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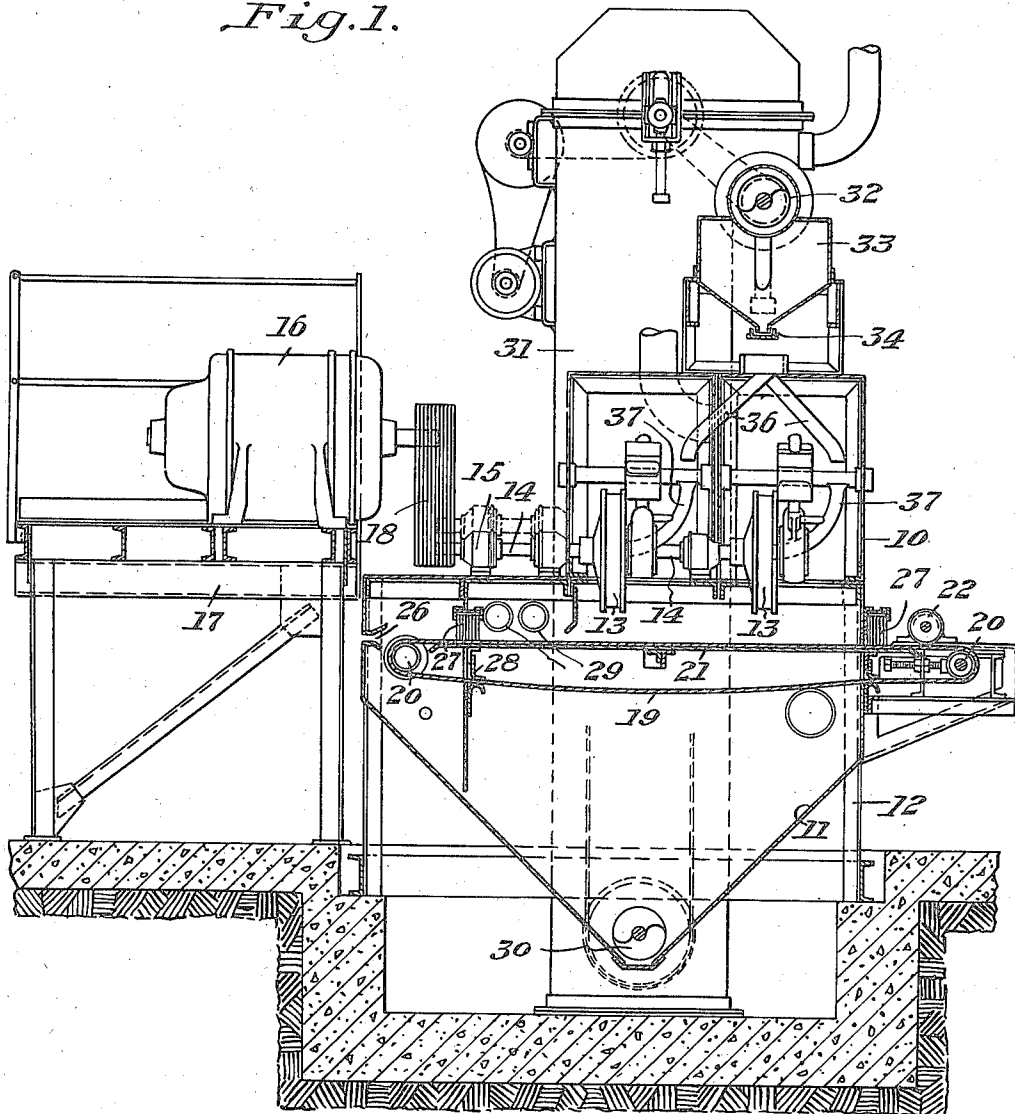
R. J. WEAN ET AL
CLEANING METAL PLATES

2,131,776

Filed June 1, 1934

5 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

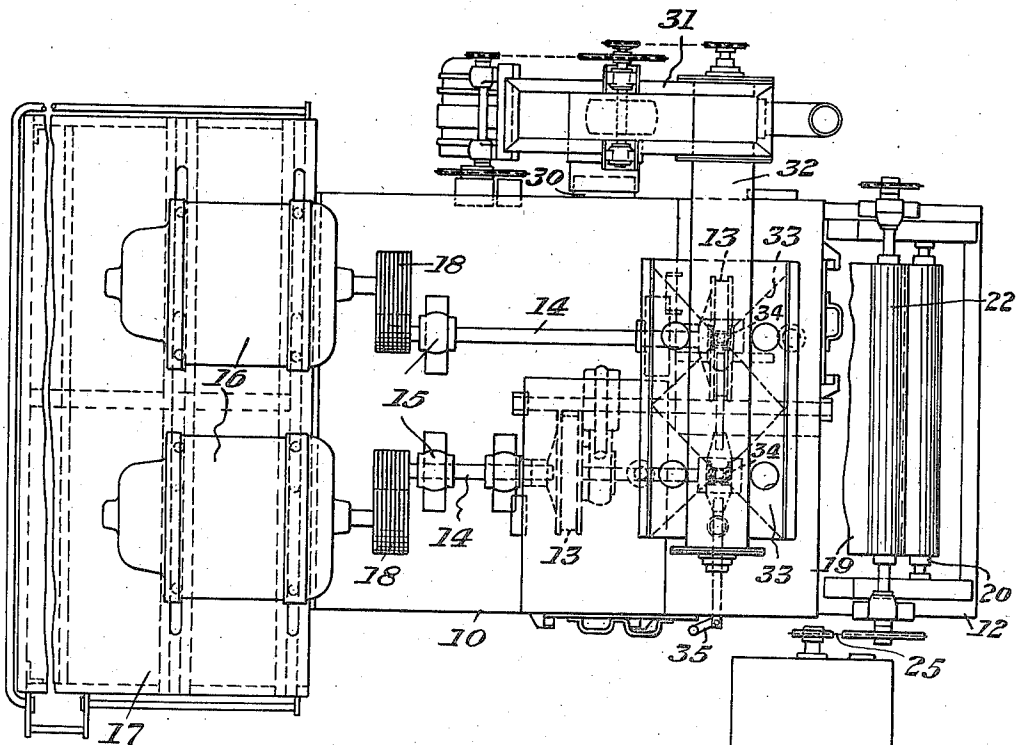
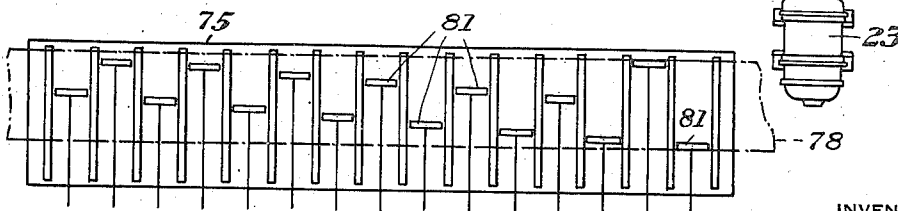


Fig. 7.



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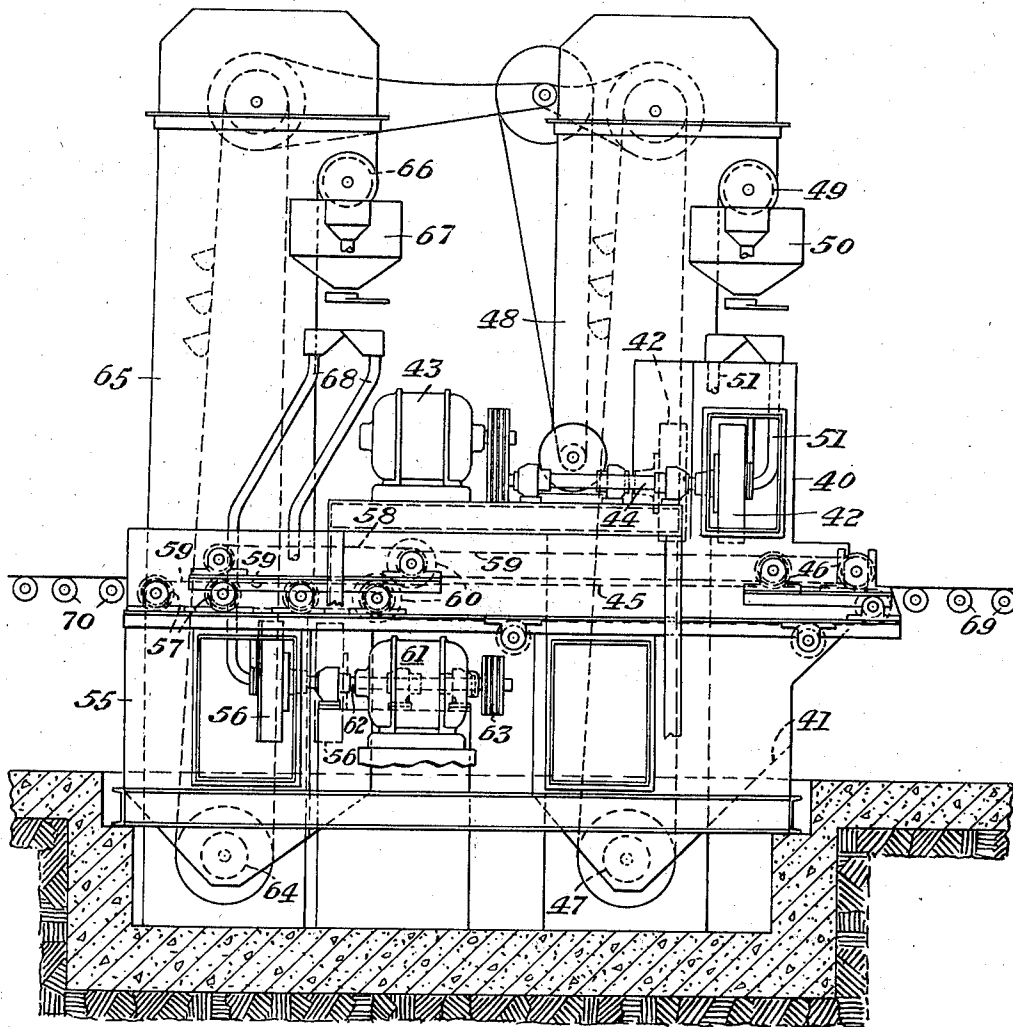
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5 Sheets-Sheet 3

Fig. 3.



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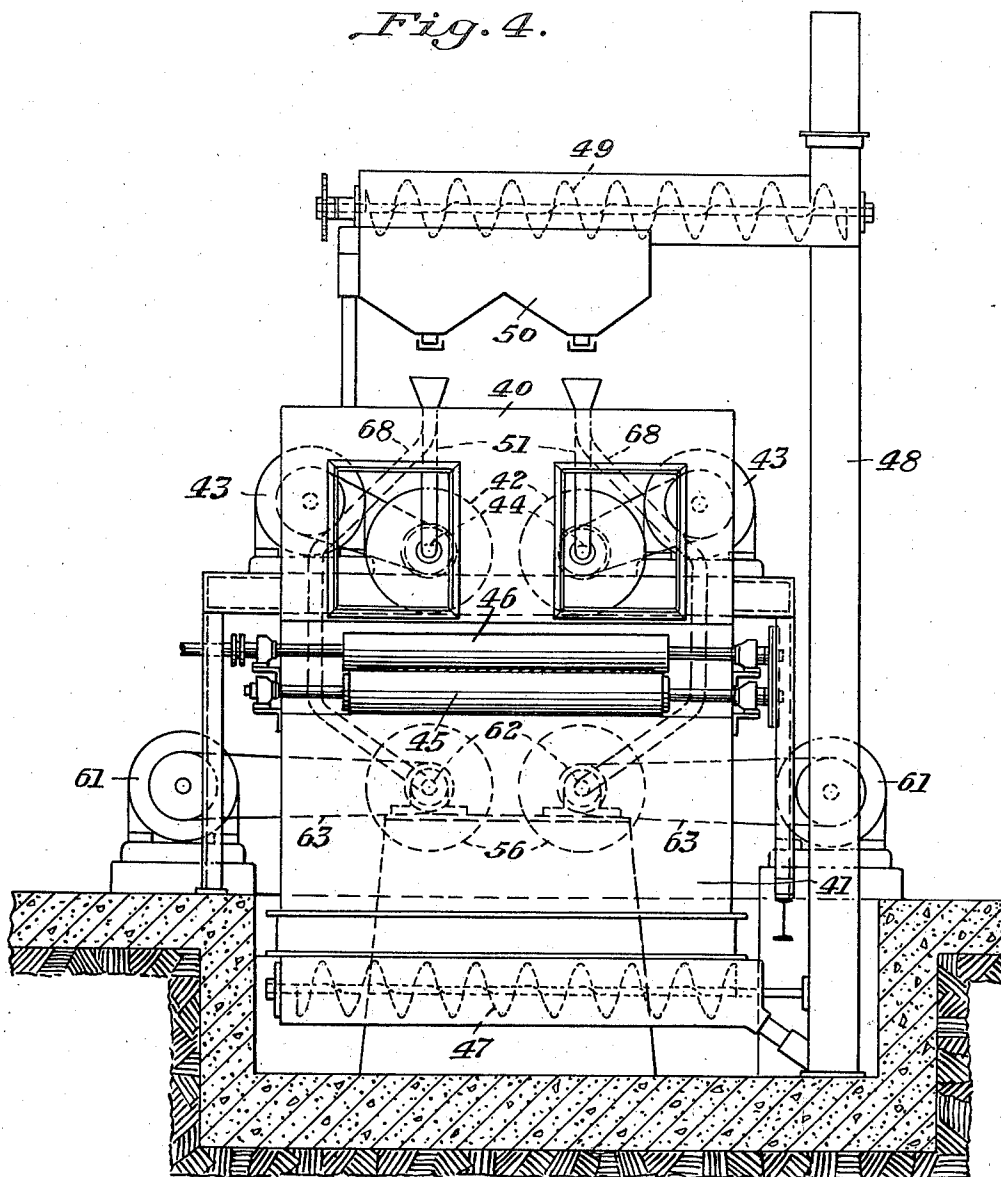
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5 Sheets-Sheet 4

Fig. 4.



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Fig. 5.

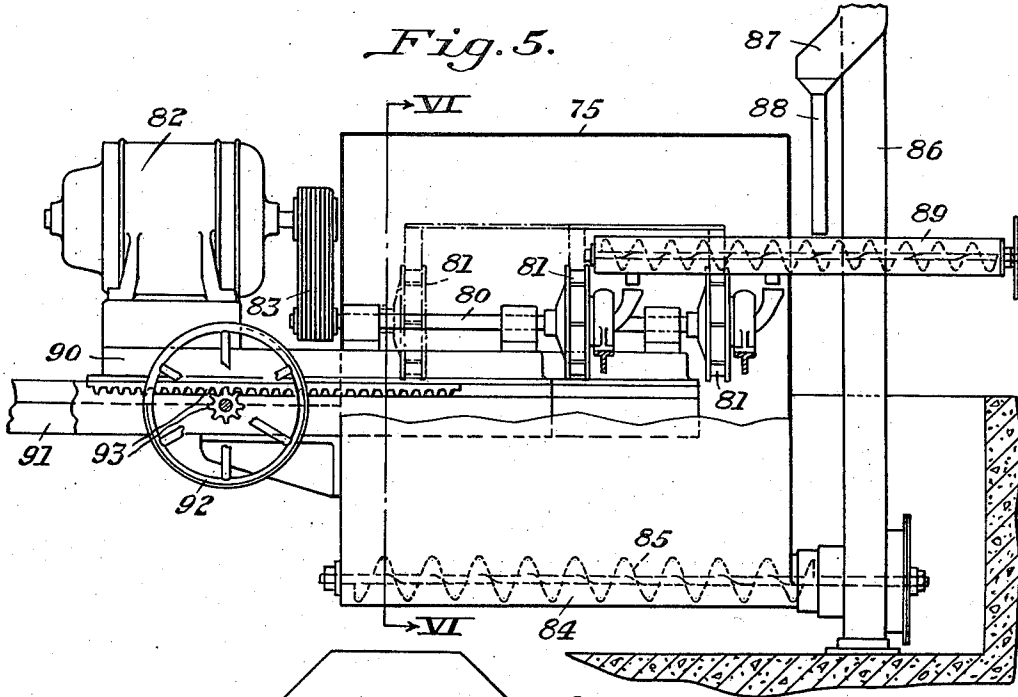
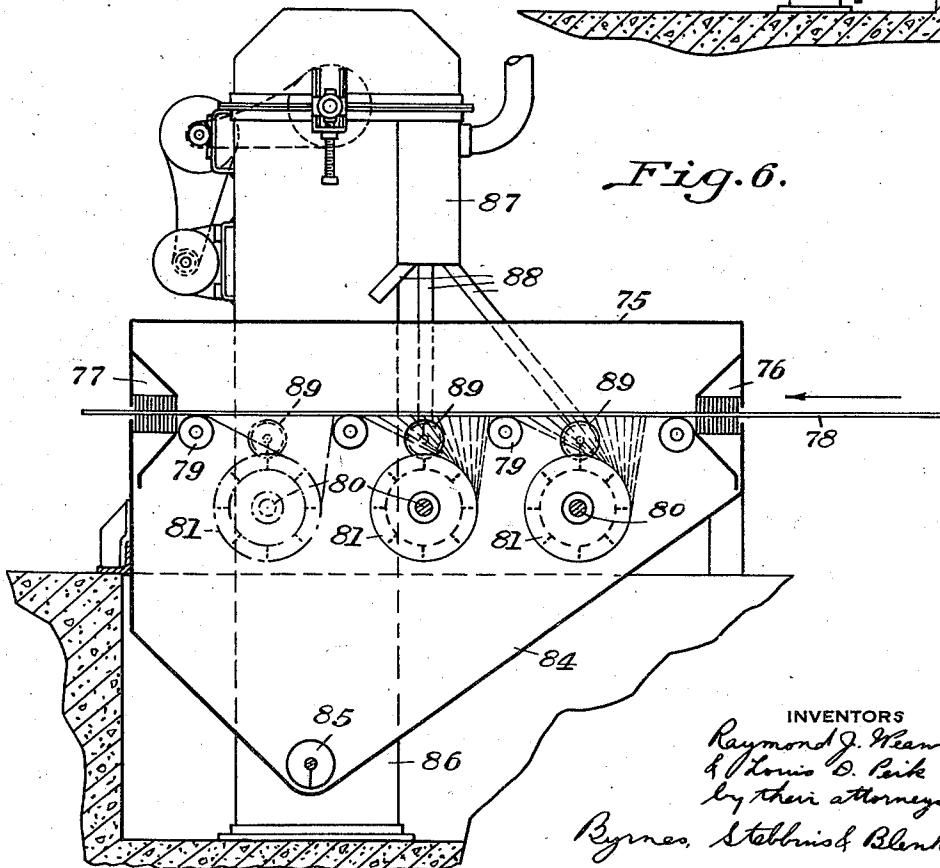


Fig. 6.



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UNITED STATES PATENT OFFICE

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CLEANING METAL PLATES

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Application June 1, 1934, Serial No. 728,484

10 Claims. (Cl. 51—9)

Our invention relates to the cleaning of the surfaces of metal articles and, in particular, the cleaning of metal plates or sheets.

It is well known that layers of scale or oxide form on the surfaces of metal plates and sheets during certain steps incident to their manufacture. This scale or oxide must be removed to make the product salable, or before coatings can be applied thereto. It is the object of our invention to remove this scale or oxide layer from sheets or plates rapidly and conveniently, without materially increasing the cost of the finished product.

In accordance with our invention, we subject plates or sheets to the action of streams of abrasive particles moving at relatively high speeds. The articles treated pass through a chamber on a continuously moving conveyor and are cleaned progressively throughout all or a selected portion of their surface area.

The invention may be more readily understood by a consideration of the accompanying drawings illustrating a preferred embodiment with certain modifications, in connection with the following description relative thereto. In the drawings:

Figure 1 is a longitudinal, sectional view through an apparatus embodying our invention;

Figure 2 is a plan view of the apparatus shown in Figure 1;

Figure 3 is a side elevational view showing a modified form of construction;

Figure 4 is an end view of the apparatus shown in Figure 3;

Figure 5 is a transverse sectional view taken through a further modified form of the apparatus;

Figure 6 is a sectional view taken substantially along the line VI—VI of Figure 5; and

Figure 7 is a diagrammatic view showing how the apparatus of Figures 5 and 6 may be extended for cleaning the entire surface of a plate passing therethrough.

Referring in detail to the drawings and for the present to Figures 1 and 2, our invention comprises a housing or firing chamber 10 having a hopper-shaped lower portion 11. The housing 10 is composed of sheet metal erected on a structural frame 12. Abrasive throwing wheels 13, such as described and claimed in U. S. Patent No. 1,953,566 to Louis D. Peik, are carried on shafts 14 which are mounted in bearings 15 on the housing 10 for adjustment vertically by shims, as shown in dotted lines. Mo-

tors 16 are supported on a frame 17 and are connected to the shafts 14 by belt drives 18.

A conveyor belt 19 extends through the housing 10, being trained around sheaves 20 and over a supporting or backing-up plate 21. A feed roll 22 engages the belt 19 on the entrance side of the apparatus, and is driven by a motor 23, speed reducers 24, and a chain and sprocket drive 25. After material on the conveyor has passed through the cleaning chamber in the housing 10, it is discharged through an exit 26. Flexible curtains 27 seal the interior of the housing chamber to prevent egress of the abrasive. Wipers 28 cooperate with the lower run of the conveyor belt 19 for the same purpose. Air blast inlets 29 are provided in order to remove abrasive material from the plates traversing the apparatus before their discharge therefrom.

The abrasive material discharged by the wheels 13 onto the sheets traversing the conveyor is collected in the hopper chamber 11, whence it is removed by a screw conveyor 30 to the boot of an elevator 31 which may conveniently be of the bucket lift type, the details of which are well known in the art. The elevator 31 raises the abrasive to a point above the firing wheels and discharges it to a screw conveyor 32. This conveyor feeds hoppers 33, the discharge from which is controlled by gates 34 and an operating handle 35. The hoppers 33 discharge into ducts 36 and 37 leading to the axial inlet ports in the wheels 13.

It will be apparent from the foregoing description that the sheets or plates to be cleaned are fed into the apparatus from the right, as viewed in Figure 1. The wheels 13 are spaced so that, together, they effectively clean the entire width of the material carried on the conveyor belt 19. The wheels shown are offset longitudinally and transversely and may be adjusted to and from the work. After passing through the streams of abrasive material, the sheets emerge from the exit 26. Any abrasive material remaining thereon is blown therefrom by air blasts entering the inlets 29. The abrasive material collected in the hopper 11 is re-circulated by the conveyor and elevator mechanism arranged for that purpose, as has already been described.

Referring now to Figures 3 and 4, it will be seen that a slight modification of the apparatus as described will make it possible to clean both the upper and lower surfaces of flat material, such as sheets or plates. At the right in Figure 3 is shown an abrasive cleaning mechanism

similar in general to that which has just been described, comprising a housing or firing wheel chamber 40 having a hopper bottom or collecting chamber 41 therebelow. Abrasive-throwing wheels 42 are mounted within the chamber 40, the wheel to the right being shown in elevation through an opening in the housing wall which is ordinarily closed. Motors 43 are connected to shafts 44 on which the wheels are mounted, for driving them at high speed. A conveyor belt 45 cooperates with pinch rolls 46, as in Figure 1, to feed plate or sheet material through the apparatus below the wheels 42. A screw conveyor 47 and hopper 41, an elevator 48 and a cross conveyor 49 correspond to similar parts in Figure 1, as do the gate-controlled hoppers 50 which discharge abrasive material to ducts 51 feeding the wheels 42.

At the left in Figure 3 is a unit somewhat similar to that just described. It comprises a housing 55 enclosing abrasive-throwing wheels 56 mounted below the level of the path of travel of sheet material through the apparatus. Feed rolls 57, which also serve as pinch rolls, support and convey sheets through the housing 55, a rubber belt 58 serving as a continuous back-up and cooperating with the pinch rolls 46 in the feeding operation. The pinch rolls and belts of both units may be driven from a single motor since they are interconnected by driving chains 59 and gears 60.

Motors 61 drive shafts 62 on which the wheels 56 are mounted, through belt drives 63. The abrasive collected in the bottom portion of the housing 55 is removed by a screw conveyor 64, raised by an elevator 65 and discharged to a distributing screw conveyor 66 in the manner already explained. Hoppers 67 feed the material from the conveyor 66 to supply ducts 68 extending around one side of the apparatus and under the feed rolls to the wheels 56. Approach and run-out conveyors are indicated at 69 and 70.

By means of the apparatus just described, it is easily possible to clean flat material on both sides by a single operation. The sheets, for example, are fed between the pinch rolls 46 and belt 45 from the approach conveyor 69. They are then subjected to progressive cleaning by means of the abrasive streams hurled by the wheels 42. This thoroughly cleans one side of each sheet. The sheets next pass between the belt 58 and the supporting feed rolls 57 below the belt 58 with the result that the other side is progressively cleaned by the abrasive stream thrown upwardly by the wheels 56. Thus cleaning of both sides of the sheet is effected before the sheets are discharged to the run-out conveyor 70. It will be understood that many of the details of the apparatus shown in Figures 1 and 2 have been omitted from Figures 3 and 4 as unnecessary to a clear understanding of the latter. Since the abrasive distributing systems for the two sets of wheels cleaning the tops and bottoms of the sheets, are independent, as well as the drives for the wheels themselves, it is possible to use the apparatus to clean the tops or bottoms only of successive sheets, or both.

Figures 5 through 7 illustrate an apparatus of the same general class as that already described and illustrated except that the equipment of Figures 5 through 7 is intended especially for the cleaning of plates such as skelp, preparatory to being made into pipe by electric welding, for example. Figures 5 and 6 illustrate one unit of an apparatus which may consist of a plurality there-

of. The complete apparatus is shown in outline only in Figure 7.

Referring to Figures 5 and 6, a housing 75 has an entrance 76 and an exit 77 through which plate material indicated at 78, is passed on the rolls of a conveyor table 79. The entrance and exit are sealed by flexible curtains, as before. Shafts 80 are journaled in suitable bearings in the housing 75 and carry throwing wheels 81. Motors 82 drive the shafts 80 through belt drives 83 to cause streams of abrasive particles to impinge upon the surface of the plate traversing the housing.

The abrasive material collecting in the lower hopper-like portion 84 of the housing 75 is removed by a screw conveyor 85 to an elevator 86. The elevator discharges to a hopper 87 having feed ducts 88 leading to transverse screw conveyors 89 extending to the feed spouts of the individual firing wheels 81.

Figure 7 illustrates the arrangement of the several units to clean thoroughly the entire width of the plates 78, and each unit may contain three wheels as shown in Figs. 5 and 6, although any other similar arrangement may be employed. One or both of the wheels 81 which are positioned along the side edges of the sheet may be mounted for transverse adjustment, as shown more fully in Figure 5. A base 90 is movable along rails 91 by means of a hand wheel 92 and a rack and pinion 93. It will be apparent that rotation of the hand wheel 92 will cause the base 90 carrying the motor 82 and the bearings for the shaft 80 on which the wheel 81 is mounted, to move transversely of the housing 75. In this way, it is possible to aline the first wheel 81 with one edge of a plate of any width within the range of the apparatus. The second wheel 81 may be fixed, as may all the others if desired and, as before stated, are arranged to cover the entire surfaces of any plate within the capacity of the apparatus. When narrow plates are being handled, the wheels are positioned so that the stream projected thereby will strike the side edges of the plate to be treated.

The conveyor 89 supplying abrasive to the adjustable wheel 81 is movable therewith and has an open top adapted to receive abrasive at any point along its length from the elevator 86, as shown in Figure 5. If it is desired to clean only the edges of the skelp, it is necessary to drive only the first two firing wheels, the first adjustable wheel being alined with one edge of the plate, the other edge of the plate being alined with the second fixed wheel. The several units making up the complete apparatus are similar except for the location of the throwing wheels and the fact that only the first unit has a wheel which is adjustable transversely.

The adjustable wheel may be employed to cover the entire surface of the sheet or plate moving slowly therebelow. The rate of travel of the work, of course, should be coordinated with the rate of oscillation of the wheel. The movement of the wheel, furthermore, could be adjusted to cover the entire width of the material or any part thereof.

We have found that a highly desirable abrasive action is effected by disposing the wheel for rotation in a plane containing the path of movement of the material, as shown in Figures 5 and 6. Referring particularly to Figure 6, it will be observed that the work initially enters an abrasive stream at substantially right angles to its surface. As the work moves through the

cleaning chamber, the abrasive particles strike the surface at an increasing angle to the normal. The particles directed substantially perpendicular against the surface of the work appear to exert a very effective cleaning operation which is of particular advantage when scale is to be removed. The particles striking the surface of the work at a greater angle to the normal as the plate moves past the firing wheel, appear to exert a finer abrasion, with the result that a high polish is imparted to the work.

This discovery may be taken advantage of by using two separate wheels for cleaning and polishing, respectively. The cleaning wheel would be mounted as shown in Figures 1 through 4. A polishing wheel would be mounted for rotation about an axis inclined to the normal to the work but in the vertical plane containing the path of movement thereof. The inclination of the polishing wheel axis should be such that a stream of abrasive particles is discharged on to the work at an angle of approximately 70° to the normal. As before, the action of the inclined stream of particles is more of a polishing effect as compared to the cleaning and scale removing action of the stream of particles directed substantially normal to the surface of the work.

Our invention is characterized by numerous advantageous features. In the first place, it makes possible the rapid and economic cleaning of flat rolled material for the purpose of removing scale therefrom. The apparatus is very flexible in that it may be designed to meet almost any requirements as to the nature and size of the material handled. The abrasive is closely confined at all times and is used over and over again. As described herein, the apparatus may be designed to clean one or both sides of flat material and the cleaning operation may be co-extensive with the area of the piece or may be confined to a limited portion thereof. It is possible, of course, to clean both sides of material in an apparatus designed to treat only one side at a time by reversing the sheets and subjecting them to a second passage through the apparatus. The operation of the equipment is entirely continuous and automatic so that once started, it functions almost without attention.

Although we have illustrated and described herein but a preferred embodiment of the invention with certain modifications thereof, it will be apparent that changes in the construction illustrated and described may be made without departing from the spirit of the invention or the scope of the appended claims.

We claim:

1. Sheet-cleaning apparatus comprising a cleaning chamber, a conveyor belt extending horizontally thereinto, a backing plate supporting the upper run of the belt, centrifugal abrasive propelling mechanism above the belt, and a pinch roll cooperating with the belt to advance sheets into said chamber.

2. Sheet-cleaning apparatus comprising a cleaning chamber, a belt conveyor for carrying sheets thereinto, centrifugal abrasive propelling mechanism above the conveyor for cleaning the upper side of a sheet thereon, conveyor rolls adapted to receive a sheet from said belt conveyor, and centrifugal abrasive propelling mechanism below said rolls effective to clean the under side of the sheet.

3. Plate-cleaning apparatus comprising a cleaning chamber, a centrifugal abrasive discharge mechanism, means for moving said mech-

anism transversely of the chamber, and a power conveyor having a trough arranged substantially horizontally and movable longitudinally with said mechanism and adapted to receive abrasive from a fixed source of supply and deliver it to said mechanism, said trough having an elongated opening in the upper side thereof.

4. Plate-treating apparatus comprising a substantially closed chamber, an abrasive discharge mechanism of the rotary type movable transversely thereof, and means for collecting the abrasive discharged by said mechanism and returning it thereto, including a collecting conveyor, an elevator, and a horizontally extending feeding conveyor adjustable with said discharge mechanism and adapted to receive abrasive from said elevator in any position of said discharge mechanism.

5. Plate-treating apparatus comprising a chamber, a supporting member movable transversely thereof, a centrifugal abrasive discharge wheel rigidly mounted thereon for rotation, means for driving the wheel, means for adjusting said support transversely of the chamber, and a screw conveyor adjustable with said support for delivering abrasive to said wheel in any adjusted position thereof.

6. Apparatus for blast cleaning elongated metallic stock including, an enclosed housing, means for conveying said stock in a generally horizontal direction through said housing, a plurality of centrifugal abrasive throwing wheels operative to throw individual fan-shaped streams of abrasive each having an elongated impingement pattern against said stock as it passes through said housing, means for driving said wheels at blasting speeds, said wheels being arranged in spaced relation with the axes of rotation of said wheels extending substantially at right angles to the direction of travel of said stock and with the longitudinal axes of the respective impingement patterns extending in a direction parallel substantially to the travel of said stock through said housing, and means including a support adjustable transversely of said conveyor means for mounting at least one of said wheels for adjustment bodily in a direction transversely to the direction of advance of said stock.

7. Apparatus for cleaning plates comprising a chamber, a conveyor in the chamber, a plurality of centrifugal abrasive-throwing wheels mounted above the conveyor in spaced relation longitudinally and transversely thereof, driving means for said wheels, fixed means mounting at least one of said wheels for rotation, and means including a support adjustable transversely of the chamber for mounting at least one of said wheels for adjustment bodily in a direction transversely of said chamber.

8. Apparatus for cleaning plates comprising a chamber, a conveyor in the chamber, a plurality of centrifugal abrasive-throwing wheels mounted above the conveyor in spaced relation longitudinally and transversely thereof, driving means for said wheels, means including a support movable transversely of the chamber for mounting at least one of said wheels, and manually operable means for adjusting said support, and constituting means for maintaining said support in adjusted position.

9. The apparatus defined by claim 7 wherein is provided a conveyor for feeding abrasive to said adjustably mounted wheel, said conveyor being adjustable with the wheel, and a relatively

fixed supply hopper spout cooperating with said conveyor.

10. In a plate cleaning apparatus, a chamber,
a conveyor therein for moving plates there-
5 through, an abrasive throwing wheel mounted
adjacent the conveyor, and traveling means in-

cluding an endless element for holding a plate
on the conveyor against the thrust of the abra-
sive stream created by the wheel.

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