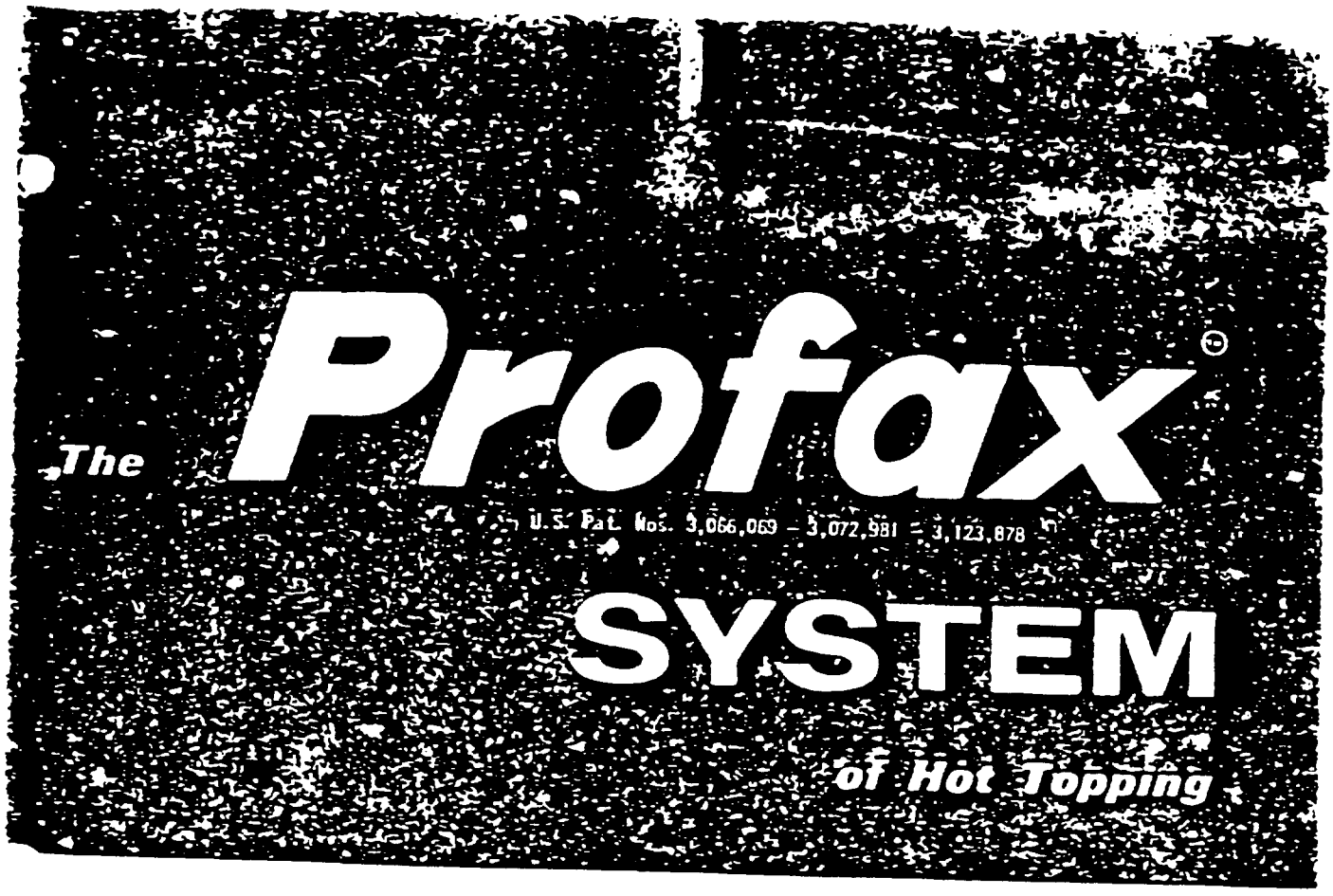


PRODUCES BETTER INGOTS

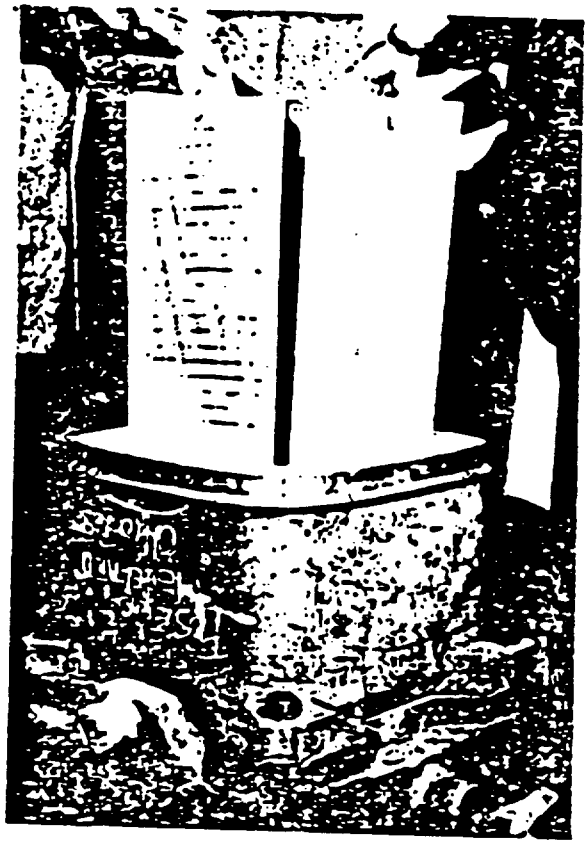
From Foseco®

For

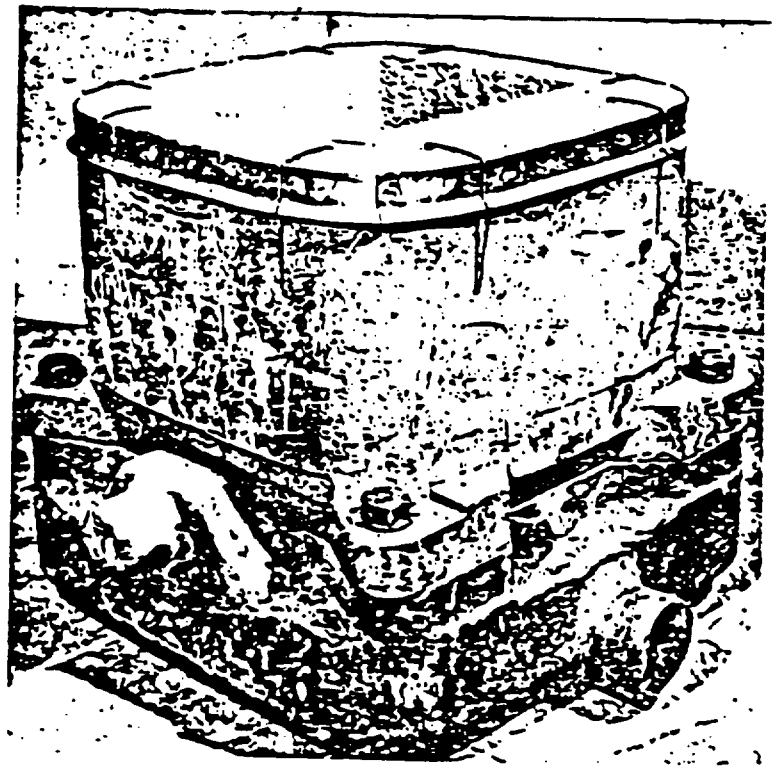
0245

Foseco Inc 1964

PLAINTIFF'S EXHIBIT FOS-9



THE FOSECO "PROFAX" INSERT ASSEMBLY
FOR USE IN PERMANENT TYPE HOT TOP CASTINGS



THE USE OF FOSECO "PROFAX" INSERTS IN PERMANENT TYPE HOT TOP CASTINGS.

The acceptance of numerous technological advances is rapidly changing the procedures for manufacturing steel. The effects on steel production rates of (1) basic oxygen converters, and (2) open hearths employing basic roofs and oxygen lancing are well known. The "Profax" system of hot-topping big end up ingots is designed specificially to give steel producers an efficient and economic method for hot-topping this increased production of steel into solid ingots.

Due to increasing strict metallurgical specifications, more of this tonnage is being made as killed steel which must be hot-topped to produce a sound, acceptable product.

A general survey of the steel industry indicates that a number of specifications should be met to cope with the present steel hot-topping requirements. These specifications are as follows:

1. Low volume hot-top so as to produce maximum yield at the rolling mill.
2. The assurance of producing consistently sound metallurgical product.
3. Minimum capital investment.
4. Minimum number of permanent hot top units to conserve space for preparation and storage.
5. The ability to prepare rapidly the hot-top units between casts so that they may be used several times per day.
6. A system that can be used economically in periods of both low and peak production with ease and speed of preparation, at minimum cost.
7. Low maintainence cost, and A system requiring a minimum of skilled labor for preparation.
8. Cleanliness at the hot-top preparation and pouring platforms and stripping area; minimum of debris and carry-over into soaking pits.

The steel industries acceptance of "Profax" for hot-topping big-end-down molds led to the use of "Profax" as a liner in permanent hot-top castings for big-end-up molds. Its use in production provides a new hot-topping method that meets all of the preceeding specifications.

The "Profax" liner is light weight, 3/4" thin. The finished liner is refractory, possesses insulating properties at steel pouring temperatures and does not adhere to either the ingot feeder-head or the hot-top casting wall. This results in both a smooth feeder-head and clean hot-top interior walls upon stripping from the ingot.

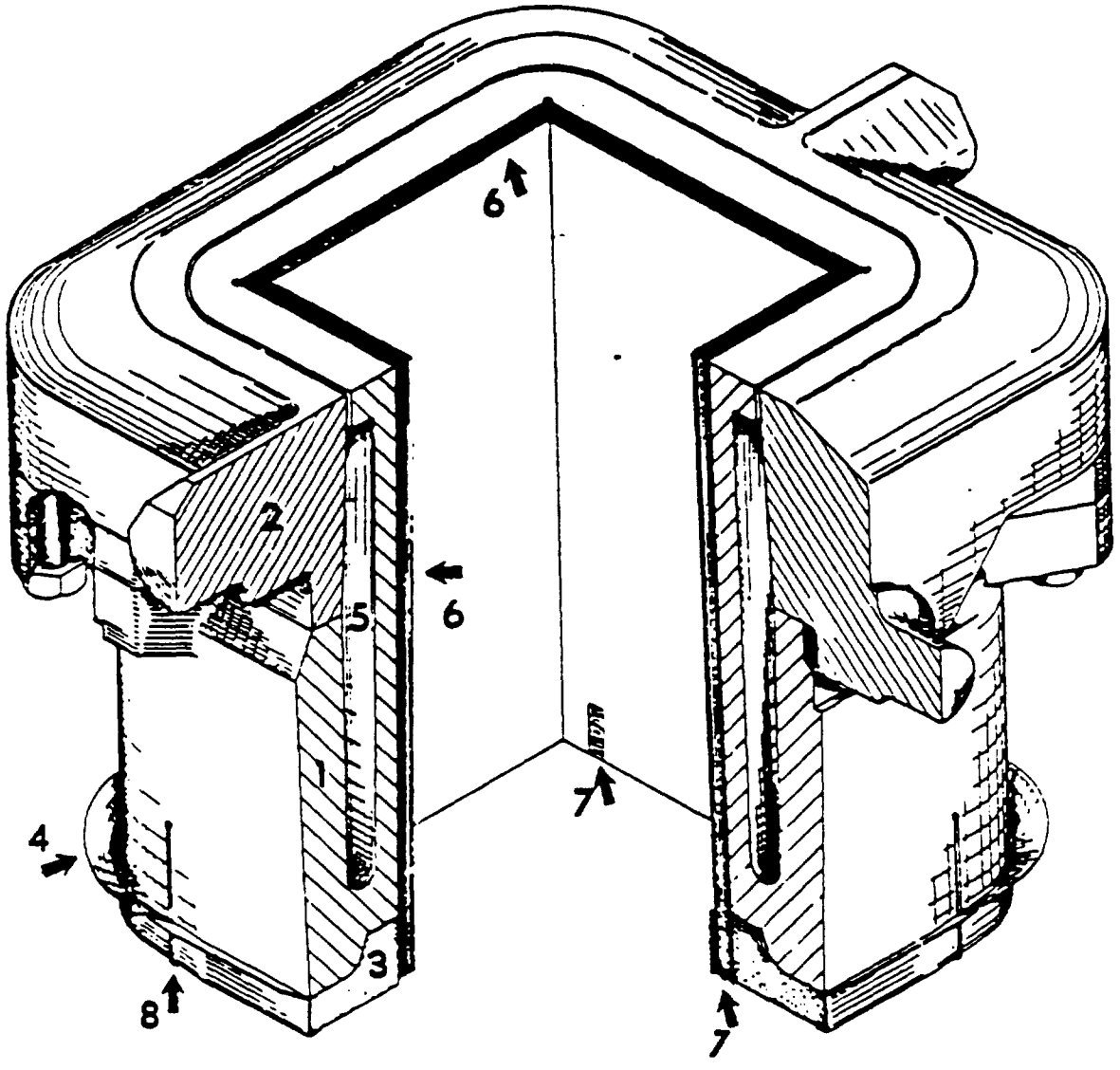
The permanent hot-top unit for the "Profax" liner is a special heavy-duty iron casting and completely eliminates costly back-up brick or castable. Two designs of casting are currently used: (1) a "J" shaped casting (Fig. 1) which is bolted on to the top casting of a conventional permanent hot-top unit or (2) a one piece casting which eliminates the need of assembling top and bottom units.

ADVANTAGES OF THE USE OF FOSECO "PROFAX" INSERTS

IN PERMANENT TYPE HOT TOP CASTINGS

1. Low volume hot top means increased yields.
2. Consistently sound metallurgical product.
3. Good handling strength under normal steel mill conditions with no waste of material.
4. Greatly reduced turn-around time of hot tops; permanent hot top available for use up to four times per day.
5. Fewer hot top castings needed; less space needed for given number of hot tops per day or increased hot top capacity with the same number of hot castings.
6. Improved flexability in scheduling of both the melt shop and rolling mill.
7. Less labor needed; no skilled labor required; improved working conditions in the hot top house.
8. Eliminates: (1) chipping out old lining; (2) clean up of brick or castable debris; (3) relining of hot tops.
9. Less time needed for assembly of top and bottom castings due to the prolonged life of the bottom casting with the "Profax" process.
10. Eliminates use of slurry for linings or patches and drying of hot tops.
11. Reduced debris means cleaner hot top house; elimination of drying means reduced costs and better working conditions.
12. Rapid preparation of hot tops; 20 hot tops per man hour possible.
13. Inserts not friable - will not contaminate steel by introducing non-metallic inclusions. No slurry present to fall into mold during insertion in mold or during subsequent tracking to pouring platform. Reduced sand-ring breakage and fall-off. Eliminates vacuuming molds at the pouring platform.
14. Can be transported over rough tracks without damage to hot top.
15. Totally dry "Profax" system eliminates boiling due to retained moisture.
16. Refractory carry-over to soaking pit minimized.
17. Fast, clean strip of hot top; fewer stickers. Fast, consistent delivery of ingots to the soaking pits.
18. Clean, simple compact storage. Low density of "Profax" reduces freight charges.
19. Easily adaptable to all types of permanent hot tops.

PROFAX LINER SYSTEM FOR USE IN PERMANENT TYPE HOT TOPS



1 THE IRON CASTING USED AS PERMANENT BACKING FOR THE PROFAX LINERS.
2 CONVENTIONAL TOP CASTING WHICH IS BOLTED PERMANENTLY TO BOTTOM CASTING.
3 SAND RING WHICH PROTECTS BOTTOM CASTING FROM LIQUID METAL.
4 STEEL WIPER STRIPS USED TO AID IN SEALING METAL BETWEEN MOLD AND HOT-TOP.
5 AIR-SPACE BETWEEN INNER AND OUTER WALLS OF THE CASTING.
6 PROFAX LINERS USED TO FORM HIGHLY INSULATING HOT-TOP
7 METAL CLIPS HOLD PROFAX LINERS SECURELY IN PLACE.
8 WIRE SPRING CLIPS SECURES SAND RING.

FIGURE 1

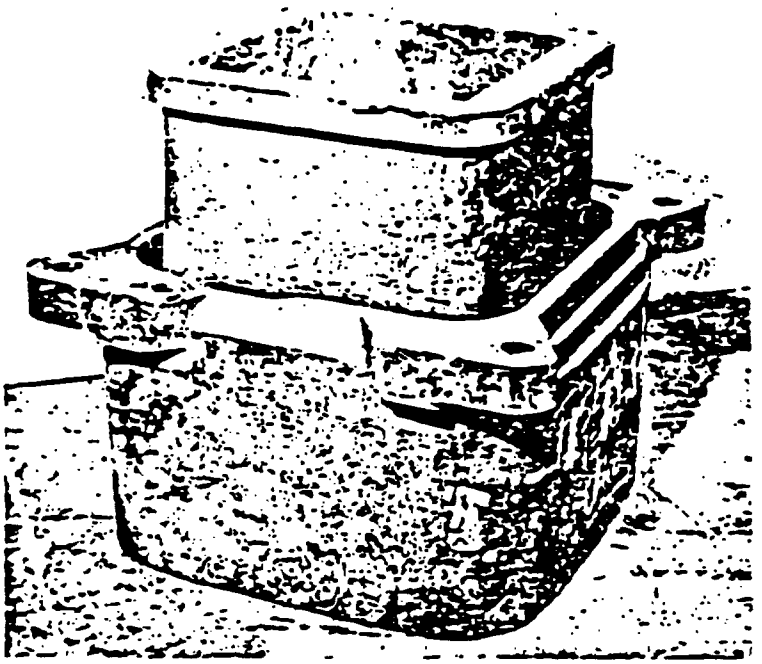


Figure 2
Bottom casting of iron used in the "Profax Liner System" of hot-topping. This casting acts as the backing support for the "Profax" liners. "Profax" is such an excellent insulator that the casting is only between 800° and 900° degrees F. at stripping. The metal walls of the casting enable the unit to cool very rapidly after stripping.



Figure 3
A conventional permanent type top casting is bolted to the "Profax System" bottom casting. To keep costs at a minimum, the "Profax" bottom casting can always be designed so as to allow the conventional top casting to be bolted to the "Profax" bottom casting. The present permanent top castings in any shop can be used with the "Profax System."



Figure 4
Top view of the "Profax" system permanent hot-top casting assembly. The top and bottom castings are now bolted together to form a single unit. Air setting cement is used to fill the top joint between the castings so as to prevent metal penetration during pouring. The "bolted-together" unit is so rigid that the cement joint will remain intact indefinitely and does not have to be replaced.

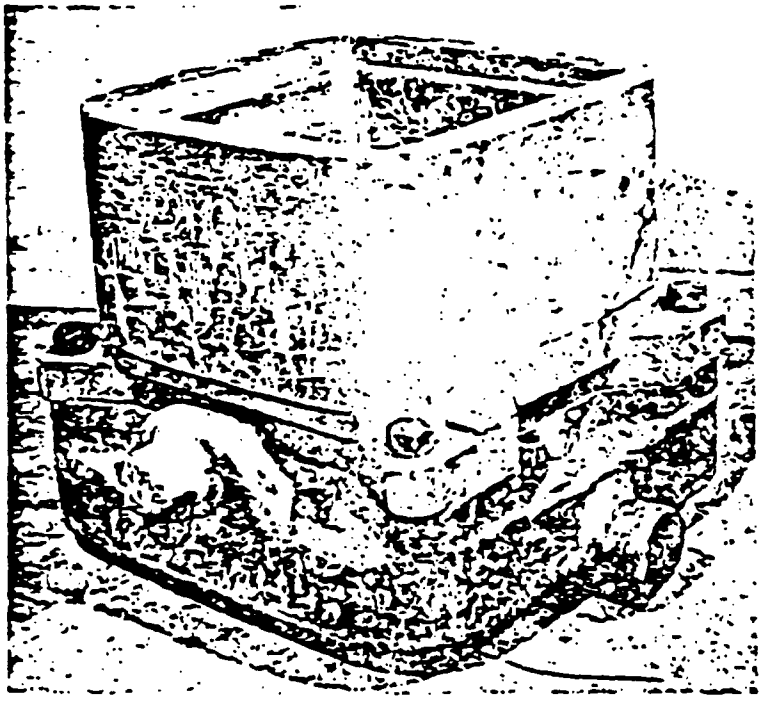


Figure 5
Bottom view of the "Profax" system hot-top casting assembly. The bottom portion of the casting conforms to the shape of the top of the sand ring. The unit is designed so that it is impossible to have the hot-top head hang up in the hot-top. The design effects a decrease in the number of hot-top stickers and permits faster, cleaner stripping of the hot-top from the head of the ingot.

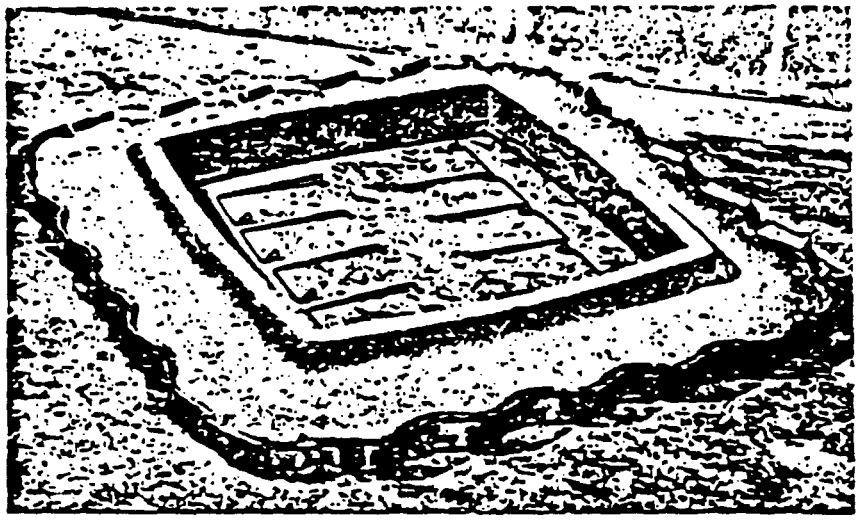


Figure 6
The specially designed sand-ring is used to protect the bottom casting from liquid metal during pouring. The eight wire spring-clips are used to secure the sand-ring tightly to the bottom of the bottom casting.

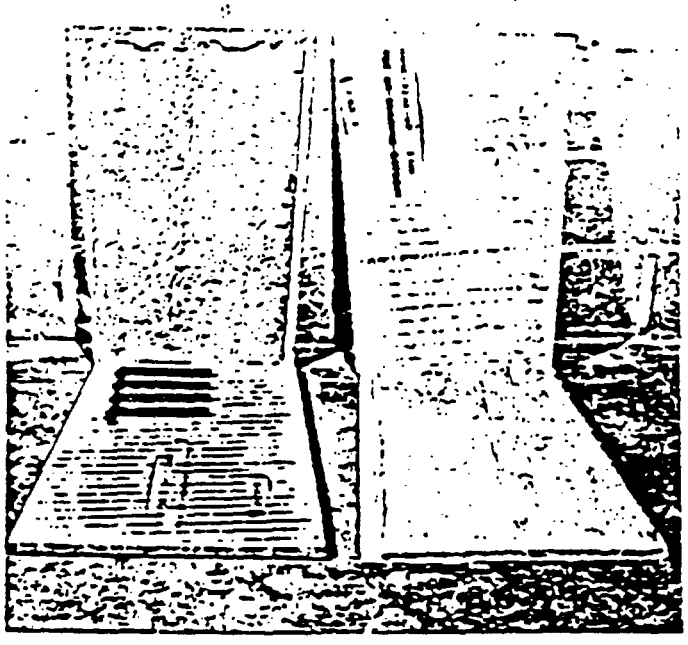


Figure 7
The four wedge-shaped "Profax" liners are inserted into the iron casting to provide a highly insulating, low volume hot-top. The four metal clips are used to hold the "Profax" liners securely in place in the hot-top during insertion into the mold and during transit to the pouring platform.

Figure 8

Figures 8 through 13 show steps required to assemble the "Profax" hot-top unit. The 10½% volume hot-top shown is for 12,000 lb. ingot made in a 25" x 27" mold. At the time of stripping from ingot, the inner walls of the casting are about 900° F. The unit takes about 1 hour to cool to 400° F, at which time the hot-top is assembled. Note cleanliness of interior walls of hot-top. The "Profax" strips clean from the casting and no cleaning or other preparation must be made before reassembling the hot-top for use.

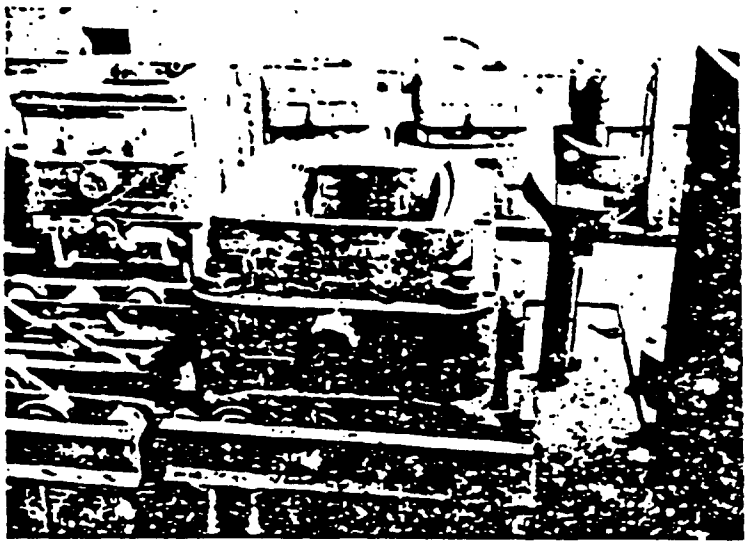




Figure 9

The first step in the assembly is to place the sand ring on the bottom of the casting in the conventional manner. The unit shown is being assembled on an automated hot-top line; when stanchions are used to assemble the hot-tops it is often more convenient to turn the castings on their sides and assemble the unit horizontally rather than vertically as shown in the above photo.



Figure 10
This photo shows the location of the retainer straps which are bent over the bottom of the "Profax" liners to hold them securely in place during handling and transportation of the hot-top. Only one strap is used on each side and it is located about 2" in from the corner of the "Profax" liners.

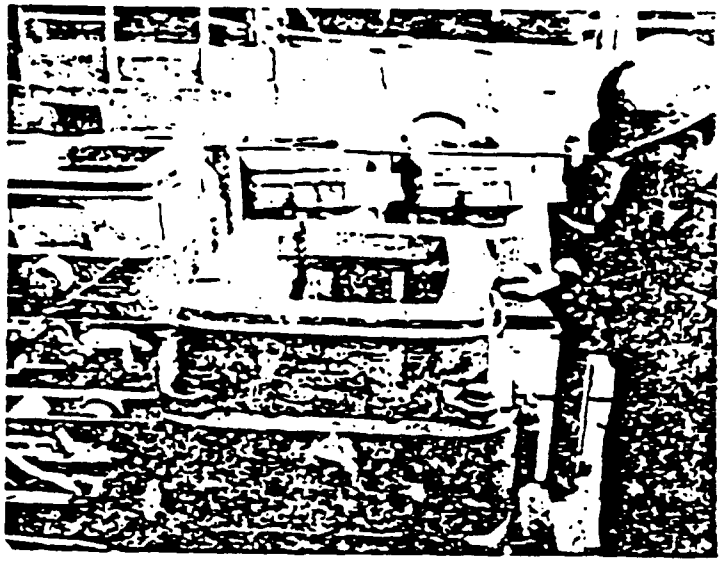


Figure 11
The photo shows the securing of the sand ring to the bottom of the casting. Usually 2 wire spring clips are used on each side of the hot-top. If desired the sand ring can be secured to the casting at any time during the cooling period then as soon as the casting has reached 400°F the "Profax" liners can be inserted in the hot-top.

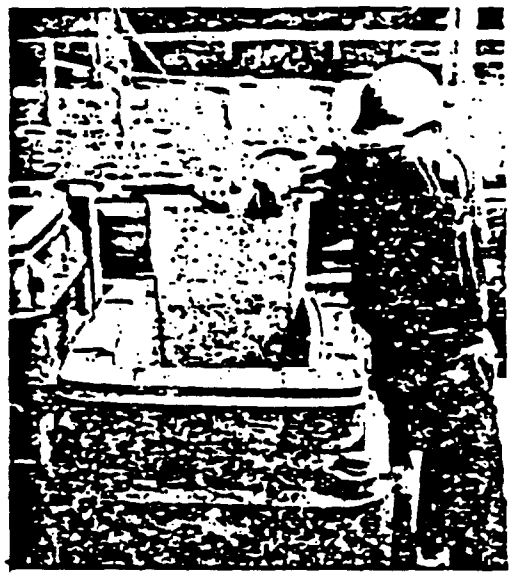


Figure 12
Insertion of "Profax" liners into the iron casting. Complete time to fit the liners in the hot tops is approximately 1 minute per top. The complete operation can be done by one man. The "Profax" liners for the long side of this hot top weigh only 11 lbs. each and the liners for the short side weigh 9 lbs. each. The wedge shaped units slide easily into place and can usually be secured tightly with the use of hand pressure. The only tool needed is a wooden head mallet that may have to be used to tap the liners in place on a tight fit.



Figure 13
The last step of the assembly operation is to bend the retainer clips over the bottom of the "Profax" liners to secure them in the hot top. Although a hammer is shown being used in this picture, the clips are of light enough gauge that they can be bent into place with finger pressure. This hot top was completely assembled and back on a mold ready for use 1 hour and 15 minutes from the time it was stripped from the previous heat. Slurrying or drying of hot top between heats is not necessary.



Figure 14
Typical Pallet of "Profax" liners for 32" square ingot. There are 30 liners for hot tops per pallet and 26 pallets per truck load for a total of 780 hot tops per truckload.

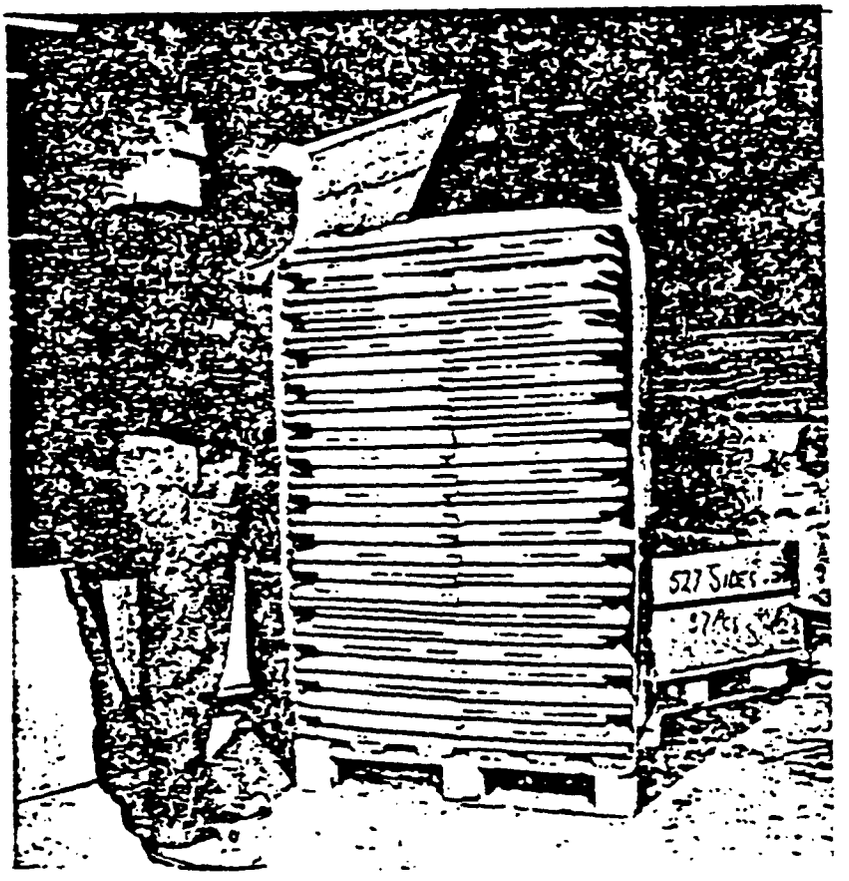
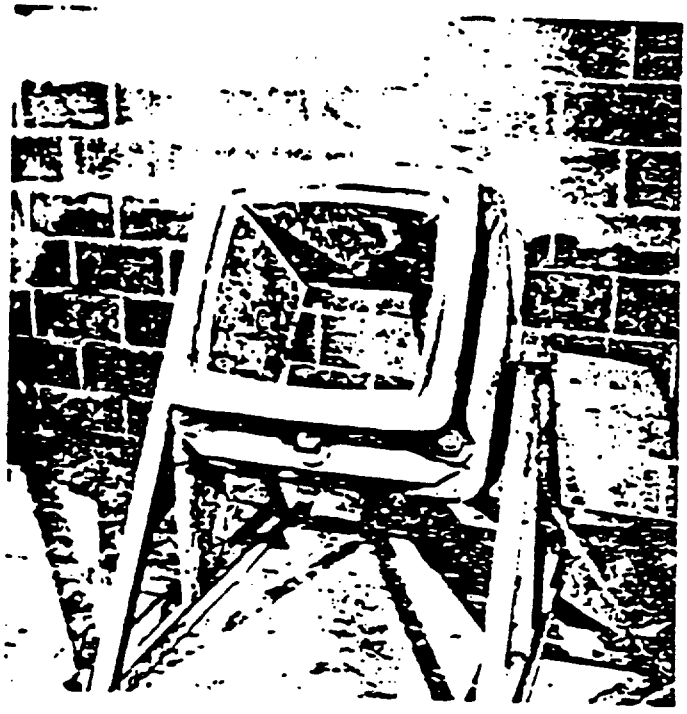


Figure 15
Open pallet of "Profax" liners showing the easy access for handling. The "Profax" liners do not deteriorate under normal steel mill storage and are strong enough to withstand normal steel mill handling. Breakage has been less than 1/2% where this process has been used the longest time.

INSTRUCTIONS FOR INSTALLING FOSECO PROFAX IN PERMANENT TYPE HOT TOP CASTINGS

Figure 1



Brush away any loose Profax powder remaining from the previous use and remove any steel splashes from the inside of the casting. Attach setting blocks. Tilt casting to 45° angle.

Figure 2



Place sand ring on casting

Figure 3, 4

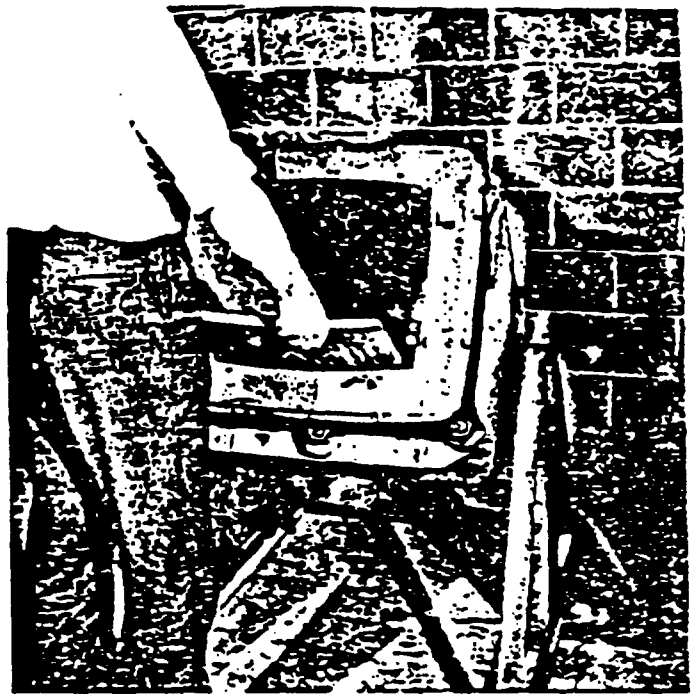


Locate 4 retaining straps in grooves on sand ring approximately 3 inches from edge. Bend the legs back out of the way.

ALLOW CASTING TO COOL BEFORE PUTTING PROFAX IN PLACE. CASTING SHOULD BE MAX. 400° F BEFORE SETTING PROFAX.

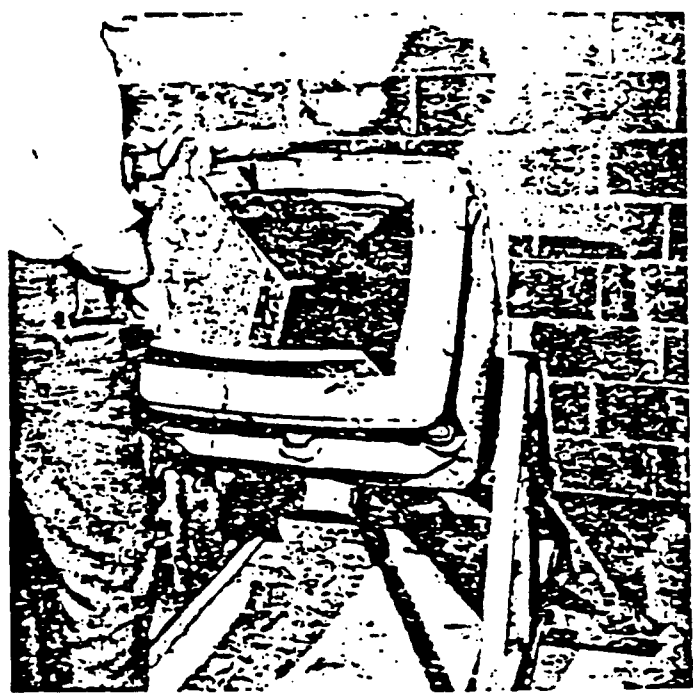
Spring clips may be attached during this cooling period, or after the Profax has been set (see Figure 14, 15).

Figure 5



Place 1st Profax slab on lower face of casting. Allow approximately 2 inches to protrude. Left edge of slab should be touching left face of casting, leaving a gap along right edge of slab.

Figure 6



Place 2nd Profax slab against left face of casting. Allow approximately 2 inches to protrude. The lower edge of the 2nd slab will rest on the end of the 1st Profax slab.

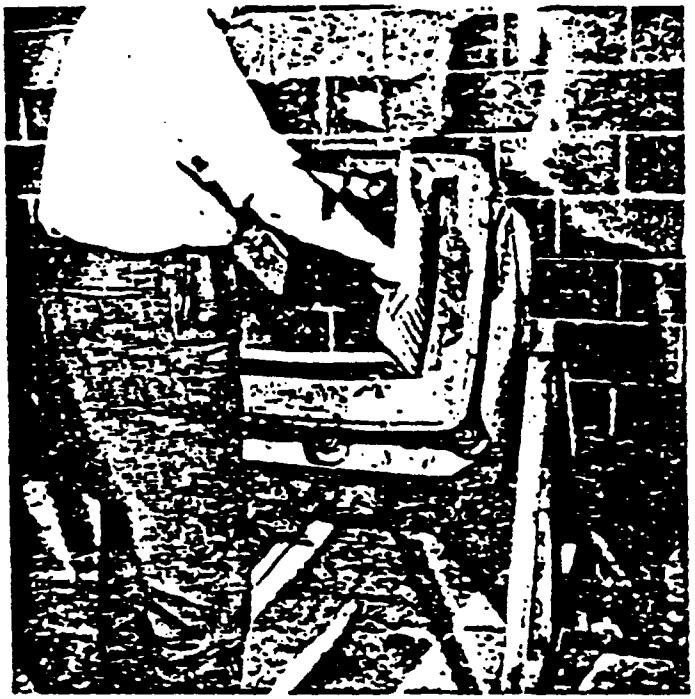


Figure 7

Place 3rd Profax slab against right face of casting. Allow approximately 2 inches to protrude. The bottom edge of the 3rd slab will locate in the gap running along the right edge of the 1st slab.

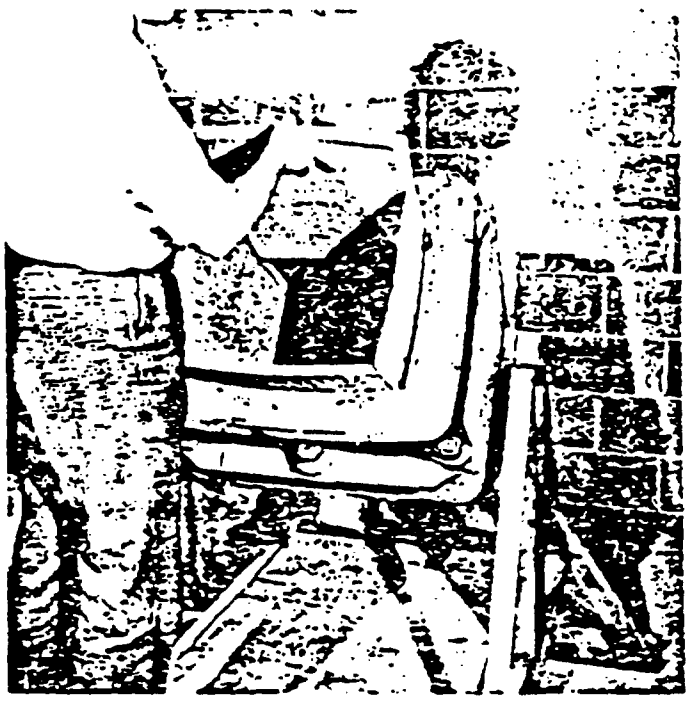


Figure 8

Place 4th Profax slab against top face of casting. Keep right edge against right face of casting. Push in until even with other three slabs.

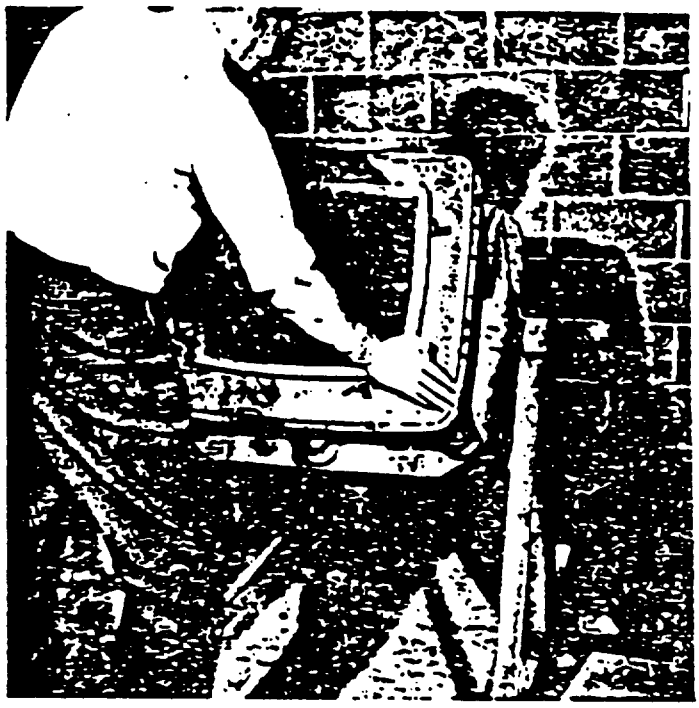


Figure 9

Push all 4 slabs in evenly by hand until they lock. Slabs will extend about 1 inch above bottom of sand ring.

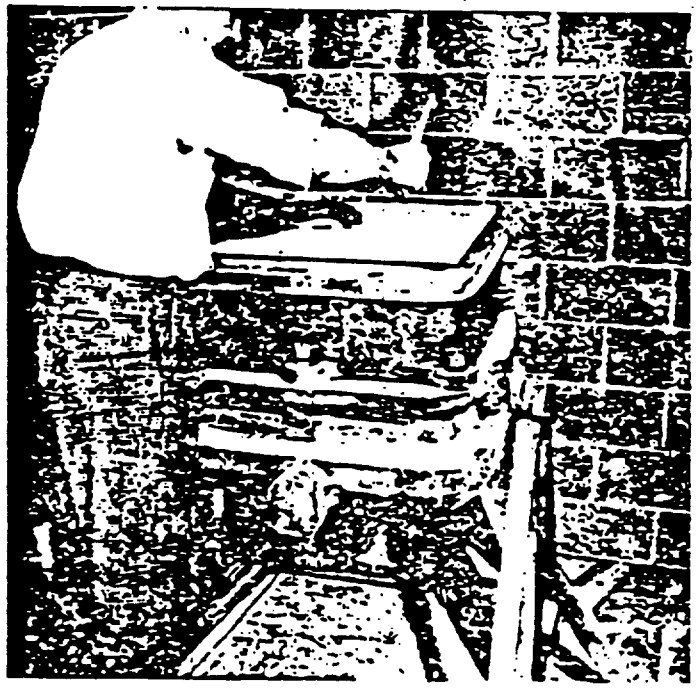


Figure 10

Tilt casting to vertical position and cover all slab edges with wooden locking plate. Top locking plate evenly on all 4 sides to drive slabs flush with sand ring.

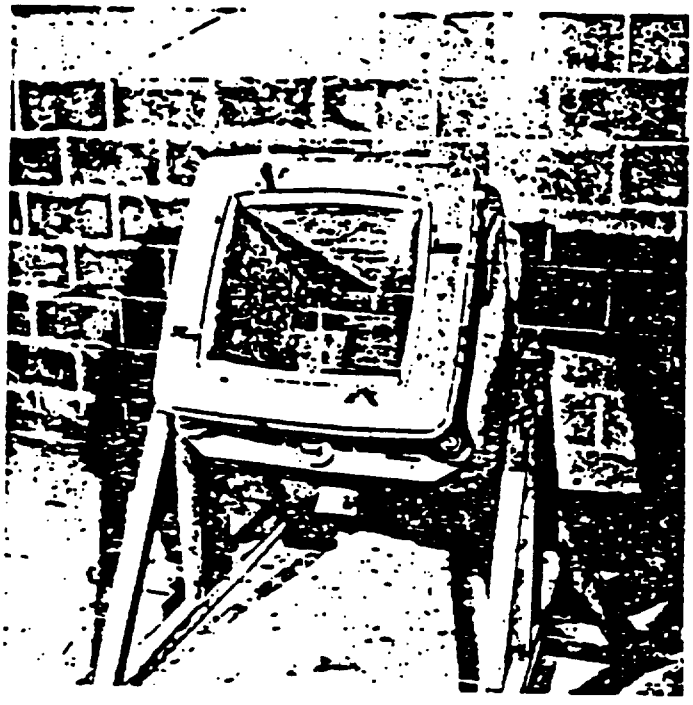
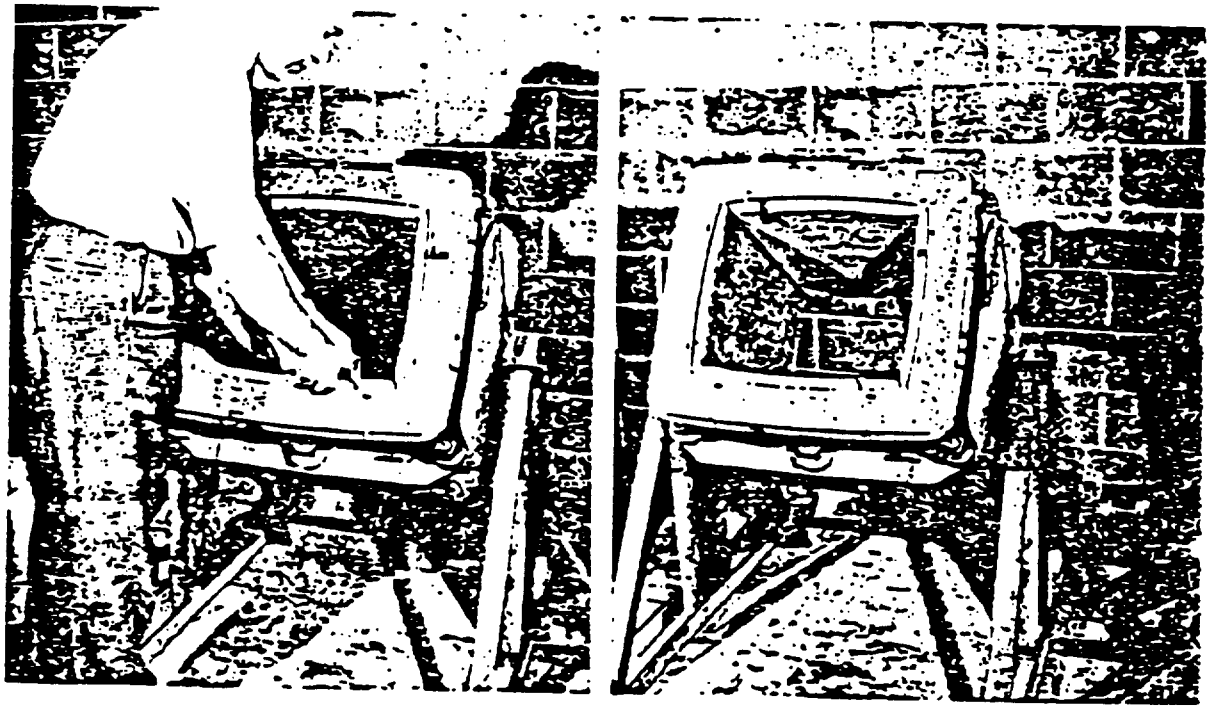


Figure 11

Remove locking plate. Return casting to 45° angle.

Figure 12, 13



Bend 4 retaining straps inward and downward to lock Profex slabs in position.

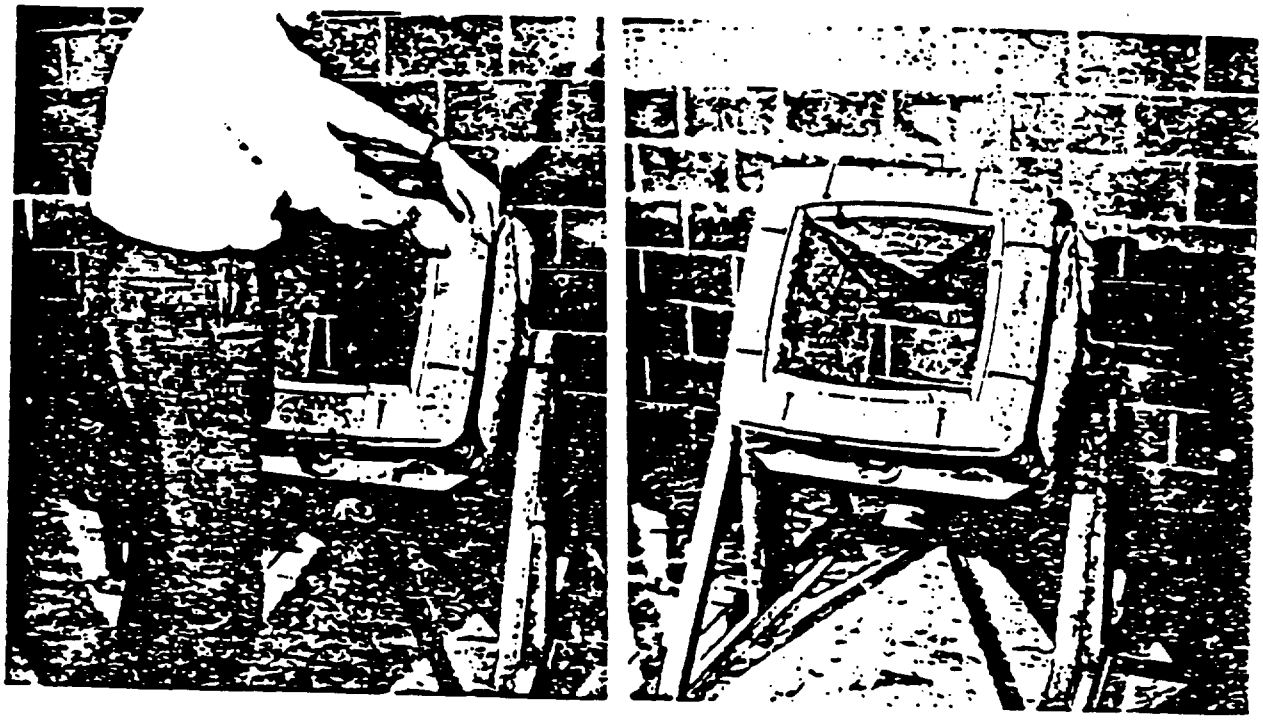


Figure 14, 15 Attach spring clips—or attach steel straps to secure sand ring in place.

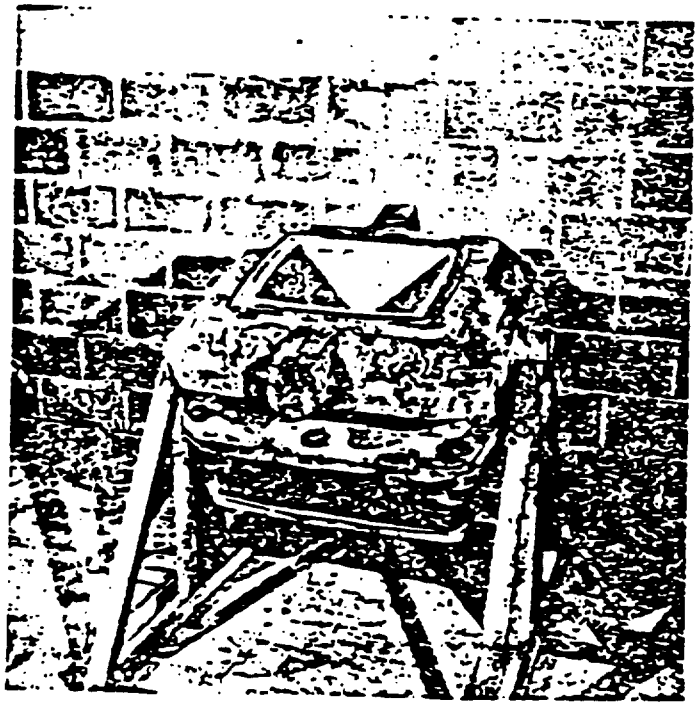


Figure 16

Return casting to upright position, ready for setting on ingot mold.