. 16.

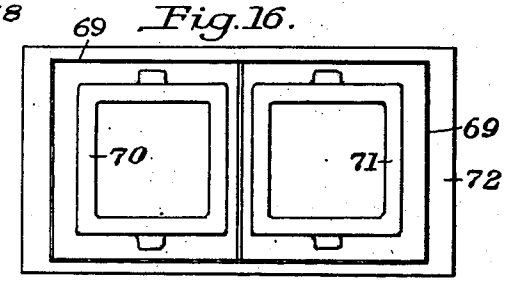


Fig. 17.

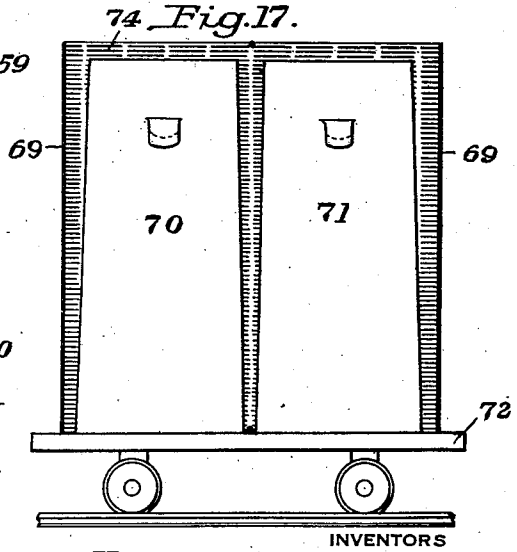
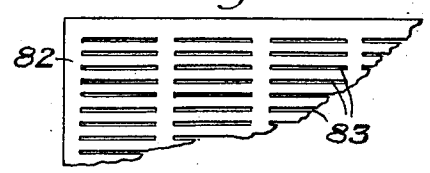


Fig. 20.



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UNITED STATES PATENT OFFICE

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HEAT SCREEN

Harrison D. Sterick and Leslie C. Strickland,
Pittsburgh, Pa.

Application September 8, 1943, Serial No. 501,554

16 Claims. (Cl. 160—179)

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Our invention relates to heat screens, and particularly to heat screens that do not greatly interfere with vision therethrough.

Heretofore heat screens have been made of various elements, such as chains and cables. While such screens are somewhat effective, they are heavy, do not greatly affect the flow of heat therethrough and when they get heated up their efficiency as a heat screen greatly declines. Moreover they are usually heavy and fairly expensive and are not suited to be freely moved from place to place.

The screens made according to our invention are light, inexpensive and cause the heat to be deflected so that the operator or object is protected, and furthermore the screen is of such character that observation of an operation or process therethrough is not materially affected.

In accordance with our invention the preferred screen has as its principal element one that has a plurality of closely spaced transverse slits that form a row of very narrow ribbon-like fins or prickles. The slits extend only part way across the strip so that the fins are integrally connected to the strip by a portion which extends therealong. The fins conduct heat from the unslit portion and provide a much larger area of radiating surface than does an uncut strip. We also contemplate the use of perforated sheets and also expanded metal as screen elements.

The elements are made use of in various forms of screens which are such as to cause the heat to be deflected along the screen and this action deflects much of the heat from a person or thing to be protected.

In the drawings, which represent the present preferred embodiments of our invention,

Fig. 1 is a plan view of one form of our screen element;

Fig. 2 is a view in perspective of one shape of the louvers in said element;

Fig. 2*a* is a view in perspective of another shape of the louvers;

Fig. 2*b* is a view in perspective of still another shape of the louvers;

Fig. 3 is a plan view of another form of our screen element;

Fig. 4 is a view in elevation of a heat screen embodying the screen element shown in Fig. 1;

Fig. 5 is an end view of the heat screen shown in Fig. 4;

Fig. 6 is a section view along the line VI—VI of Fig. 4;

Fig. 7 is a plan view of a heat screen in position around an ingot mold;

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Fig. 8 is a section view along the line VIII—VIII of Fig. 7;

Fig. 9 is a plan view of a corner of the screen shown in Fig. 7 but to a larger scale;

Fig. 10 is a view in elevation of another form of heat screen, suitable for use on the top of an ingot mold;

Fig. 11 is a top plan view of the screen shown in Fig. 10;

Fig. 12 is a view of another form of heat screen, shown in place around an ingot mold;

Fig. 13 is a view in elevation of the screen shown in Fig. 12;

Fig. 14 is a view in elevation of another type of heat screen;

Fig. 15 is an end view of the screen shown in Fig. 14;

Fig. 16 is a top plan view of still another form of ingot screen;

Fig. 17 is a view in elevation of the screen shown in Fig. 16;

Fig. 18 is a plan view of another form of screen element;

Fig. 19 is a plan view of still another form of screen element; and

Fig. 20 is a plan view of still another form of screen element.

In Fig. 1 of the drawing we have shown a typical screen element **10**, consisting of a rectangular strip **11** of metal such as steel or copper of any convenient length having rows of substantially parallel closely spaced cuts or slits **12** that extend inwardly from the opposite side edges of the strip at right angles to the strip edge and terminate at such points as to leave a solid strip or body portion **13**, relatively narrow, which extends lengthwise of the strip along its center. The portions of the strip between the slits form a plurality of very narrow ribbon-like fins or louvers **14** which are connected at their inner ends to the body portion **13**. The fins **14** may be made to assume various forms, for example, they may be rectangular; they may be crinkled longitudinally so as to have a concave portion **14***a* as shown in Fig. 2; they may have two concave portions **14***b* with a rib **14***c* in between as shown in Fig. 2*a*; or they may have an S cross-section **14***d* as shown in Fig. 2*b*. Sections such as shown in Fig. 2, Fig. 2*a* and Fig. 2*b* tend to provide somewhat stiffer fins than flat fins of rectangular section. A convenient size of strip is 8'' wide, of 1/16'' material having slits 1/8'' of an inch apart and a central body portion about 3/4'' wide. It is to be observed that no metal is removed in slitting

the metal strip, but that the fins are forced out of the normal plane (see Fig. 9).

In Fig. 3, the fins 15 form an angle with the side edge of the strip. In this figure the body portion 16 has openings 17 each with a projecting portion or lip 18. It is to be understood that such openings could also be formed in body portion 13 of the strip shown in Fig. 1. It is also apparent that the cross section of the fins 15 can be rectangular, or otherwise, as for example those shown in Figs. 2, 2a, and 2b.

In Fig. 4 we show a heat screen which may be usefully employed to screen an operator from a source of heat such as a furnace ladle or the open door of a heating furnace. The screen comprises a frame 19, which is formed from an inverted U-shaped piece of pipe in the inner sides of which a groove 20 is provided. The ends of the U-frame are secured to pedestals 21 and braced by the triangular plates 22. Slidably received in the groove 20 is a screen 24 including vertical strips 25 of screen element, like the element 10 shown in Fig. 1. It is to be understood that the screen elements can be also arranged horizontally or at an angle to the horizontal. The strips are secured at the ends of the body portions 13 to an edge strip or sash 25' of metal which extend around the four sides of the screen and is slidably received in the groove 20. Bolts 26 and 27 are threaded through the frame 19 and support the lower edge of the edge strip 25'. The screen can be readily removed or replaced by withdrawal of the bolts 26 and 27. It is also within our contemplation to make each screen element 10 detachable so that they could be readily replaced in case of injury to the element.

One of the important uses of the screen element 10 is in the construction of a mold screen 28 illustrated in Figs. 7 and 8. The screen consists of a frame 29 of such a size as to enclose a mold 30 and leave a space of several inches, say 3, between the screen and the ingot mold sides. The frame which is slightly higher than the mold includes uprights 31 of angle iron or other suitable section, top braces 32, side braces 33 and bottom braces 34 all of angle iron or other convenient section, all secured together as by welding. Lifting eyes 35 are secured midway of the sides of the top brace 32. The sides of the frame 29 are formed by vertical strips 10 of the screen elements, such as shown in Fig. 1 or Fig. 2, preferably arranged vertically. They could be horizontal or at an angle to the vertical. The ends of the fins adjoin or slightly overlap as shown in Fig. 9. A screen of this character can advantageously be used to surround an ingot mold and causes the heat from the hot mold to flow upwardly along the spaces between the mold wall and the screen. This heat flow keeps the top portion of the mold and its contents hot for a longer period than where a screen is not used, thus reducing piping and segregation of the elements of the poured ingot.

In Figs. 10 and 11 we show an improved top screen 36 which in use is placed on top of the ingot mold and serves as a hot top. It allows gases to escape but reduces the dissipation of heat from the top portion of the poured ingot. The screen consists of layers or sheets of flat screen elements 37, the elements being similar to those shown in Figs. 1 or 3 secured between a top frame 38 and a bottom frame 39. Each frame includes a cross member 40 and brace member 41 of flat strip metal. The layers are spaced apart by spacers 42 through which passes the bolts 43, which bolts pass through appropriate openings in the screen layers and through the bottom and top frames. Each corner of the bottom and top frames are joined by corner pieces 44, conveniently made from angle iron. A lifting eye 45 is fastened to the top frame. The dimensions of the top screen are such that the brace members 41 rest on the top of the ingot mold walls and the screen extends beyond each end wall.

In Figs. 12 and 13 there is shown an ingot mold screen 46 which is hinged so as to be opened or closed to surround a space around an ingot mold 47 (shown in broken lines). The mold screen consists of two portions, each portion including a side screen 48 and an end screen 49. Each screen includes uprights 50 of angle iron, a top brace 51 of strap iron, a center brace 52 of strap iron and a bottom brace 53 of strap iron. The sides and ends are covered with adjoining strips of screen element 54, like that shown in Fig. 1 or 3. Each of the portions are hinged at 55, 56 and 57 and are secured by fasteners 58, 59 and 60 at the opposite corners. This form of mold screen is wrapped around the ingot mold, while the form shown in Figs. 8 and 9 are dropped down over the ingot mold. The effect of each when in position is the same.

In Figs. 14 and 15, we have shown a screen which includes a U-shaped frame 61 mounted on a pedestal 62, a screen element 63 and a guard element 64, each received in the frame, both elements preferably being slidably received. The screen 63, the rear one in Fig. 14, is made from strips of screen element such as shown in Fig. 1 or Fig. 3 joined to a sash or an edging 65 which is slidably received in the frame 61 and secured by bolts 66. The other screen or guard 64 is spaced from the screen 63 and is made of expanded metal or woven wire, secured to an edging 67 slidably received in frame 61 and secured by bolts 68. This kind of screen screens an observer from most of the heat from a source, such as a furnace or pouring ladle beyond the screen and protects the observer from flying particles of metal, and at the same time does not greatly interfere with the operator's view of the heat source.

In Figs. 16 and 17, we have shown diagrammatically a mold screen 69 large enough to surround two ingots 70 and 71 placed on a car 72. The screen includes a frame 73 similar to frame 28 (Figs. 7 and 8) and the screen elements 74 are like the screen elements in Fig. 1 or Fig. 3. It is evident that a similar frame can be arranged so as to enclose any number of ingots. This screen, as well as the ingot screens heretofore described, not only aid in a better solidification of an ingot, but also protect it from adverse atmospheric currents when standing or passing through an ingot yard which is usually open. Not infrequently a very cold blast may be directed against one or more sides of the cooling ingot and mold while the other sides are not subjected to the blast. This results in uneven cooling and undesirably effects the solidifying ingot. The screen we have described greatly minimizes such effects.

The screens also shield a passer-by from the intense heat of the hot ingots and molds—a desirable feature where ingot cooling space is limited.

Screens such as shown in Figs. 4 and 5 and Figs. 14 and 15 are useful where operators are to be shielded from the heat of a furnace. In

such instances, the screen may be large enough or enough screens provided to screen a desired part of the walls. The screens may rest on the ground or may be suspended from or hinged to the furnace or from any other convenient support.

In Fig. 18 we have shown another suitable screen element 75. The element 75 is made from a strip of relatively thin metal and has narrow edge portions 76 and 77, a top portion 78, a bottom end portion not shown, and a center portion 79. The portions between the edges and center portion are slitted to form fins 80. The pins are offset from the plane of the strip.

In Fig. 19, we have shown a screen element 81 which is similar to the one shown in Fig. 18, but without the center portion.

In Fig. 20, we have shown a screen 82 of perforated metal having narrow cut out slots 83 spaced apart. When an element of this character or a screen of ordinary fine meshed expanded metal is employed, the sheet may be of any desired practical dimensions.

It is understood that in practice the screen fins do not lie in a flat plane, but each alternate one except where it joins the center portion or body portion is above or below the plane of the strip and forms a small angle therewith. Thus it is possible for light rays to travel through the element.

It is apparent that the hot top shown in Fig. 11 can be protected, top and bottom, by expanded metal or metal mesh such as we have shown and described in Fig. 14. It is also apparent that the mesh protecting screen 64 can be placed on both sides of a screen similar to that shown in Fig. 14.

The strip elements 10 such as are used in the various screens, can be so attached to the frame in such manner that any element can be readily replaced.

It appears that the prickled elements change radiant heat to conducted heat, and this may explain the efficiency of the screen in general and particularly where the screen element is incorporated in an ingot mold.

While we have described certain presently preferred embodiments of our invention, it is to be understood that the invention may be otherwise embodied within the scope of the following claims.

We claim:

1. A substantially planiform heat screen including a frame, and a screen element attached to said frame, said screen element including a body portion extending lengthwise thereof, and a plurality of closely spaced substantially parallel strips forming slits one end of each of said strips terminating at the body portion integrally therewith.

2. A heat screen including a frame, a plurality of substantially planiform screen elements attached to the frame, said screen elements each including a body portion extending lengthwise thereof, and a plurality of closely spaced substantially parallel strips forming slits one end of each of said strips terminating at the body portion.

3. A heat screen including a frame, a plurality of substantially planiform screen elements attached to the frame, said screen elements each including a body portion extending lengthwise thereof, and a plurality of closely spaced substantially parallel strips forming slits one end of each of said strips terminating at the body portion, the edges of adjoining screen elements being in contact.

4. A heat screen including a frame, and a flat strip like screen element attached to said frame, said screen element including a centrally disposed narrow body portion extending lengthwise thereof, and a plurality of closely spaced substantially parallel strips forming slits one end of each of said strips terminating at the narrow body portion.

5. A heat screen including a frame, and a flat strip-like screen element, said screen element including a central body portion extending lengthwise thereof, and a plurality of strips extending from the body portion to the edges of said element forming a series of fins, said fins being inclined at an angle to the body portion and having intervening slits.

6. A heat screen including a frame, and a flat strip-like screen element, said screen element including a central body portion extending lengthwise thereof, and a plurality of strips extending from the body portion to the edges of said element forming a series of fins, the fins being crinkled longitudinally.

7. A heat screen comprising a frame having a slot therein, and a sash slidably received in the slot, screen elements attached to the sash, said elements each including a centrally disposed body portion, extending lengthwise thereof and a plurality of closely spaced substantially parallel strips forming slits one end of each of said strips terminating at the body portion, said screen elements being mounted in the sash with the edges of adjacent elements in contact.

8. A heat screen for enclosing a heated object said screen comprising a frame surrounding and spaced from the object said frame having screen elements attached thereto and said elements each including a narrow body portion of thin material, extending lengthwise thereof, and a plurality of narrow fins integrally attached to the body portion.

9. A heat screen for enclosing a heated object said screen comprising a frame having a plurality of sides, certain of said sides being hingedly secured to an adjacent side, and spaced from the sides of the object to be enclosed, said frame having screen elements attached thereto, said elements each including a narrow body portion of thin material extending lengthwise thereof, and a plurality of narrow fins integrally attached to the body portion.

10. A heat screen including a frame, and a screen element attached to said frame, said screen element including a centrally disposed body portion extending lengthwise thereof, a plurality of closely spaced substantially parallel strips forming slits one end of each of said strips terminating at the body portion, said body portion having spaced openings therein.

11. A heat screen including a frame, and a screen element attached to said frame, said screen element including a centrally disposed body portion extending lengthwise thereof, a plurality of closely spaced substantially parallel strips forming slits one end of each of said strips terminating at the body portion, said body portion having spaced openings therein, and lips adjoining said openings.

12. A heat screen comprising a frame, a plurality of screen elements attached to the frame, and forming a substantially plane surface, said elements each including a body portion extending lengthwise thereof, a plurality of narrow fins attached to said body portion, and a guard element spaced apart from the screen element and sub-

stantially parallel thereto, both elements being slidably received in the frame.

13. A heat screen, including a plurality of layers of screen elements side by side, each screen element comprising a narrow body portion, and narrow elongated fins integrally connected thereto, and a frame for holding said layers in spaced apart parallel relationship.

14. A heat screen including a frame, screen elements attached to the frame, said screen elements including a centrally disposed body portion, a plurality of very narrow ribbon-like fins attached to said body portion and extending outwardly, at least some of said fins lying outside the normal plane of the body portion.

15. A heat screen for enclosing an ingot mold, said screen comprising a frame surrounding and spaced from the sides of the mold, said frame having screen elements attached thereto, said elements including a centrally disposed body portion of thin material extending lengthwise of the element, and a plurality of narrow ribbon-like fins extending from the body portion.

16. A heat screen including a plurality of

spaced apart layers, each layer including screen elements, in side by side relation, said elements including a body portion of thin material extending lengthwise of the elements, and a plurality of narrow fins integrally attached to the body portion.

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