Sept. 3, 1940. F. PUENING 2,213,533

MEANS FOR FREEING COKE FROM THE METALLIC WALLS OF COKE OVENS AND OTHER CARBONIZING CHAMBERS

Filed May 27, 1938 6 Sheets-Sheet 1

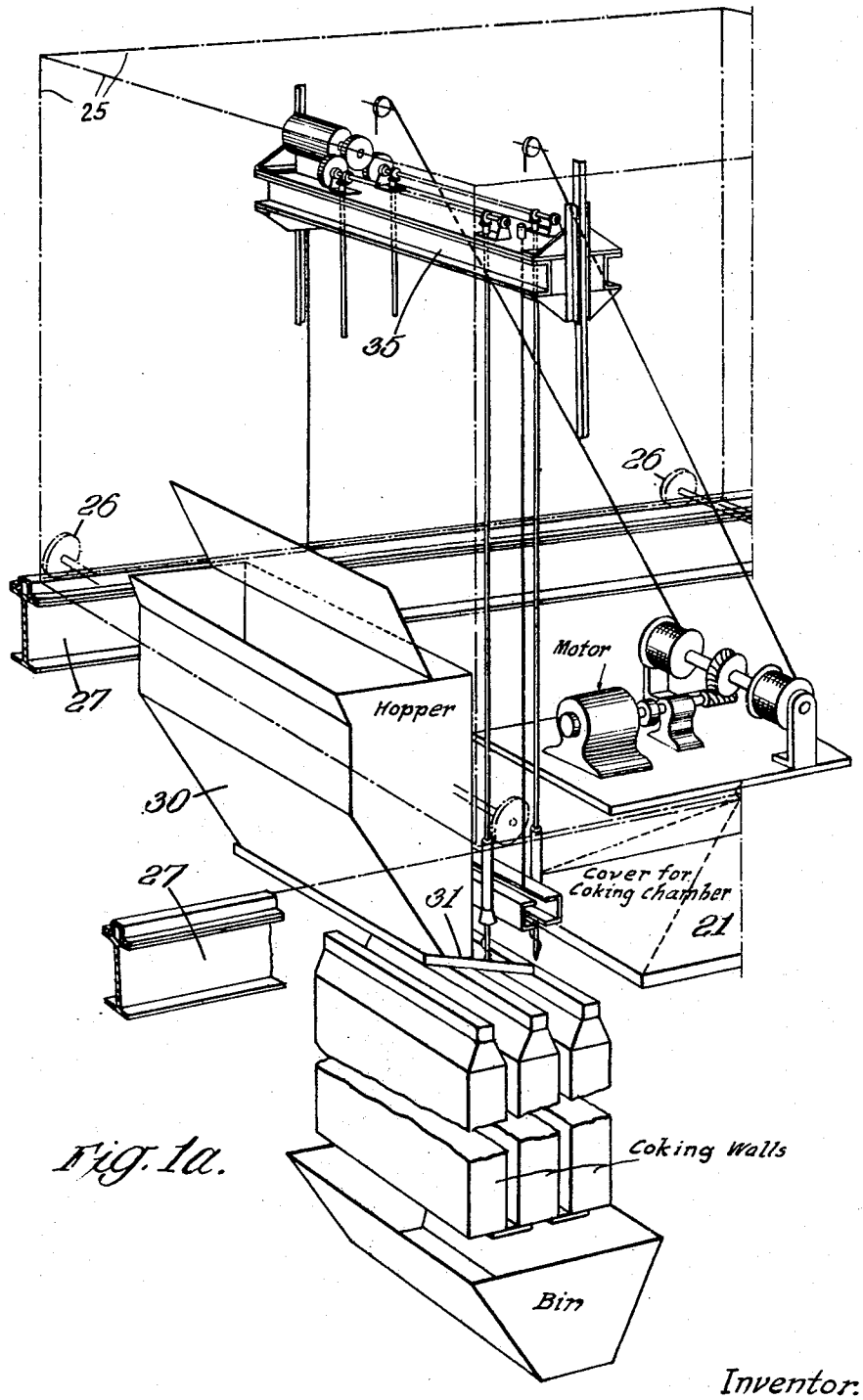


Fig. 1a.

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Sept. 3, 1940. F. PUENING 2,213,533

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Filed May 27, 1938 6 Sheets-Sheet 2

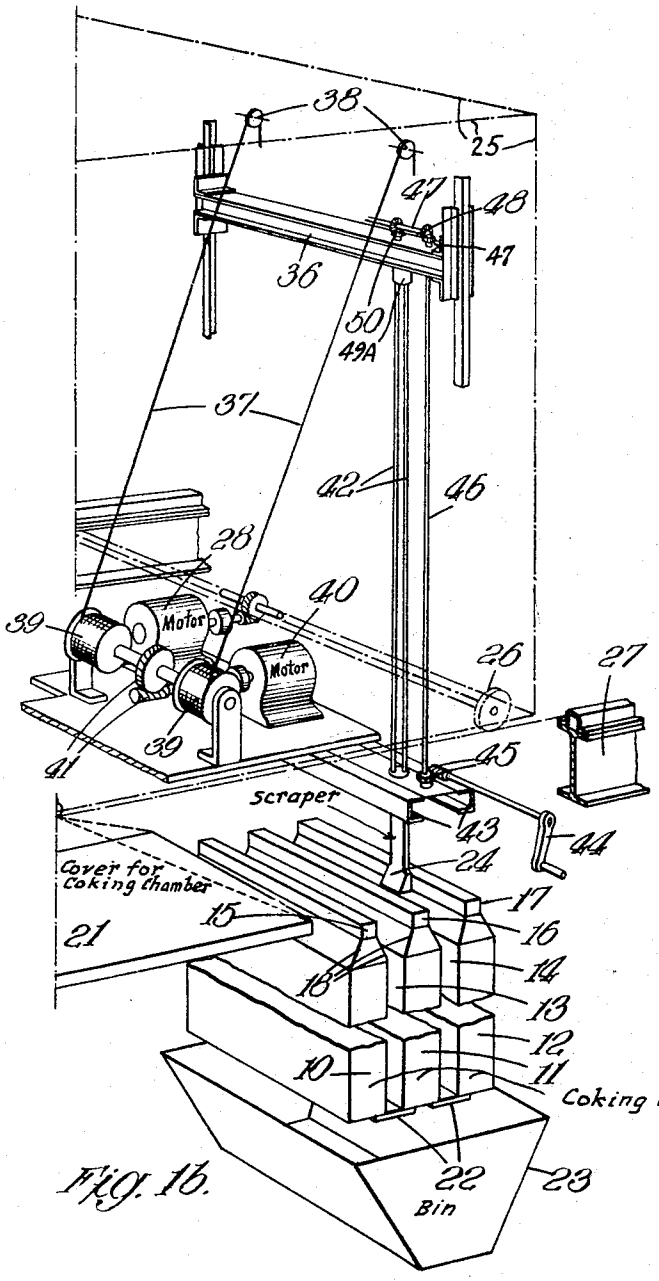


Fig. 16.

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Sept. 3, 1940. F. PUENING 2,213,533

MEANS FOR FREEING COKE FROM THE METALLIC WALLS OF COKE OVENS AND OTHER CARBONIZING CHAMBERS

Filed May 27, 1938 6 Sheets-Sheet 3

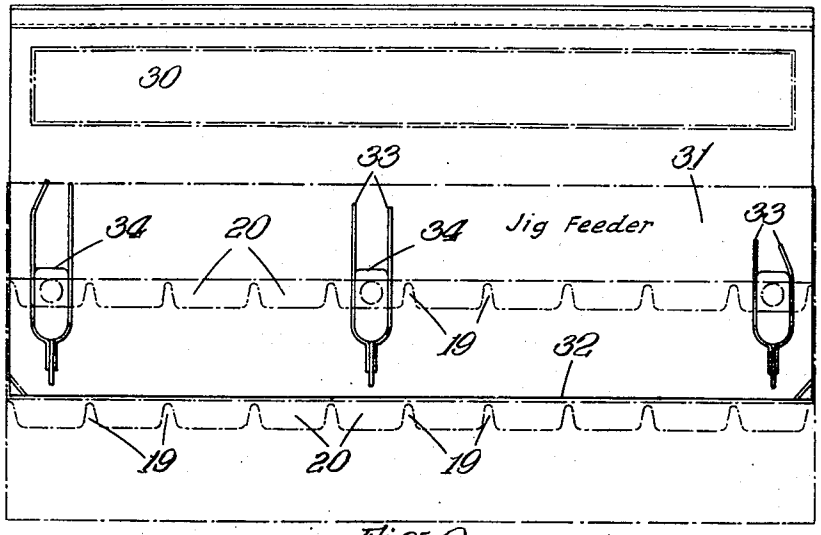


Fig. 2.

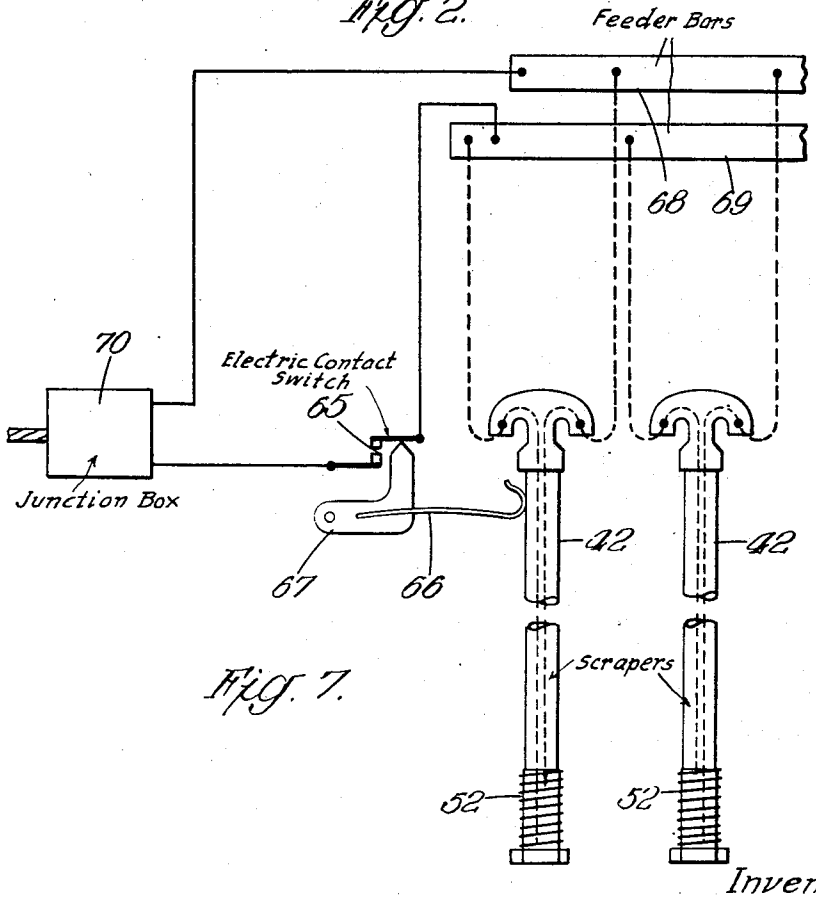


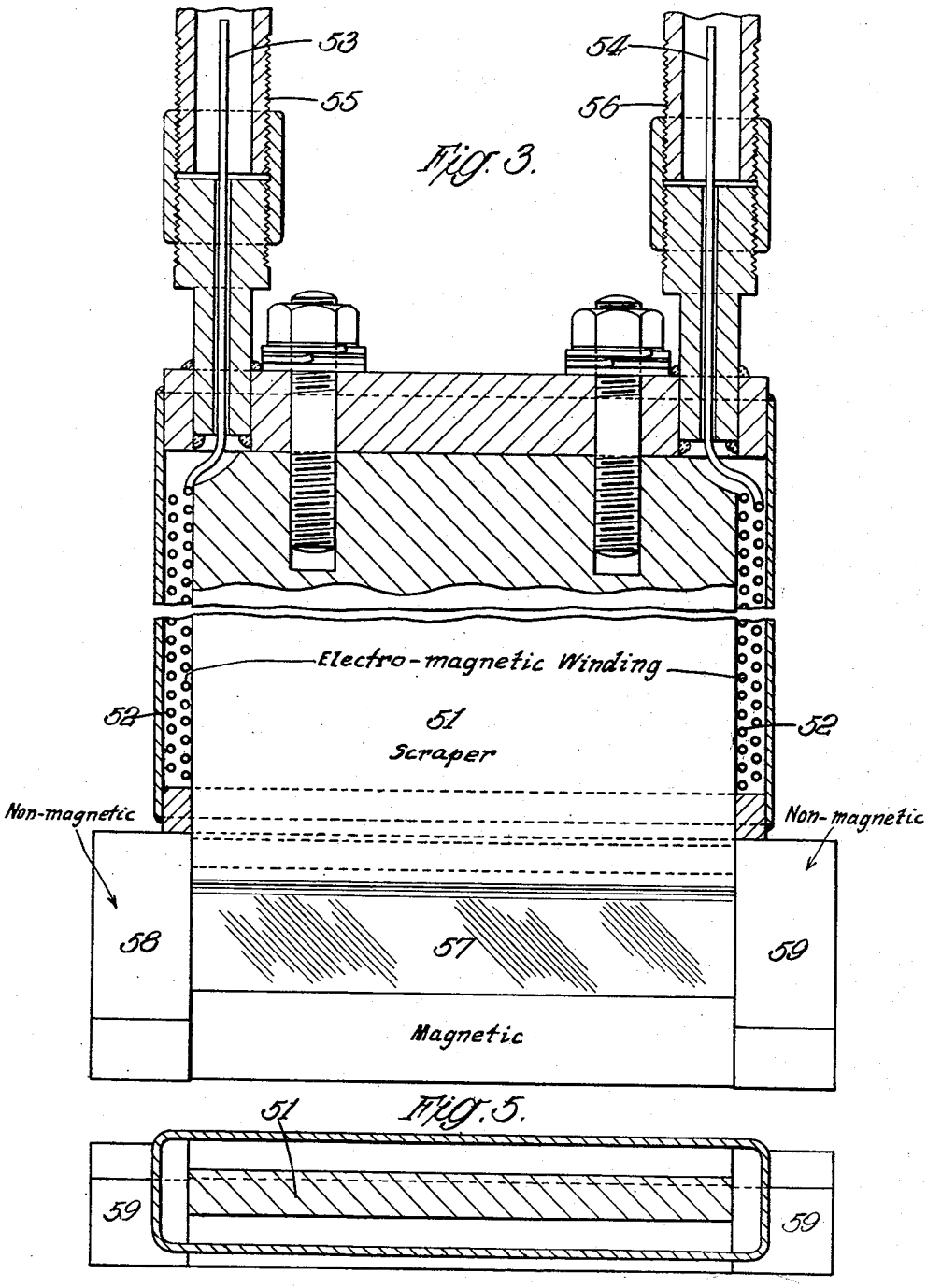
Fig. 7.

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Sept. 3, 1940. F. PUENING 2,213,533

MEANS FOR FREEING COKE FROM THE METALLIC WALLS OF COKE OVENS AND OTHER CARBONIZING CHAMBERS

Filed May 27, 1938 6 Sheets-Sheet 4



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Sept. 3. 1940. F. PUENING 2,213,533

MEANS FOR FREEING COKE FROM THE METALLIC WALLS OF COKE OVENS AND OTHER CARBONIZING CHAMBERS

Filed May 27, 1938 6 Sheets-Sheet 5

Fig. 4.

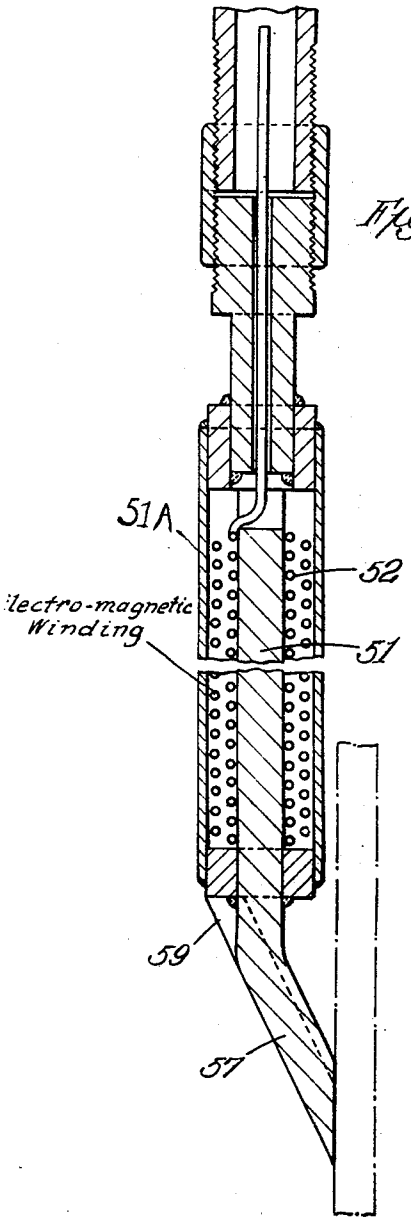
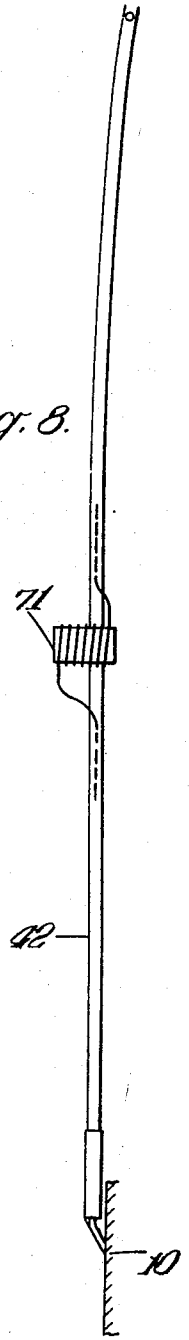


Fig. 8.



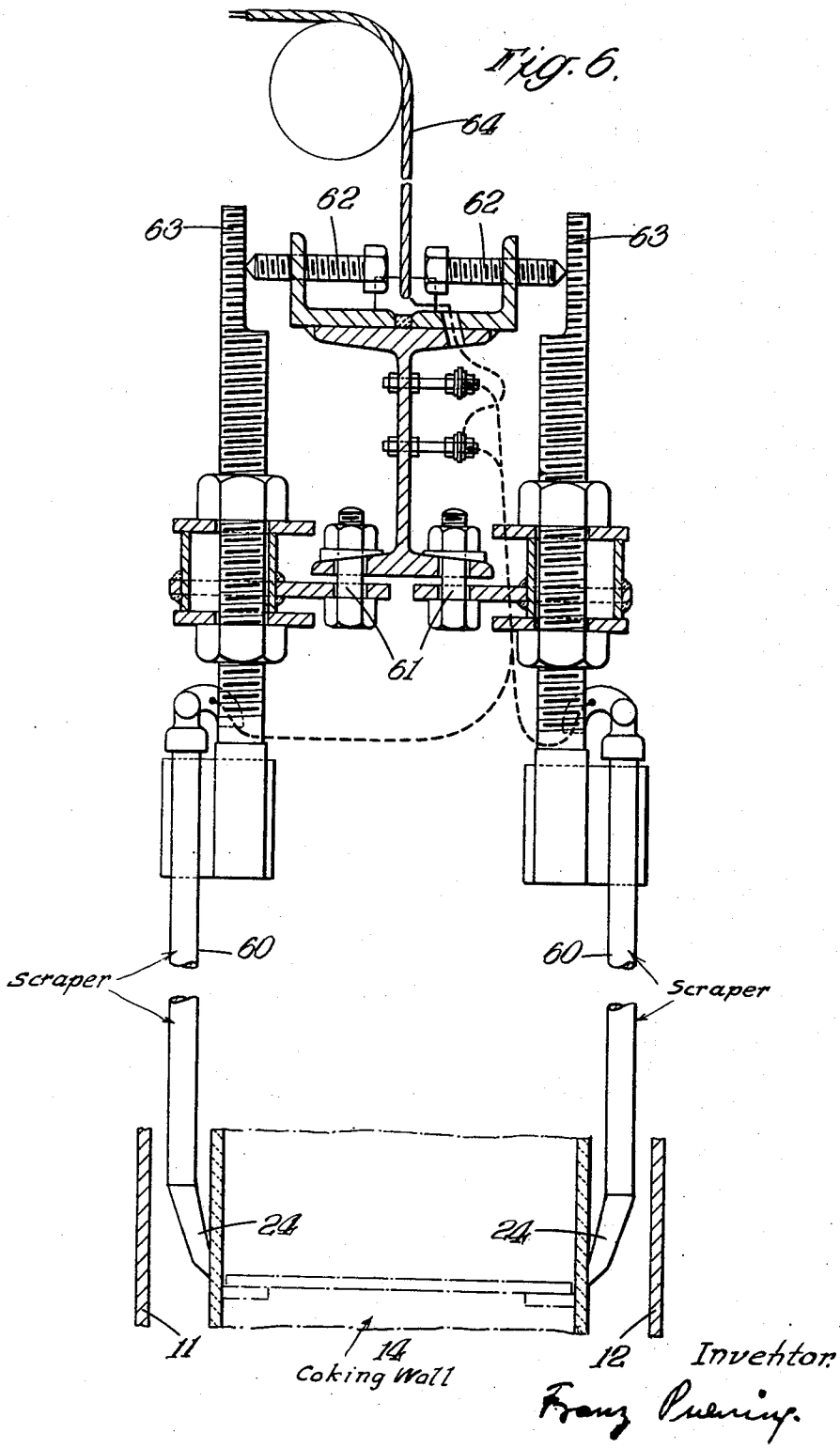
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Sept. 3, 1940. F. PUENING 2,213,533

MEANS FOR FREEING COKE FROM THE METALLIC WALLS OF COKE OVENS AND OTHER CARBONIZING CHAMBERS

Filed May 27, 1938 6 Sheets-Sheet 6

Fig. 6.



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UNITED STATES PATENT OFFICE

2,213,533

MEANS FOR FREEING COKE FROM THE METALLIC WALLS OF COKE OVENS AND OTHER CARBONIZING CHAMBERS

Franz Puening, Claygate, England

Application May 27, 1938, Serial No. 210,414
In Great Britain June 9, 1937

9 Claims. (Cl. 202—114)

The invention relates to low- and medium-temperature carbonization processes and apparatus therefor and particularly to coking ovens of the kind in which, owing to the shape of the coking chambers, the temperature of working and so forth, the resulting coke tends to adhere to the metal walls of the coking chambers.

Even in the case of coking chambers with movable walls, heated or unheated, the resulting coke will fall away from the walls by its own gravity after the walls have been moved apart, only when the weight of the coke is considerable and the coke itself is compact and dense in texture.

If for any reason it is not desired to raise the temperature of the coke to the full temperature of low- or medium-temperature coking, or if the coking chambers have only small dimensions transversely, it is generally necessary to provide mechanical means for loosening the coke from the walls.

The tendency for the coke to adhere is increased, moreover, if the wall is formed with ribs or the like affording the coke additional holding surfaces.

In addition, with a coking chamber of 25 or 30 feet in height and narrow transversely, only a small space is available for introducing an appliance of any great strength for loosening the coke adhering to the lower parts of the wall, while the walls themselves may warp and twist so that a rigid loosening device would not be well adapted to follow the buckled surfaces.

From the point of view of economical production, in addition, it is of great importance that the least possible time should be taken up in removing adhering coke because with chambers (and charges) of only small dimensions transversely, the number of coking operations per day is increased and the removal of the coke produced must be effected quickly as otherwise the gain in speed of coking is neutralized by the delay in removing the coke.

The heavy pushers heretofore proposed for freeing the coke are not well adapted for manipulation at the required speed and are quite unsatisfactory for high and narrow retorts.

It is an object of the present invention to provide, for use in a coking chamber, a scraper and means for holding the scraper automatically in contact with a wall of the coking chamber whilst the scraper is moved so as to remove any coke adhering to the wall at the end of the coking process.

It is another object to provide, in a coking chamber having opposed walls of which at least one is a coking wall, a scraper, means for magnetizing the scraper, and mechanical means for moving the scraper so as to remove any coke adhering to a wall at the end of the coking process.

It is another object to provide means for demagnetizing the scraper automatically at the commencement of its upward motion out of a coking chamber.

Other objects of the invention will appear in the following description thereof, reference being made to the accompanying diagrammatic drawings in which:

Figures 1A and 1B together constitute a single Figure 1 which is a perspective view illustrating the general lay-out of a coking plant constructed and arranged in accordance with the present invention; Figure 2 is a plan view of the table of a jig feeder with the aid of which the coking chambers are charged;

Figures 3, 4 and 5 are front, side and plan views in section of a magnetized scraper;

Figure 6 is an elevation partly in section of a pair of magnetized scrapers;

Figure 7 shows an electrical circuit for use in conjunction with several magnetized scrapers, and

Figure 8 shows a scraper mounted upon a rod which is bowed in such a manner as to hold the scraper against a coking wall to be scraped and which carries an additional magnet for holding the rod near the wall.

The coking plant illustrated in Figure 1b comprises three internally heated movable coking walls, 10, 11 and 12, between which are formed two coking chambers 13 and 14. The three walls are suspended from girders 15, 16 and 17 respectively, by inclined plates 18 to which reference will be made later.

The walls may also be formed if desired with vertical ribs or flutings, as shown at 19 in Figure 2, which divide the coking chamber into a series of compartments 20.

During the coking process all the compartments 20 of the coking chambers 13 and 14 are filled with coal from the top, a cover plate 21 is placed over the tops of the coking chambers, which are then heated by hot gases circulating within the walls 10, 11 and 12, and, when coking is complete, the cover 21 is removed, the bottom doors 22 are opened, and the distance between the walls is increased so as to allow the coke formed to fall out of the bottom of the coking chambers into a bin 23.

As stated above, difficulty is experienced at the end of the coking process in removing the coke from the chambers 13 and 14, particularly if the latter are very narrow and/or are formed with the ribs 19 shown in Figure 2, and this difficulty is overcome by the present invention with the aid of a set of scraping tools one of which is shown at 24 in Figure 1. The scrapers are capable of being lowered into and retracted from the coking chambers and of being moved transversely from one coking wall to another, and for this purpose are mounted so as to be movable vertically upon a tower indicated generally at 25, which is itself movable transversely of the coking walls.

Since the tower can be moved horizontally, it will be apparent that the tower can be moved to occupy any position relatively to the coking walls 10, 11, 12 of Figure 1b. As shown in Figure 1a, the tower has been moved to the left so that a hopper lies above the coking walls, and as shown in Figure 1b, it has been moved to the right to bring a set of scraping tools above the coking chambers.

The tower 25 is movable on wheels 26 running on fixed gantry girders 27. The tower is driven by an electric motor 28, mounted on a platform 29 on which is also mounted a coal charging hopper 30.

Coal is fed from the hopper 30 into the coking chambers 13 and 14 by means of a jig feeder 31 (Figures 1 and 2), some of the coal passing off the end 32 of the jig feeder into one chamber and another portion being directed by suitable fins 33 so as to pass through holes 34 into the adjacent chamber.

Also suspended from the top platform of the tower is a platform 35 carrying screws for compacting the coal in the chambers 13 and 14 as described and claimed in my co-pending application Serial No. 210,415.

At the end of the coking process, the cover plate 21 is removed, the walls are spread apart and the tower 25 is moved until the scrapers 24, Figure 1, lie above one of the coking chambers, for instance 14, after which they are lowered into chamber 14 so as, under their own weight, to scrape off any coke adhering to one of the coking faces of the chamber. The scrapers 24 are suspended from a platform 36 hung upon cables 37 passing over pulleys 38 mounted upon the top tower platform and thence over drums 39 driven from a motor 40 through worm and wheel gearing 41.

By reversal of the motors, the tower 25 may be driven both ways, and the platform 36 may be hoisted and lowered.

As the scrapers are lowered the inclined plates 18 at the top of each coking wall serve as guides to direct them smoothly into the coking chambers. The scrapers are retracted by reversing the electric motor and can be brought above the second coking face of the same chamber or above another chamber, by moving the whole tower 25 transversely of the walls.

As shown in Figure 1, there are provided 10 scrapers, of which only one is shown at 24, and these are rotatable about their individual longitudinal axes; each of these scrapers is suspended upon a pair of pipes 42 hung upon the traveling platform 36 and passing through guides in the members 43. Each scraper 24 is rotatable from a crank 44 through gearing 45 driving a square-section shaft 46 on which is slidably mounted a mitre wheel 47 meshing with a mitre wheel 48 fast on a shaft 49 serving to rotate the scrapers 24 through mitre gears 50. The member 49A and the two pipes 42 carried by it are rotated as a whole. With this arrangement, each scraper is used to scrape first one coking face of a chamber and is then rotated through 180° to scrape the opposite face of the coking chamber; after which the whole set of 10 scrapers are retracted from one coking chamber and lowered into another. Each rotatable scraper may, of course, be replaced by a pair of non-rotatable scrapers of the kind shown in Figure 6.

The scrapers are magnetized so as to cause them to adhere strongly to the iron coking walls and for this purpose are constructed as the cores of solenoid windings in the manner shown in Figures 3, 4 and 5.

As shown in these figures the central portion 51 of each scraper forms the core of a winding 52, the asbestos insulated leads 53, 54 to which enter the scraper through bushes 55, 56. The end portion 57 of the scraper is inclined obliquely to the main rectangular portion 51 so that the scraper takes the form of a chisel, the edge of which can be insinuated into the plane of adhesion between the coking walls and the coke adhering to the wall. The magnetic portion of the cutting edge of the chisel is flanked on either side by two non-magnetic portions 58 and 59, which portions ensure that the chisel is attracted to and held in the troughs of the compartments of the coking chamber lying between the ribs 19 shown in Figure 2. The outer shell 51A surrounding the coil 52 is of non-magnetic metal, for instance copper, or an iron alloy containing a sufficiently high percentage of non-magnetic metals to render it non-magnetic.

In addition to, magnetizing the scrapers, they may be caused to bear against the wall to be scraped by suspending them so that the scraping edges rest against the wall, or again screw means may be employed to force the scraping edge against a wall. A pair of scrapers embodying all three of these schemes is illustrated in Figure 6. The two scrapers 24 operate on two faces of a coking wall simultaneously. Pipes 60 carrying the scrapers constitute the lower arms of two-armed levers pivoted about the points 61 in such manner that the scraper edges bear against the coking walls 11, 12. The light pressure of the scrapers on the walls thus achieved is supplemented by a pressure exerted by screws 62 bearing against the upper and shorter arms 63 of the two-armed levers. In addition each scraper is magnetized in a manner similar to that described with reference to Figures 3, 4 and 5, leads to the windings being taken through a cable 64.

Instead of moving the tower 25 in such a way that it stops above one of the coking walls 10, 11 or 12, whereupon it removes the coke from both faces of a wall, it is of course possible to move the tower to a point above one of the coking chambers 13 and 14 and to scrape the two coking faces of the chamber. In this case, each scraper is used to scrape one wall of a chamber and is then rotated through 180°, so as to scrape the other coking faces of the wall.

It is desirable that, as the scrapers are withdrawn from the coking chambers, they should be demagnetized as soon as the upward motion of the scrapers begins, and this may be done, as illustrated in Figure 7, by means of a contact switch 65 in series with the coil windings, operated by the scraper rods 42, against which a spring 66

is pressed, with the effect that lever 67, to which the spring is secured, is pushed upwards as soon as the upward motion of the rods 42 begins.

Direct current is supplied to a pair of feeder bars 68, 69 via a junction box 70 and through a contact switch 65 which is broken when the scrapers are retracted from the coking chambers. From the bar 68 a lead is taken through the scraper rod 42 to the winding 52 around each scraper and thence back to the bar 69.

As shown in Figure 8, the scraper rods 42, which are elastic, are given a permanent set, so as to be bowed outwardly away from the coking wall 10 to be operated upon, so that when the scrapers are pressed against the walls the rods tend to become straight. In addition a second magnet may be attached to each rod, at a point intermediate their length, as at 71, to assist in preventing the rods from buckling.

Various modifications of the device described above are possible. For example, the screws 62 of Figure 6 may be replaced by turnbuckle or like tension devices, provided below the pivot points 61. The working edges of the scrapers may be strengthened against wear by alloying with the iron other metals such as manganese or chromium to an extent not sufficient to interfere with the magnetization.

If the oven walls are flat, i. e. not fluted, and of considerable breadth, a number of scrapers may be provided side by side, linked together by intermediate hinges having vertical axes, the hinges being preferably of non-magnetic metal, so that in this way the whole breadth of even a warped surface may be adequately cleared of adherent coke while avoiding the danger of the scraper getting out of position by their mutual magnetic attraction.

It will be understood that while the invention has been described above as applied to coking chambers with movable heated walls, it is equally applicable to other types in which the heated walls are stationary, while movable unheated "false" walls, wedges or the like may be arranged opposite heated walls, which unheated walls can be moved at the end of the carbonization process to assist in the removal of the coke from the coking chamber.

By virtue of the present invention the difficulties referred to in an earlier part of the specification are satisfactorily overcome.

The scrapers described can remove quickly and completely all the coke that may adhere to the walls even when the retorts are very high with but small space available for the loosening appliances and the coking chamber quite narrow.

The invention has special advantages when applied to the case of coking ovens of very large capacity and facilitates the use of low-temperature coking chambers of dimensions heretofore impossible.

Moreover, very thin bodies of coal of, for example, not more than 1 inch thickness, can now be coked and the coke successfully removed.

In addition, even if the wall to which the coke adheres is warped, the flexibility of the rods supporting the coke scrapers will enable the scrapers to keep in contact with a wall that has warped considerably. The force required to operate the loosening appliances according to the present invention is in addition small as compared with the pushers referred to above, since instead of a pressure being required that would at once set in motion the entire column of coke adhering to the walls of a coking chamber, with the appliances now proposed the coke is wedged or scraped away in successive lumps or fragments from the wall, the scraper being firmly held against the wall and being pressed against the coke at the plane of adhesion between the coke and the walls.

An additional advantage arising from the present invention in its preferred form arises from the fact that in the case of a strongly adherent coke, the electric current producing the magnetic force can be increased while with less adherent coke, the current can be reduced, thus avoiding unnecessary wear and tear on the scrapers.

In this specification the words "means for automatically holding the scraper in contact with a coking wall" are meant to include any one or more of means for pivoting a scraper so that it bears against a coking wall, screw or the like mechanical means for pressing a scraper against a coking wall, and means for magnetizing a scraper so that it adheres mechanically to the iron-containing coking wall.

I claim:

1. Coking plant including a coking chamber having opposed iron-containing walls, of which at least one is a coking wall, means for moving the walls apart on completion of the coking process, a magnetizable scraper, a winding for an electric current around said scraper, means for supplying current thereto, and mechanical means for moving the scraper so as to remove any coke adhering to a wall at the end of the coking process.

2. Coking plant including a coking chamber having opposed iron-containing walls, of which at least one is a coking wall, means for moving the walls apart on completion of the coking process, a magnetizable scraper, a winding for an electric current around said scraper, a contact switch, which may be broken when the scraper is raised out of a coking chamber, means for supplying current to said winding through said switch, and mechanical means for moving the scraper so as to remove any coke adhering to a wall at the end of the coking process.

3. Coking plant including a coking chamber having opposed iron-containing walls, of which at least one is a coking wall, means for moving the walls apart on completion of the coking process, parallel ribs on said walls, a magnetic scraper a winding therefor and means for supplying current to said winding, the scraping edge of the scraper being flanked by non-magnetic material so that the scraping edge may be caused to sit in the trough formed between two parallel ribs of the coking wall, and mechanical means for moving the scraper so as to remove any coke adhering to a wall at the end of the coking process.

4. Coking plant including a coking chamber having opposed iron containing walls, of which at least one is a coking wall, means for moving the walls apart on completion of the coking process, a two armed lever pivoted in the manner of a bell crank, a magnetizable scraper mounted upon the lower and longer arm of said lever so that the scraper and lever under gravity assume a position against a wall, a winding for electric current around said scraper, means for supplying current thereto, and mechanical means for moving the scraper so as to remove any coke adhering to a wall at the end of the coking process.

5. Coking plant including a coking chamber having opposed iron-containing walls, of which at least one is a coking wall, means for moving the walls apart on completion of the coking proc-

ess, a pivoted member, a magnetizable scraper mounted on said pivoted member, a winding for electric current around said scraper, means for supplying current thereto, and a means for exerting pressure mechanically against said pivoted member to cause the scraper to bear against a wall, and mechanical means for moving the scraper so as to remove any coke adhering to a wall at the end of the coking process.

6. Coking plant including a coking chamber having opposed iron-containing walls, of which at least one is a coking wall, means for moving the walls apart on completion of the coking process, a two-armed pivoted lever, a magnetizable scraper mounted upon the lower arm of said lever, a winding for electric current around said scraper, means for supplying current thereto, screw means for exerting pressure against the upper arm of said lever, to cause the scraper to bear against a wall, and mechanical means for moving the scraper so as to remove any coke adhering to a wall at the end of the coking process.

7. Coking plant including a coking chamber having opposed iron-containing walls, of which at least one is a coking wall, means for moving the walls apart on completion of the coking process, an elastic rod having a permanent set so as to be bowed convexedly away from a wall, a magnetizable scraper mounted upon the lower end of said elastic rod, a winding for electric current around said scraper, means for supplying current thereto, and mechanical means for moving the scraper so as to remove any coke adhering to a wall at the end of the coking process.

8. Coking plant including a coking chamber having opposed approximately plane parallel iron-containing walls, of which at least one is a coking wall, means for moving the walls apart on completion of the coking process, ribs on said walls dividing each chamber into a plurality of vertical compartments, a magnetizable scraper for each compartment, a winding for electric current around said scraper, means for supplying current thereto, and a platform movable vertically above the chambers from which said scrapers are suspended.

9. Coking plant including a group of coking chambers, each having opposed approximately plane parallel iron-containing walls, of which at least one is a coking wall, means for moving the walls apart on completion of the coking process, a group of magnetizable scrapers for at least one of the chambers, a winding for electric current around said scraper, means for supplying current thereto, a platform movable vertically above the chambers, from which said scrapers are suspended, and means for moving said platform transversely of the coking chambers whereby the scrapers may be withdrawn vertically from one chamber, moved horizontally to a second chamber, and lowered vertically into the second chamber.

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