Aug. 30, 1949. H. H. YEAGER ET AL 2,480,804

APPARATUS FOR APPLYING METAL CASES TO REFRACTORY BRICKS

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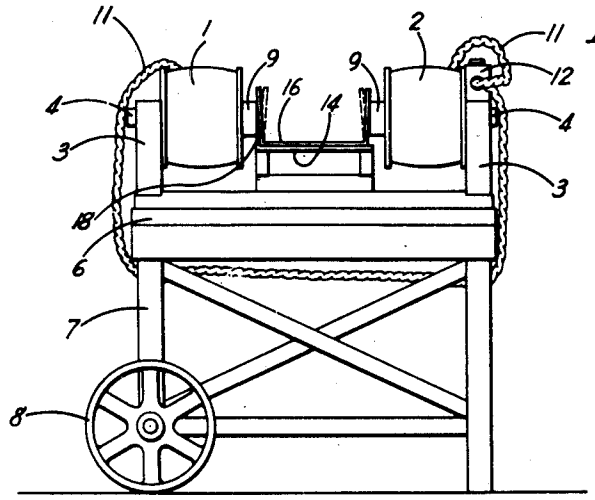


Fig. 1

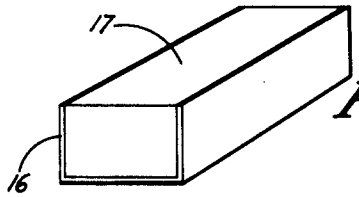
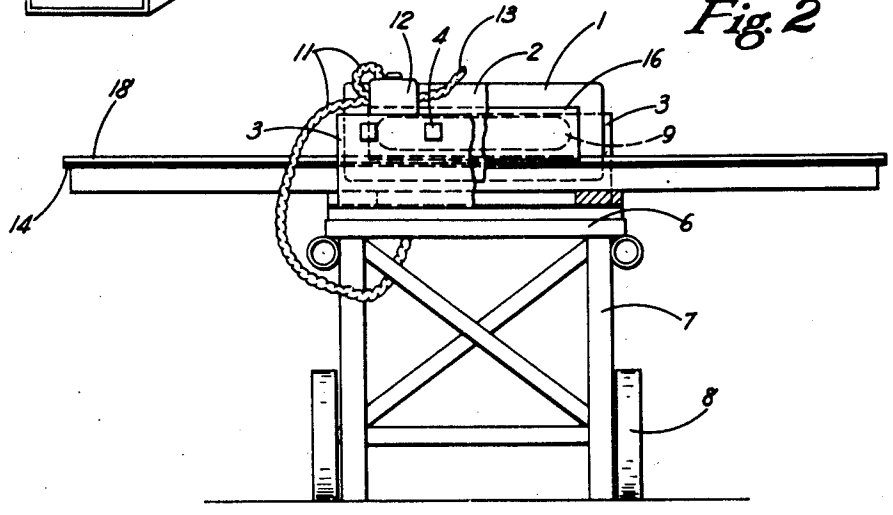


Fig. 3

Fig. 2



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Fig. 5

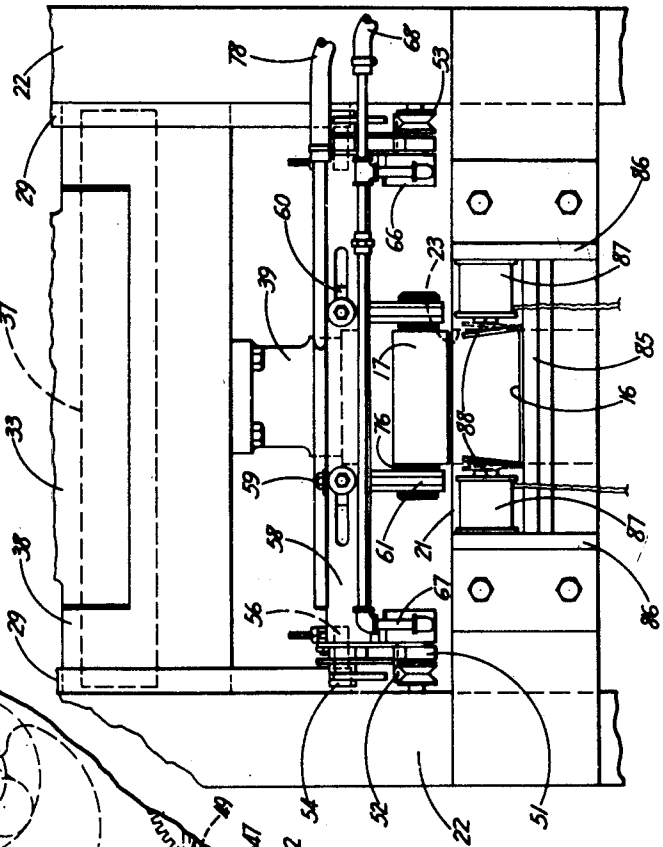
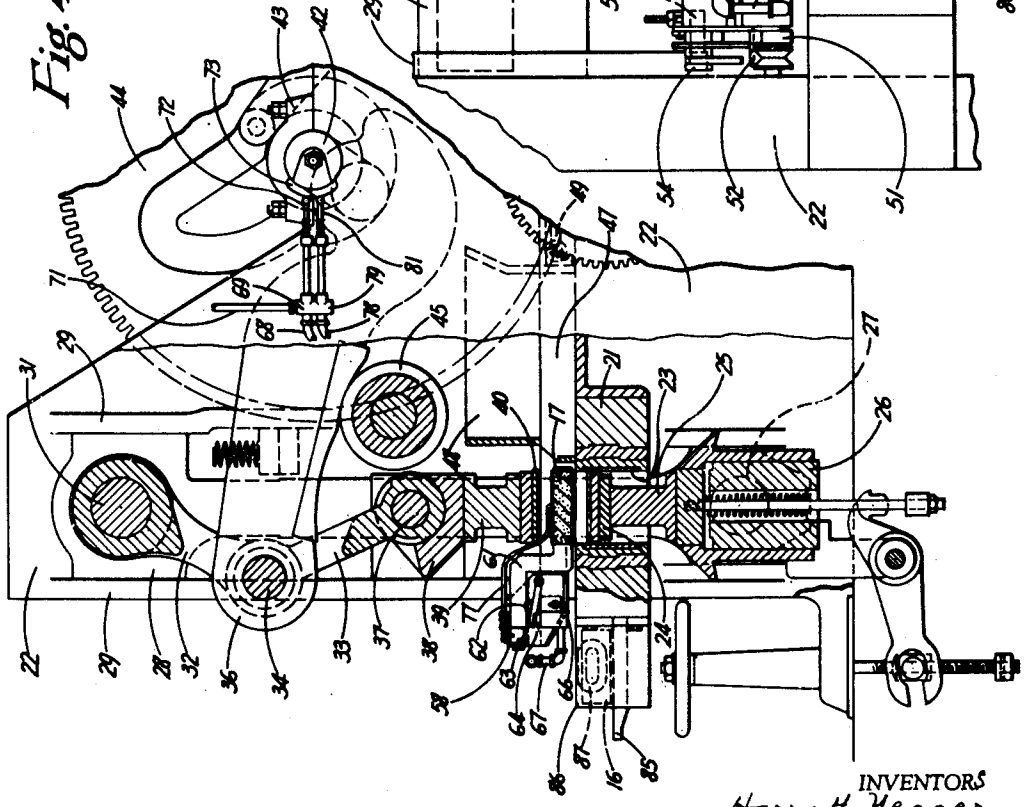


Fig. 4



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APPARATUS FOR APPLYING METAL CASES TO REFRACTORY BRICKS

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Application November 15, 1946, Serial No. 710,004

8 Claims. (Cl. 25—1)

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This invention relates to bricks provided with metal cases, and more particularly to apparatus for applying the metal cases to the bricks.

In certain instances refractory bricks for industrial furnaces are partially enclosed in individual metal cases. Such bricks are made of non-acid refractory material, such as magnesite, spinel, chrome ore, olivine, or a mixture of these, and usually are not fired before being laid up. The high temperature of the furnace fires the bricks and causes adjoining metal cases to fuse with one another and with the bricks, whereby an integral structure is formed. The most common type of case is made from sheet metal bent into the form of a channel. The flanges of the case converge toward their free edges and must be sprung apart in order to permit a refractory block to be inserted between them. When the flanges are released, they spring back and tightly grip the block. In the past, it has been the general practice to spread the case flanges apart by hand, which was difficult to do as well as time consuming.

It is an object of this invention to provide electromagnetic apparatus for opening such cases so that they can be applied to refractory bricks or have bricks pressed in them directly.

In accordance with this invention, a channel shaped sheet metal case is placed on a support with its side flanges extending upwardly. Electromagnets are disposed on opposite sides of the support with their poles facing each other above the support. These poles are spaced apart farther than the case flanges. Preferably, means is provided for centering the case between the poles. An electric switch is employed for energizing the magnets at intervals so that they will pull the flanges of the case outwardly toward their poles. This spreads the flanges far enough apart to permit them to receive a refractory body, such as one or more refractory blocks, between them. The magnets then are de-energized so that the case flanges will spring back and grip the opposite sides of the body. In one form of the invention the cases and blocks are placed between the magnets by hand, while in another form this apparatus may be combined with a block press which automatically places blocks in the cases as fast as the blocks are pressed.

The preferred embodiment of the invention is illustrated in the accompanying drawings in which Fig. 1 is a side view of a manually fed casing apparatus; Fig. 2 is an end view shown partly in section; Fig. 3 is a perspective view of a cased brick; Fig. 4 is a fragmentary side view of a block press with the pressing portion of it shown in vertical section; and Fig. 5 is an enlarged fragmentary front view of the press.

Referring to Figs. 1 and 2 of the drawings, a pair of elongated electromagnets 1 and 2 are

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supported in parallel spaced relation by vertical plates 3 to which they are connected by bolts 4. These plates are rigidly mounted on a table 6 which is supported by a framework 7 that may be provided with wheels 8 so that it can readily be moved to any desired location. The magnets have central pole pieces 9 which project toward each other from the inner faces of the magnets. The magnets are connected by electric wiring 11 to a manually operated electric switch 12 mounted on one of the supporting plates 3. This switch is connected by an electric cable 13 to a suitable source of electric current (not shown).

Supported crossways of the table between the two magnets is a long plate 14 that is located below the pole pieces. The purpose of this plate is to support between the poles of the magnets a case 16 that is to partially enclose a refractory brick 17 (Fig. 3). The case is formed from sheet metal that is bent into the shape of a channel having a flat bottom or web and upstanding side flanges. The flanges normally converge upupwardly, as indicated by the dotted lines in Fig. 1, and the distance between their upper or free edges is less than the width of the block that is to be placed in the case so that the flanges will grip the block between them and hold it in place. The supporting plate 14 preferably has a rib 18 extending along one side for engaging one lower edge of the case. The rib is in such a position that when a case is in contact with it the case will be centered between the poles of the magnets. The plate preferably is long enough to support at least three cases at the same time; one between the magnets, one ready to be pushed between them, and one that has just been applied to a block and pushed from between the magnets by the middle case. The poles of the magnets are located farther apart than the case flanges, and for best results should be far enough apart to cause the flanges to diverge upwardly when they are in contact with the two poles as shown in Fig. 1.

In using this apparatus, an empty case 16 is placed one one end of supporting plate 14 and against the rib along its side. The case then is slid along the plate until it is between the two magnets. The electric switch 12 is closed, whereupon the magnets are energized and the metal flanges of the case are pulled outwardly against the magnet poles. This spreads the flanges far enough apart to receive a refractory block which is deposited in the case by a workman, or by any suitable mechanism. Following this the switch is opened so that the magnets will release the case flanges and permit them to spring back into tight engagement with the sides of the block. The next empty case placed on the end of the supporting plate then is pushed into position between the magnets, thereby pushing the cased

block out onto the opposite end of the plate from which it can be removed. It will be seen that no manual effort is required to spread the flanges of the cases to permit blocks to be placed between them, and that the casing operation can be carried on very rapidly. The blocks may be dried either before or after being placed in the cases.

Magnetic case-spreading apparatus can be combined with the press in which the refractory blocks are made so that it is unnecessary for a workman to handle the blocks between the time they are pressed and the time the cases are applied to them. One application of this principle is illustrated in Figs. 4 and 5 of the drawings where part of a Boyd type brick press is shown, like the one shown in the copending patent application Serial No. 641,275, filed by Clair I. Young on January 15, 1946. The press includes a table 21 which is rigidly mounted between the front portions of a pair of vertical side frames 22. The center portion of this table is provided with a rectangular opening 23 extending down through it to form a mold. The bottom of this mold is formed by a bottom die or pad 24 mounted on a vertically reciprocable plunger 25. This plunger is mounted on a cross head 26 having at its ends circular projections 27 that extend into circular openings in the lower ends of a pair of vertical side bars 28. Each of these side bars slides up and down the inner surface of the adjoining side frame between parallel guide ribs 29 projecting from the frame. The tops of these side bars are connected by a horizontal shaft 31 on which the upper end of a heavy toggle link 32 is oscillatably mounted. The lower end of this link is provided with a central recess in which the bifurcated upper end of a lower toggle link 33 is disposed. The adjoining ends of these links are connected by a horizontal shaft 34 on the central portion of which the front end of a crank arm 36 is oscillatably mounted. The lower end of the lower link carries a shaft 37 the ends of which are mounted in a cross head 38 that carries a plunger 39 on the bottom of which there is a top die or pad 40. This pad is aligned with the mold so that it can be moved down into the mold when the plunger is moved downwardly.

In order to reciprocate the plungers in unison and also toward and away from each other, the rear end of crank arm 36 is shown in Fig. 4 as being journaled on the offset central portion of a crank shaft 42 the ends of which are mounted in bearings 43 in the side frames of the machine. One end of the crank shaft projects from the outside of one of the side frames and carries a large gear 44 that is driven through a conventional train of gears from an electric motor (not shown). As the rear end of the crank arm is carried around the circle the front end of the arm alternately breaks and straightens the toggle and also moves the toggle, the plungers and the side bars 28 up and down in unison. The exact movement desired is obtained by mounting a roller 45 between the side frames where it is engaged by the bottom of the crank arm at certain points in the cycle.

In order to charge the mold with clay or other refractory material, all of which is referred to herein as clay, the usual reciprocating charging box 47 is mounted on the table behind the mold and directly beneath a hopper 48 that contains the loose clay. This box is reciprocated by a rod 49 connected to its rear end and operated in well known manner from the driving mechanism.

Projecting forward from opposite sides of charging box 47 are bars 51 which carry rails 52 that travel on grooved rollers 53 attached to the side frame. Mounted on the front ends of these bars are socket members 54 in which horizontal pins 56 are removably disposed. The inner ends of these pins pivotally support a horizontal angle bar 58. Connected to the inside of the flanges of the angle bar by means of cap screws 59 is a pair of blocks 60 from each of which a picker arm 61 projects rearwardly. Each arm has an upper portion and a lower portion. The upper portions are supported by a cross bar 62 that has its ends mounted on lifters 63 the rear ends of which are pivotally connected to the side bars. The front ends of the lifters rest on pistons 64 mounted in vertical cylinders 66 supported by the side bars. These cylinders are connected by pipes 67 to a flexible hose 68 that leads to a valve 69 connected to a compressed air supply pipe 71. This valve has an actuating stem 72 that is operated by a cam 73 on the projecting end of crank shaft 42. When this valve is opened, compressed air raises pistons 64 in cylinders 66 and thereby causes lifters 63 to raise cross bar 62 which in turn lifts the picker arms slightly for a purpose to be described presently.

The lower portions of the picker arms carry gripper plates 76 that are moved outwardly in well known manner by air under pressure in pipes 77 connected to a flexible hose 78 that leads to a valve 79 connected to compressed air pipe 71. The actuating stem 81 for this valve likewise is operated by cam 73. The position of this cam on the crank shaft is such that when a block is ejected from the mold the cam first opens valve 79 to cause gripper plates 76 on the picker arms to move out to grip the block between them, and then the picker arms are lifted slightly by pistons 64 and held in that position until they have been moved to their forward position, whereby the block is not dragged across the table and damaged. The picker arms being connected by angle bar 58 and bars 51 to the reciprocating charging box 47, the arms are moved back and forth with the box to pick up a block at the mold and to deposit it in front of the table.

In accordance with this invention a forwardly projecting plate 85 is mounted on the front of table 21 below its upper surface. On opposite sides of this plate vertical side members 86 are bolted to the front of the table for supporting a pair of laterally spaced electromagnets 87 above the bottom plate. These magnets have inwardly projecting poles 88 that are spaced apart a distance greater than the width of the block formed in the press.

In the operation of the press, a block 17 is lifted from the mold and is engaged by gripper plates 76 on the picker arms, and then the arms are lifted slightly by pistons 64 and moved forward by the charging box until the block is located above a sheet metal case 16 resting on plate 85 between the magnets. By that time the magnets have been energized, by closing an electric switch (not shown) either manually or automatically, so that the upstanding case flanges will be drawn against the magnet poles to spread the flanges farther apart, as shown in broken lines in Fig. 5. The gripper plates then release the block which drops into the open case below it. Following this, the magnets are de-energized and the case flanges spring back to grip the opposite sides of the block while the picker arms return to pick up the next block molded in the press. The cased block is

removed from its support, and an empty case is placed between the magnets.

According to the provisions of the patent statutes, we have explained the principle and construction of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. Apparatus for applying a channel shape sheet metal case to refractory material, comprising means adapted to support such a case with its side flanges extending upwardly, electromagnets disposed on opposite sides of said means and having poles facing each other, said poles being spaced apart farther than said flanges, and means for energizing said magnets at intervals to pull the flanges of a case between them outwardly toward the adjacent magnet poles, whereby the flanges will be spread farther apart in readiness to receive refractory material between them.

2. Apparatus for applying a channel shape sheet metal case having upwardly extending flanges to a refractory body that is wider than the space between the upper edges of the flanges, comprising means adapted to support such a case, electromagnets disposed on opposite sides of said means and having poles facing each other, said poles being spaced apart farther than said flanges, means adapted to center the case between said poles, and means for energizing said magnets simultaneously at intervals to pull the flanges of a case between them toward the adjacent magnet poles, whereby the flanges will be spread farther apart in readiness to receive a refractory body between them.

3. Apparatus for applying a channel shape sheet metal case to a refractory block, comprising means adapted to support such a case with its side flanges extending upwardly, electromagnets disposed on opposite sides of said means and having poles facing each other, said poles having substantially flat opposing faces spaced apart farther than said flanges, said supporting means projecting in opposite directions beyond said magnets to form a support for a case at each end of the first-mentioned case, and means for energizing said magnets simultaneously at intervals to draw the flanges of said first-mentioned case outwardly against the adjacent magnet poles, whereby its flanges will be spread farther apart in readiness to receive a refractory block between them.

4. Apparatus for applying a channel shape sheet metal case to a refractory block, comprising an elongated member adapted to support such a case with its side flanges extending upwardly, electromagnets disposed on opposite sides of said member and having poles facing each other, said poles being farther apart than said flanges, a rib extending along one side of said member and projecting upwardly a short distance for engagement by one of said flanges to center the case between said poles, and means for energizing said magnets simultaneously at intervals to attract the flanges of a case between them against the adjacent magnet poles, whereby the flanges will be spread farther apart in readiness to receive a refractory block between them.

5. Apparatus for applying a channel shape sheet metal case to a refractory block, comprising

means adapted to support such a case with its side flanges extending upwardly, electromagnets disposed on opposite sides of said means and having poles facing each other, said poles being farther apart than said flanges, means for energizing said magnets at intervals to pull the flanges of a case between them against the adjacent magnet poles, whereby the flanges will be spread farther apart, and means adapted to deposit a refractory block in the case between said spread flanges.

6. Apparatus for applying a channel shape sheet metal case to a refractory block, comprising means adapted to support such a case with its side flanges extending upwardly, electromagnets disposed on opposite sides of said means and having poles facing each other, said poles being farther apart than said flanges, means for energizing said magnets at intervals to pull the flanges of a case between them against the adjacent magnet poles, whereby the flanges will be spread farther apart, and means adapted to engage opposite sides of a refractory block and to carry it to a position above the case and there to drop it into the case between said spread flanges.

7. The combination with a refractory block molding press, of means connected to the front of the press adapted to support a channel shape sheet metal case with its side flanges extending upwardly, electromagnets disposed on opposite sides of said means and having poles facing each other spaced apart farther than said flanges, means for energizing said magnets at intervals to pull the flanges of a case between them against the adjacent magnet poles, whereby the flanges will be spread farther apart, laterally spaced members adapted to grip between them a block molded in said press and to carry it forward to a position over the case, and means for releasing said members from said block to drop it between said spread flanges of the case.

8. The combination with a press having a table provided with a refractory block mold, of a horizontal support connected to the front of the table below its upper surface and adapted to support a channel shape sheet metal case with its side flanges extending upwardly, side members connected to the front of said table on opposite sides of said support and projecting upwardly therefrom, electromagnets mounted on the inner surfaces of said members above said support and having poles facing each other spaced apart farther than said flanges, means for temporarily energizing said magnets to pull the flanges of a case between them against the adjacent magnet poles, whereby to spread the flanges farther apart, laterally spaced members adapted to grip between them a block molded in said table, means for reciprocating said gripping members horizontally to carry said block forward to a position over the case and means for releasing said gripping members from said block to drop it between said spread flanges of the case.

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