Oct. 13, 1959 J. H. REIGHART 2,908,361

SURFACE AND PIT FURNACE SAFETY MAINTENANCE CAGE

Filed Oct. 21, 1957 2 Sheets-Sheet 1

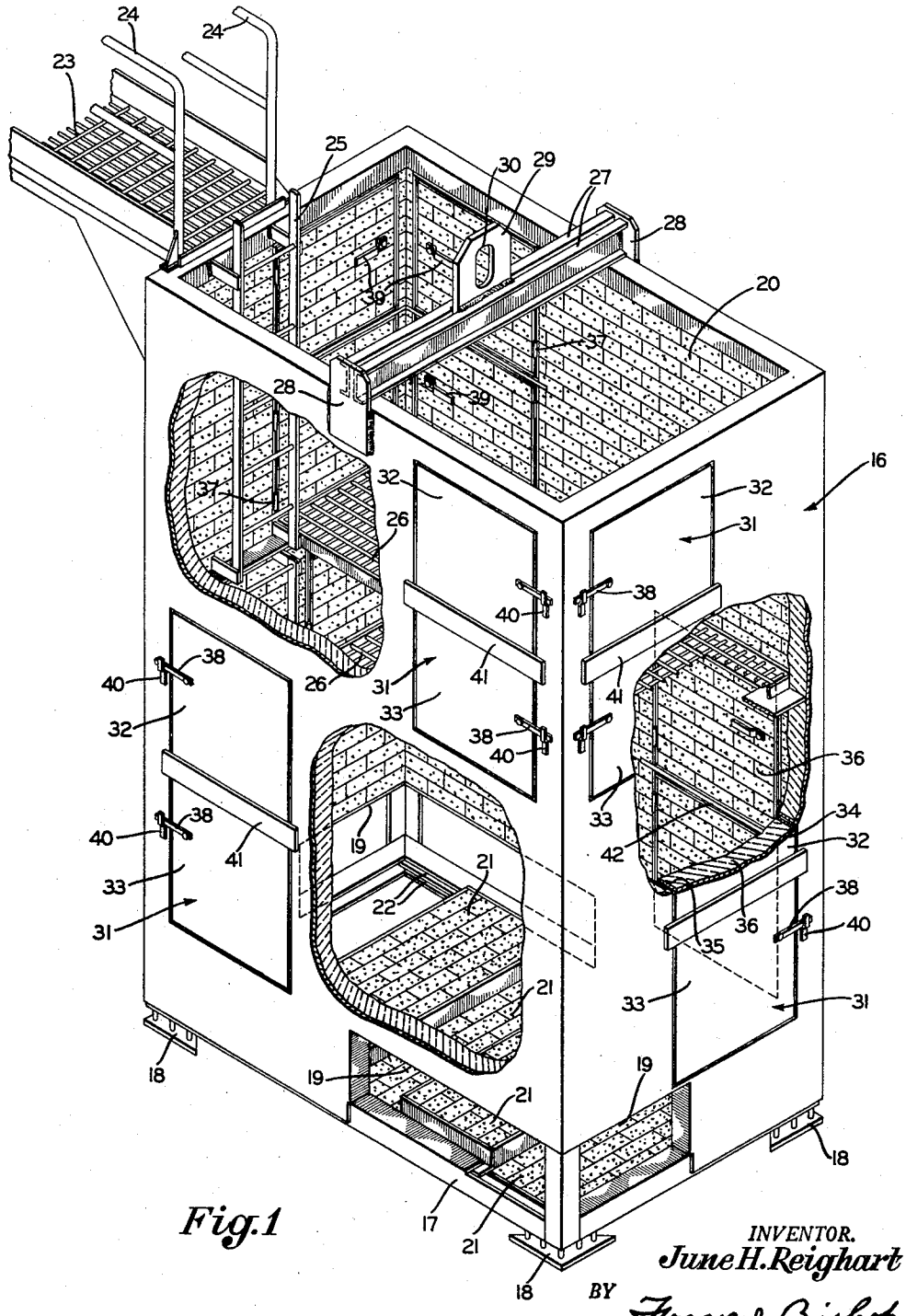


Fig. 1

INVENTOR.
June H. Reighart
BY
Frease & Bishop
ATTORNEYS

Oct. 13, 1959 J. H. REIGHART 2,908,361

SURFACE AND PIT FURNACE SAFETY MAINTENANCE CAGE

Filed Oct. 21, 1957 2 Sheets-Sheet 2

Fig. 2

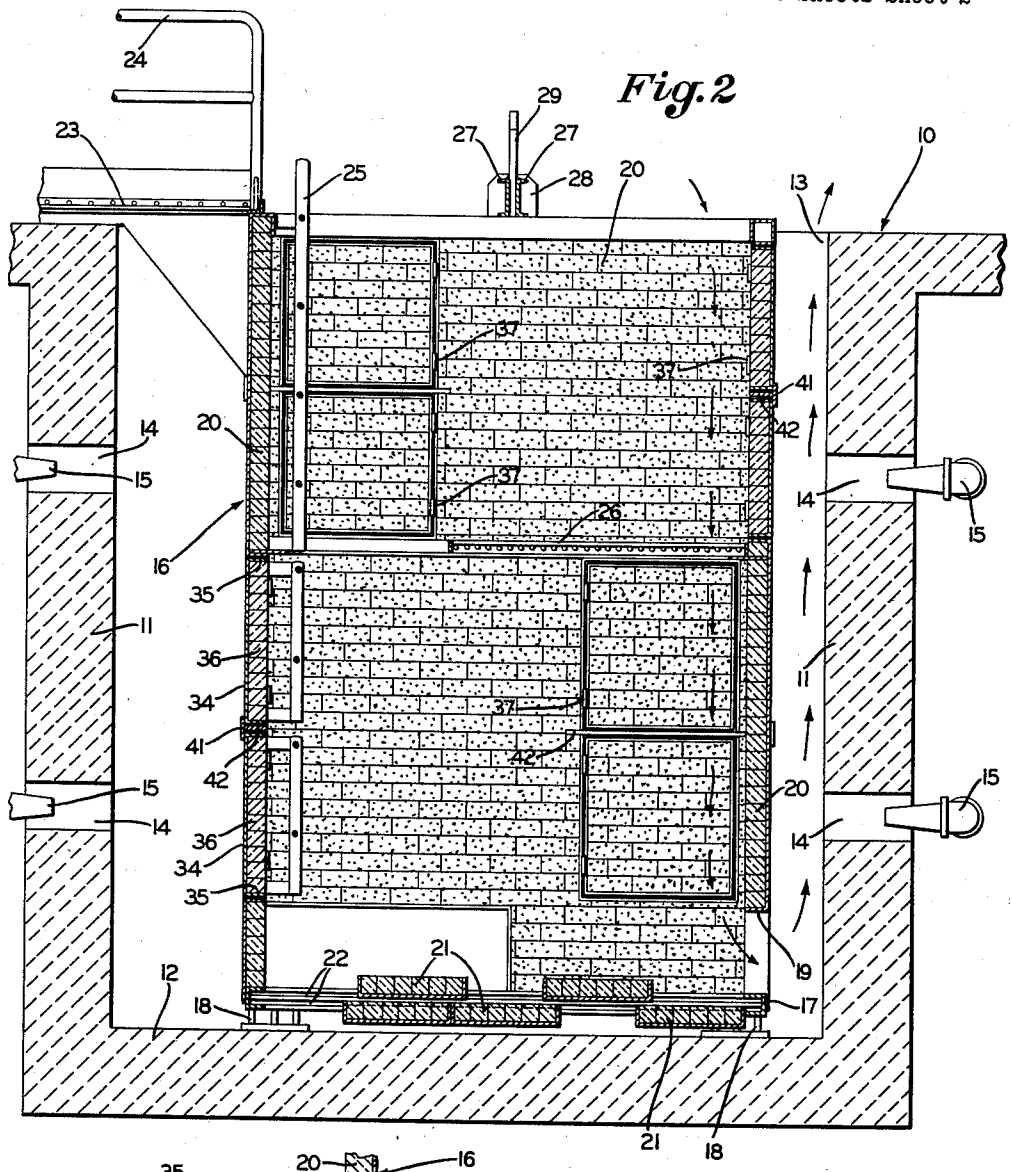
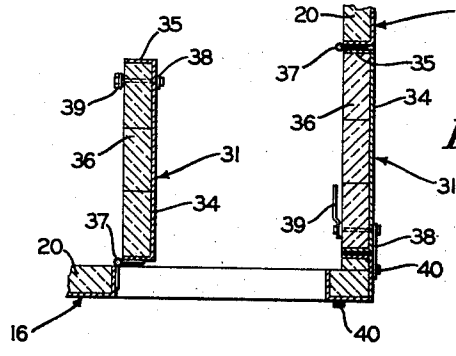


Fig. 3



INVENTOR.
June H. Reighart
BY *Frease & Bishop*
ATTORNEYS

United States Patent Office 2,908,361
Patented Oct. 13, 1959

2,908,361

SURFACE AND PIT FURNACE SAFETY MAINTENANCE CAGE

June H. Reighart, Cleveland, Ohio, assignor to Sticker Industrial Supply Corporation, Cleveland, Ohio, a corporation of Ohio

Application October 21, 1957, Serial No. 691,449

6 Claims. (Cl. 189—1)

The invention relates to a cage adapted to be temporarily placed within a top-opening surface or pit furnace, such as heating and melting furnaces, soaking pits and the like, for the purpose of permitting workmen to enter the furnace or pit for making repairs, immediately after the charge has been removed and the fuel has been shut off, with complete safety and comfort for the workmen.

Due to the extreme temperatures under which such furnaces are operated, as well as from the physical impact and abrasion of the charge, the wells, floors, copings, burners and burner ports of such furnaces are severely ravaged and damaged. These areas of such furnaces must be continually repaired in order to maintain them in such condition as to obtain the utmost efficient productivity of the furnace.

Because of the extreme heat at which these furnaces are operated, present practice requires a cooling-off period of from 8 to 16 hours after a charge is removed from a furnace and the fuel shut off, before it is possible for workmen to enter the furnace for the purpose of inspection and repairs.

This cooling-off period adds considerably to the shut-down time during which a furnace is out of production, thus adding to the production cost of the entire mill or plant. In cases where two furnaces are provided with a common dividing wall, it is frequently necessary to shut down both of the furnaces in order to accomplish the maintenance of either one or the other, thus further adding to the cost of production.

The present invention contemplates the provision of a safety maintenance cage by means of which workmen may enter a top-opening furnace or soaking pit immediately after a charge has been removed from the furnace and fuel shut off, and may work with complete safety and comfort to make any necessary repairs to the furnace or pit in order to again place it in proper condition for use.

It is therefore a primary object of the invention to provide a top-opening furnace or pit maintenance safety cage for overcoming the above-mentioned disadvantages and difficulties of present practice.

Another object is to provide such a cage which may be lowered into a top-opening furnace or pit as soon as the charge has been removed therefrom and the fuel turned off, and into which workmen may immediately enter to inspect and repair damaged areas of the walls, floor, coping, burner ports, burners, etc.

A further object is to provide a furnace maintenance cage of the character referred to which will protect the workmen from the intense heat of the furnace or pit, and in which a downdraft will be induced to contribute to the comfort and safety of the workmen.

A still further object is to provide a maintenance cage of this type comprising an open-top steel shell of a size and shape to be received within the furnace or pit, the side walls and bottom thereof being lined with suitable refractory or other heat insulation material.

It is also an object of the invention to provide a maintenance cage in which the floor is made of slidable sections, whereby access may be had to any desired portion of the floor of the furnace or pit for making repairs or replacements thereto.

Furthermore, it is an object of the invention to provide a cage of this character having inwardly opening doors at various heights and in various locations upon the side walls of the cage.

Another object of the invention is to provide such a maintenance cage having permanent openings at the bottom corners of opposite walls to insure a constant downdraft through the cage.

A further object of the invention is to provide a cage of the type referred to having feet or legs at the corners thereof so as to support the cage with the bottom thereof spaced above the bottom of the furnace or pit in which it is placed.

Still another object of the invention is to provide a maintenance cage of the character referred to having an approach platform at its open upper end, a ladder attached to a side wall of the cage adjacent to the approach platform, and internal platforms at various heights, so that workmen within the cage will have access to high points on the walls and coping of the furnace or pit in which the cage is located.

The above and other objects, apparent from the drawings and following description, may be attained, the above described difficulties overcome and the advantages and results obtained, by the apparatus, construction, arrangement and combinations, subcombinations and parts which comprise the present invention, a preferred embodiment of which, illustrative of the best mode in which applicant has contemplated applying the principle, being set forth in detail in the following description and illustrated in the accompanying drawings.

The invention may be briefly described in general terms as comprising a top-opening furnace or pit maintenance safety cage in the form of a steel shell of a size and shape to be received within a furnace or pit, with feet or legs at the corners of the shell for supporting it spaced above the bottom of the furnace or pit, a refractory lining within the bottom and side walls of the shell and a crane-handling bail at the open top of the cage, whereby it may be positioned within or removed from an open-top furnace or pit.

Permanent openings are provided in the lower portions of the side walls at opposite corners of the cage, in order to induce a constant down-draft through the cage. An approach platform is connected to the top of the cage with hand rails thereon, and a ladder is attached to an adjacent side wall of the cage so that a workman may descend from the approach platform into the cage.

Internal platforms are provided at different heights within the cage, and inwardly opening doors are provided at different heights and different locations in the side walls of the cage, so that a workman standing upon one or another of these platforms may have access to the coping, burners or burner ports or other areas at various heights on the side walls of the furnace or pit.

The bottom of the cage is formed of a plurality of horizontally slidable sections each comprising a steel shell with refractory lining therein, whereby access may be had through the bottom of the cage to every portion of the bottom of the furnace or pit.

By way of example, a preferred embodiment of the improved furnace or pit maintenance safety cage is illustrated in the accompanying drawings, in which:

Fig. 1 is a perspective view of a maintenance safety cage constructed in accordance with the invention, parts being broken away for the purpose of illustration;

Fig. 2 is a vertical sectional view through the cage located within an open-top furnace or pit; and,

Fig. 3 is a fragmentary horizontal sectional view through a portion of the maintenance safety cage.

Referring now more particularly to the embodiment illustrated in the drawings, in which similar numerals refer to similar parts throughout the several views, a conventional top-opening furnace or pit is indicated generally at **10** comprising the side walls **11**, bottom **12**, open top **13**, burner ports **14** and burners **15**, all of which may be of any conventional or well known design.

The improved maintenance safety cage forming the subject matter of the invention comprises the metallic shell **16**, which may be rectangular as shown, or may be cylindrical for use within cylindrical furnaces or pits. This shell is connected at its lower end to a metal frame **17** having feet or legs **18** depending from the corner portions thereof in order to support the cage spaced above the bottom of a furnace or soaking pit in which it is placed.

At the bottom corners of opposite walls of the cage, the metal shell **16** is cut away so as to form permanent openings **19**. This is for the purpose of creating a down-draft through the cage to add to the workman's comfort when the cage is located within a furnace or pit at shown in Fig. 2.

A down-draft of air is indicated by the arrows in this figure of the drawings, the cool air passing downward through the cage from the top thereof and through the openings **19** and then upward between the walls of the cage and the inner wall of the furnace or pit.

The inner side walls of the shell are lined with refractory or other suitable thermal-insulation as indicated at **20**. The bottom of the cage is formed of a plurality of horizontally slidable sections **21** slidable in grooves **22** formed in the bottom frame **17**.

An approach platform **23** is attached to the upper open end of the cage at one side thereof and provided with hand rails **24** in order to provide safe entrance and exit for the workman. On the inner side wall of the cage, adjacent to the approach platform **23**, a ladder **25** is attached, by means of which workmen may descend to the bottom of the cage or to either of the internal platforms **26** located at different heights within the interior of the cage.

A crane-handling bail is provided at the top of the maintenance cage and may comprise a pair of transversely disposed channel members **27**, welded or otherwise connected at opposite ends to the bracket plates **28** which are welded to the side walls of the cage, a perforate plate **29** being welded between the channel members **27** at a point intermediate the ends thereof and provided with an elongated opening **30** to receive the conventional hook suspended from an electric crane or the like.

For the purpose of providing access to different areas of the inner walls of the furnace or pit at various heights, a plurality of doors are provided upon each side wall of the cage, as indicated generally at **31**. These doors are inwardly-opening doors and are preferably made in the form of Dutch doors, so that only one section thereof need be opened at one time in order to expose the workmen within the cage to the minimum amount of heat from the furnace or pit.

For this purpose, each door **31** comprises an upper section **32** and a lower section **33**, each section comprising a sheet metal panel **34** having inturned marginal flanges **35** and being lined upon its interior with suitable refractory or other thermal-insulation material as indicated at **36**.

Each section of each door is hinged at one edge, as at **37**, so as to swing inwardly, and is provided at its swinging edge with a latch **38** operable from within the cage as by the latch handle **39**, the latch **38** being adapted to normally engage a keeper **40** on the exterior of the cage when the door section is in closed position.

Separator lintels are located between the upper and lower section or panel or each door and each comprises

a bar or plate **41** welded at opposite ends to the outer side of the metal shell **16** of the cage and having an inturned flat flange **42** extending inwardly into the cage between the opposed edges of the upper and lower door panels or sections. These separator lintels provide means for bracing heavy hand tools and the like used by the workmen in repairing the damaged furnace or pit.

In using the above-described furnace or pit maintenance safety cage, the necessary tools and materials for making repairs to the furnace or pit may be placed within the cage. The cage is then picked up by a crane, by means of the crane-handling bail on the cage, and is lowered into the furnace or pit to be repaired, as soon as the charge has been removed from the furnace and the fuel shut off.

It will be seen that when the cage is lowerd into the furnace or pit, the corner feet or legs **18** will support the cage spaced above the bottom **12** of the furnace or pit. The workmen may then enter the cage by means of the approach platform **23** and ladder **25** and may stand upon either of the interior platforms **26** and open any desired panel or section of any of the adjacent Dutch doors accessible from such platform, in order to work upon the exposed area of the furnace or pit side wall, coping, burner ports or burners.

In order to make repairs upon the bottom or floor **12** of the furnace or pit, the slidable floor panels **21** of the cage may be slidably moved to give access to any desired area of the floor of the furnace or pit upon which repairs are required.

It will be seen that during the time that the maintenance cage is located within the hot furnace or pit, a down-draft will be induced through the cage by means of the bottom corner openings **19** therein, cool air passing down inside of the cage and out through the openings **19** and then upwardly between the outside of the cage and the inner walls of the furnace or pit, as shown by the arrows in Fig. 2. Thus complete safety and thermal comfort are provided for the workmen within the cage.

Upon completion of the work at any point on the side walls or floor of the furnace, the workmen will then close the door or sliding floor section of the cage through which they have been working, and open any other door section or sliding floor section as required to continue the repairs upon the furnace or pit.

From the above it will be seen that the improved furnace or pit maintenance safety cage overcomes the disadvantages and difficulties of usual practice in repairing the ravages to the interior of top-opening furnaces and pits, permitting these repairs to be made immediately after the charge has been removed from the furnace or pit and the fuel turned off, without the necessity of a lengthy cooling-off period and with complete comfort and safety for the workmen. Thus a furnace or pit may be returned to use and put back into production in a very short time after the charge has been removed therefrom.

It will also be seen in the case of two furnaces with a common dividing wall, that it is not necessary to take both of the furnaces or pits out of production in order to accomplish the maintenance of one, as with this maintenance cage only the furnace or pit requiring servicing need be shut down, since the walls of the cage provide the necessary protection to the workmen form the heat of the furnace. This cage is applicable to all types of top-charge furnaces or pit-type furnaces such as electric furnaces, soaking pits and the like.

In the foregoing description, certain terms have been used for brevity, clearness and understanding, but no unnecessary limitations are to be implied therefrom beyond the requirements of the prior art, because such words are used for descriptive purposes herein and are intended to be broadly construed.

Moreover, the embodiments of the improved construc-

tion illustrated and described herein are by way of example, and the scope of the present invention is not limited to the exact details of construction.

Having now described the invention or discovery, the construction, the operation, and use of preferred embodiments thereof, and the advantageous new and useful results obtained thereby; the new and useful construction, and reasonable mechanical equivalents thereof obvious to those skilled in the art, are set forth in the appended claims.

I claim:

1. A top opening furnace or pit maintenance safety cage for protecting human operators from the heat of an open top furnace or pit having side walls and a bottom wall, said cage comprising an open top steel shell of a size and shape adapted to be inserted into the furnace or pit, said shell having side walls and a bottom heat insulating lining within said shell, doors in all of the side walls of the cage through which a human operator within the cage may have access to the side walls of the furnace or pit, and depending feet at the corners of the cage for spacing the bottom of the cage above the bottom of the furnace or pit, there being openings in the lower corner portions of the cage to induce a downdraft through the cage.

2. A top opening furnace or pit maintenance safety cage for protecting human operators from the heat of an open top furnace or pit having side walls and a bottom wall, said cage comprising an open top steel shell of a size and shape adapted to be inserted into the furnace or pit, said shell having side walls and a bottom, a heat insulating lining within said shell, doors in all of the side walls of the cage through which a human operator within the cage may have access to the side walls of the furnace or pit, and slidable insulated floor sections in the bottom of the cage providing access to the bottom wall of the furnace or pit, there being openings in the lower portions of the side walls of the cage for inducing a downdraft through the cage.

3. A top opening furnace or pit maintenance safety cage for protecting human operators from the heat of an open top furnace or pit having side walls and a bottom wall, said cage comprising an open top steel shell of a size and shape adapted to be inserted into the furnace or pit, said shell having side walls and a bottom a heat insulating lining within said shell, staggered doors at various heights in all of the side walls of the cage through which a human operator within the cage may have access to the side walls of the furnace or pit, and slidable insulated floor sections in the bottom of the cage providing access to the bottom wall of the furnace or pit, there being openings in the lower corner portions of the side walls of the cage for inducing a downdraft through the cage.

4. A top opening furnace or pit maintenance safety cage for protecting human operators from the heat of an open top furnace or pit having side walls with burner ports and burners therein and a bottom wall, said cage comprising an open top steel shell of a size and shape adapted to be inserted into the furnace or pit, said shell having side walls and a bottom a heat insulating lining within said shell, doors located at different heights and in staggered relation in all of the side walls of the cage, said doors providing access for an operator within the cage to the side walls of the furnace or pit and to the burner ports and burners at various locations within the furnace or pit, slidable insulated floor sections in the bottom of the cage providing access to the entire bottom wall of the furnace or pit, depending feet upon the cage for spacing the bottom of the cage above the bottom of the furnace or pit, there being openings in the lower corner portions of the cage for inducing a downdraft through the cage, a platform within the cage at a point spaced below the top of the cage to permit a human operator standing upon said platform to have access to the side walls of the furnace or pit through certain of said doors, and a crane handling bail at the top of the cage.

5. A top opening furnace or pit maintenance safety cage for protecting human operators from the heat of an open top furnace or pit having side walls with burner ports and burners therein and a bottom wall, said cage comprising an open top steel shell of a size and shape adapted to be inserted into the furnace or pit, said shell having side walls and a bottom a heat insulating lining within said shell, doors located at different heights and in staggered relation in all of the side walls of the cage, each door comprising upper and lower sections, separator lintels in the cage between the upper and lower door sections, said doors providing access for an operator within the cage to the side walls of the furnace or pit and to the burner ports and burners at various locations within the furnace or pit, slidable insulated floor sections in the bottom of the cage providing access to the entire bottom wall of the furnace or pit, depending feet upon the cage for spacing the bottom of the cage above the bottom of the furnace or pit, there being openings in the lower corner portions of the cage for inducing a downdraft through the cage, a platform within the cage at a point spaced below the top of the cage to permit a human operator standing upon said platform to have access to the side walls of the furnace or pit through certain of said doors, and a crane handling bail at the top of the cage.

6. A top opening furnace or pit maintenance safety cage for protecting human operators from the heat of an open top furnace or pit having side walls with burner ports and burners therein and a bottom wall, said cage comprising an open top steel shell of a size and shape adapted to be inserted into the furnace or pit, said shell having side walls and a bottom a heat insulating lining within said shell, doors located at different heights and in staggered relation in all of the side walls of the cage, each door comprising upper and lower sections, separator lintels in the cage between the upper and lower door sections, said doors providing access for an operator within the cage to the side walls of the furnace or pit and to the burner ports and burners at various locations within the furnace or pit, slidable insulated floor sections in the bottom of the cage providing access to the entire bottom wall of the furnace or pit, depending feet upon the cage for spacing the bottom of the cage above the bottom of the furnace or pit, there being openings in the lower corner portions of the cage for inducing a downdraft through the cage, a platform within the cage at a point spaced below the top of the cage to permit a human operator standing upon said platform to have access to the side walls of the furnace or pit through certain of said doors, a crane handling bail at the top of the cage, a ladder within the cage on one side wall thereof, and an approach platform extending outwardly from the top of the cage adjacent the top of said ladder.

References Cited in the file of this patent

UNITED STATES PATENTS

298,203	Hickman	May 6, 1884
1,578,474	Shawl	Mar. 30, 1926
2,019,162	Sipchen	Oct. 29, 1935