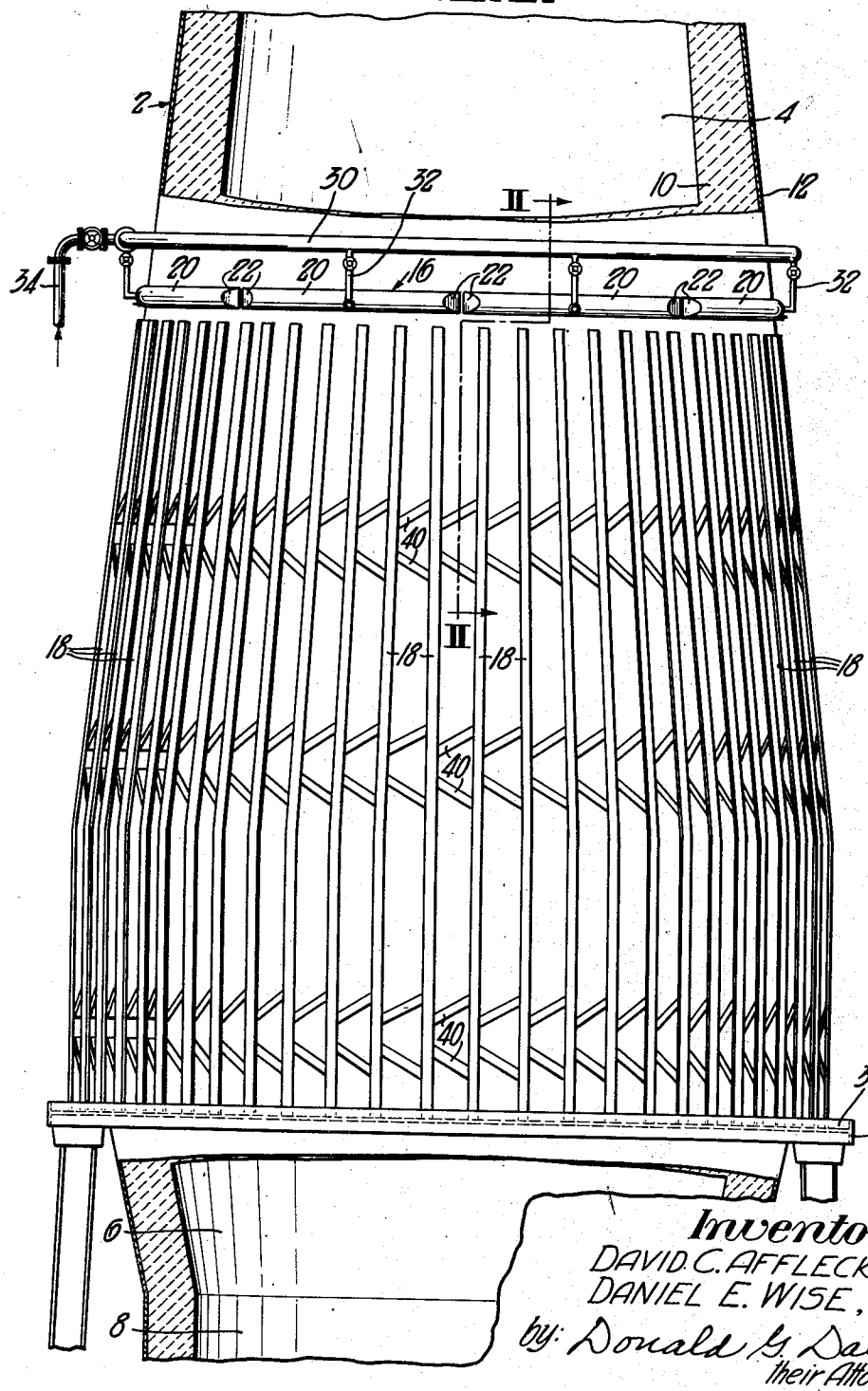
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COOLING SYSTEM FOR BLAST FURNACE

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FIG. 1.




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FIG. 2.

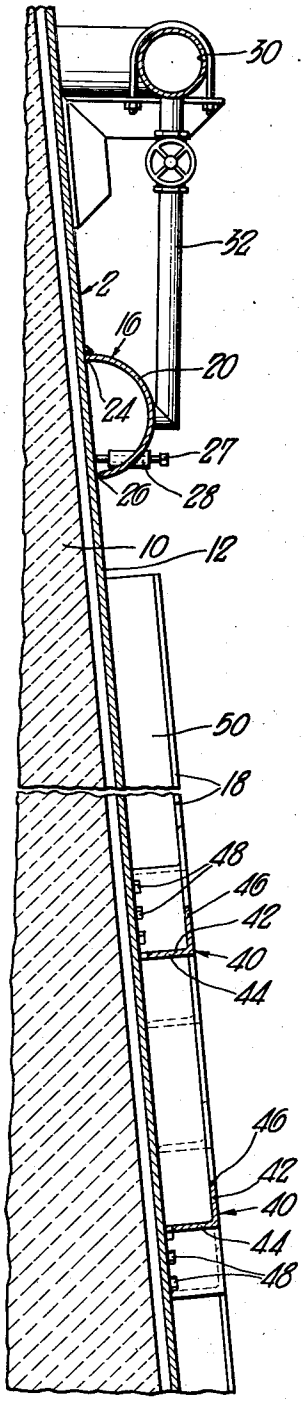



FIG. 3.

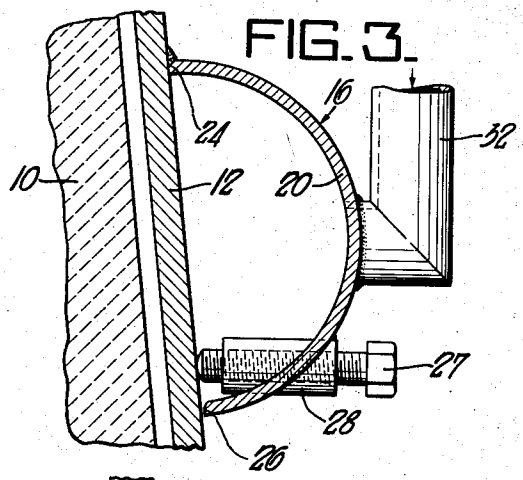



FIG. 4.

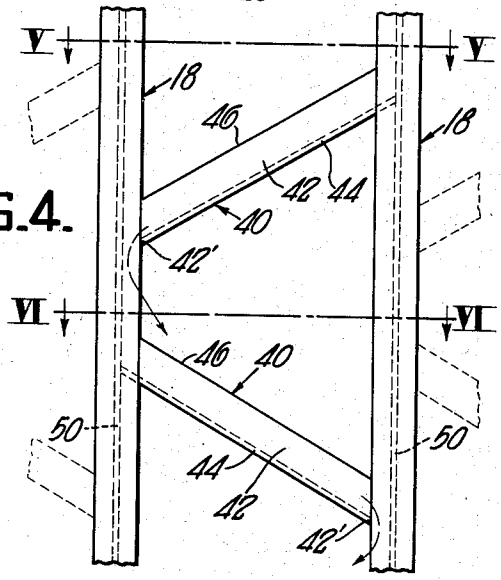



FIG. 5.

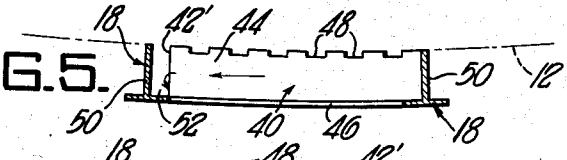
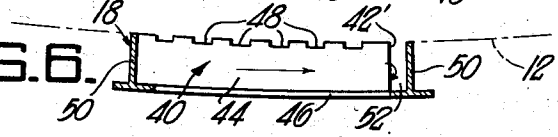



FIG. 6.




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2,711,311

# COOLING SYSTEM FOR BLAST FURNACE

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Application January 27, 1954, Serial No. 406,522

3 Claims. (Cl. 266—32)

The present invention relates to blast furnaces and more particularly to apparatus for cooling the steel shell of the furnace stack.

During the campaign of a blast furnace, the inner refractory lining of the furnace seldom wears uniformly with the result that portions of the lining become so thin that the outer steel shell of the furnace stack is not uniformly insulated over all its area. When this occurs, the steel shell becomes overheated and hot spots develop. Overheating of the furnace shell may also result when the lining itself is made of a carbonaceous material which has a relatively high coefficient of heat transfer.

In order to prevent damage from overheating and the development of hot spots the steel shell of the furnace is usually cooled by auxiliary means. Up to the time of our invention, this was usually accomplished by spraying water onto the shell. This method of cooling the shell was not satisfactory in that it did not produce efficient cooling and created environmental conditions which were detrimental to efficient operations. In spray cooling, when the water was sprayed onto the shell surface under pressure, a fine mist was formed which drifted off into the atmosphere away from the furnace and finally settled on surrounding structures such as the roof of the cast house, etc. Such constant exposure to water accelerated corrosion of the surrounding structures. During the winter season, the settling water resulted in the formation of huge icicles which created safety hazards for furnace personnel working in the area.

It is, accordingly, an object of our invention to provide apparatus for water cooling the shell of a blast furnace whereby a continuous sheet of water is caused to flow along the outer surface of the furnace shell protected from disturbance by air currents.

This and other objects will become more apparent after referring to the following specification and attached drawings, in which:

Figure 1 is an elevational view;

Figure 2 is a vertical sectional view taken on the line II—II of Figure 1;

Figure 3 is an enlarged detail vertical sectional view;

Figure 4 is an enlarged detail view in frontal elevation showing the weir construction of our invention;

Figure 5 is a sectional view taken on the line V—V of Figure 4; and

Figure 6 is a view similar to Figure 5 taken on the line VI—VI of Figure 4.

Referring more particularly to the drawings, reference numeral 2 indicates generally a conventional blast furnace having a stack area 4, bosh area 6 and hearth area 8. The stack area is encircled by a refractory lining 10 and an outer steel shell 12. The steel shell extends from the mantle 14 of the furnace upwardly to the top of the furnace stack. The foregoing structure is conventional and is not claimed as part of our invention the details of which will now be described.

A reservoir 16 encircles the shell 12 at a point approximately midway between the mantle and the top of the furnace. Radial ribs 18 which are in the form of T sections disposed with the flange portion thereof outward of the furnace, are arranged in spaced parallel relation around the shell 12 extending vertically between the mantle 14 and the reservoir 16.



The reservoir 16 is comprised of a plurality of channel members in the form of arcuated conduit sections 20 disposed circumferentially of the furnace shell in a common horizontal plane. Each of the sections 20 is made up in the form of a plate bent into semi-cylindrical shape. The ends of each of the individual sections 20 are cut off at an acute angle to the longitudinal axis of the section and a cover plate 22 is welded or otherwise affixed to each end. The sections 20 are mounted on the furnace by means of welds along their upper edges 24 while the lower edges 26 of each of the sections are maintained adjustably spaced from the surface of the furnace shell by means of adjusting bolts 27, each of which are threaded into a cylindrical sleeve 28 which is rigidly fitted transversely through the lower portion of each section 20. Each of the sections is provided with a plurality of sets of sleeves 28 and cooperating bolts 27 in spaced relation. Water is supplied to the reservoir 16 by means of a water supply line 30 which extends circumferentially around the furnace shell spaced above the reservoir 16. Each section is connected with the water supply line by means of a conventional pipe and conventional fittings 32 which extend from the supply line to the reservoir. A supply pipe 34 connects the supply line 30 to a source of water (not shown). By adjusting the bolts 27 to move the lower edges of the sections 20 away from the shell 12, a continuous sheet of water is caused to flow from the reservoir 16 downwardly along the outer surface of the steel shell around the stack to the mantle 14 where the water is collected by a trough 36 which encircles the furnace at the mantle and is connected with a drain (not shown).

In order to control the velocity of the flow of the sheet of water emanating from the reservoir 16, a plurality of pairs of weirs 40 are provided between adjacent ribs in the path of the flow of water. Each of the weirs is in the form of an angle plate 42 which is welded by one edge 44 to the steel shell. The opposite edge 46 of each angle plate is spaced from the shell 12 and is disposed above the level of the edge 44. The edge 44 is provided with a plurality of spaced notches 48 along its length. The pairs of angle plates in each weir are slanted in opposite directions between adjacent ribs 18. The downward end 42' of each of the two angle plates making up each weir terminate short of the webs 50 of the adjacent ribs 18 forming an opening 52 between the downward end of the plate and the web of the adjacent rib. The upward ends of the plates extend to the webs 50 of the adjacent ribs. So constructed, the weirs effectuate the slow-down of the flow of the film of water at regular intervals. The weirs prevent gravitational acceleration from causing the flow of water to attain such velocity that the continuity of the water film would be broken. They also prevent the water from bouncing off, in effect, when the film strikes irregularities on the surface of the furnace shell. The notches 48 permit a continual flow of water which, though channeled by the notches, again forms a continuous film of cooling water after passing through the weirs. The water that overflows the notches flows down the slanted surface of each plate and through the openings 52 to join the continuous film of water below the weirs. The diagonal disposition of each of the angle plates 42 maintains the water in constant motion thereby preventing any scale or dirt, which the water may be carrying, from settling in and clogging the weirs.

While one embodiment of our invention has been shown and described, it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

We claim:

1. In a blast furnace having a frusto-conical metal shell, the improvement therewith of means for distributing cooling liquid over the exterior of said shell comprising a plurality of channel members closed at their ends with their open portions facing said shell disposed circumferentially of said shell substantially in a common horizontal plane, each of said channel members secured to the shell at its upper edge, means for adjusting the lower edge of each channel member from and toward the shell, and means for supplying coolant liquid to each channel member.

2. In a blast furnace the improvement therewith as



defined by claim 4 characterized by each of said channel members being comprised of a semi-cylindrical plate.

3. In a blast furnace the improvement therewith as defined by claim 4 characterized by said means for adjusting the lower edge of each channel member being comprised of at least one internally threaded cylindrical sleeve fitted through the lower portion of each channel member normal to said shell, and a bolt adjustably threaded through said sleeve with one end projecting toward said shell.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 349,513 | Michael | Sept. 21, 1886 |
| 1,236,721 | Kunz | Aug. 14, 1917 |
| 2,277,447 | Moore | Mar. 24, 1942 |
| 2,671,658 | Moore | Mar. 9, 1954 |