

R. BAGGALEY.

MEANS FOR INCREASING THE AIR BLAST OF CONVERTERS AND FURNACES.

APPLICATION FILED JULY 14, 1913.

Patented Apr. 13, 1915.

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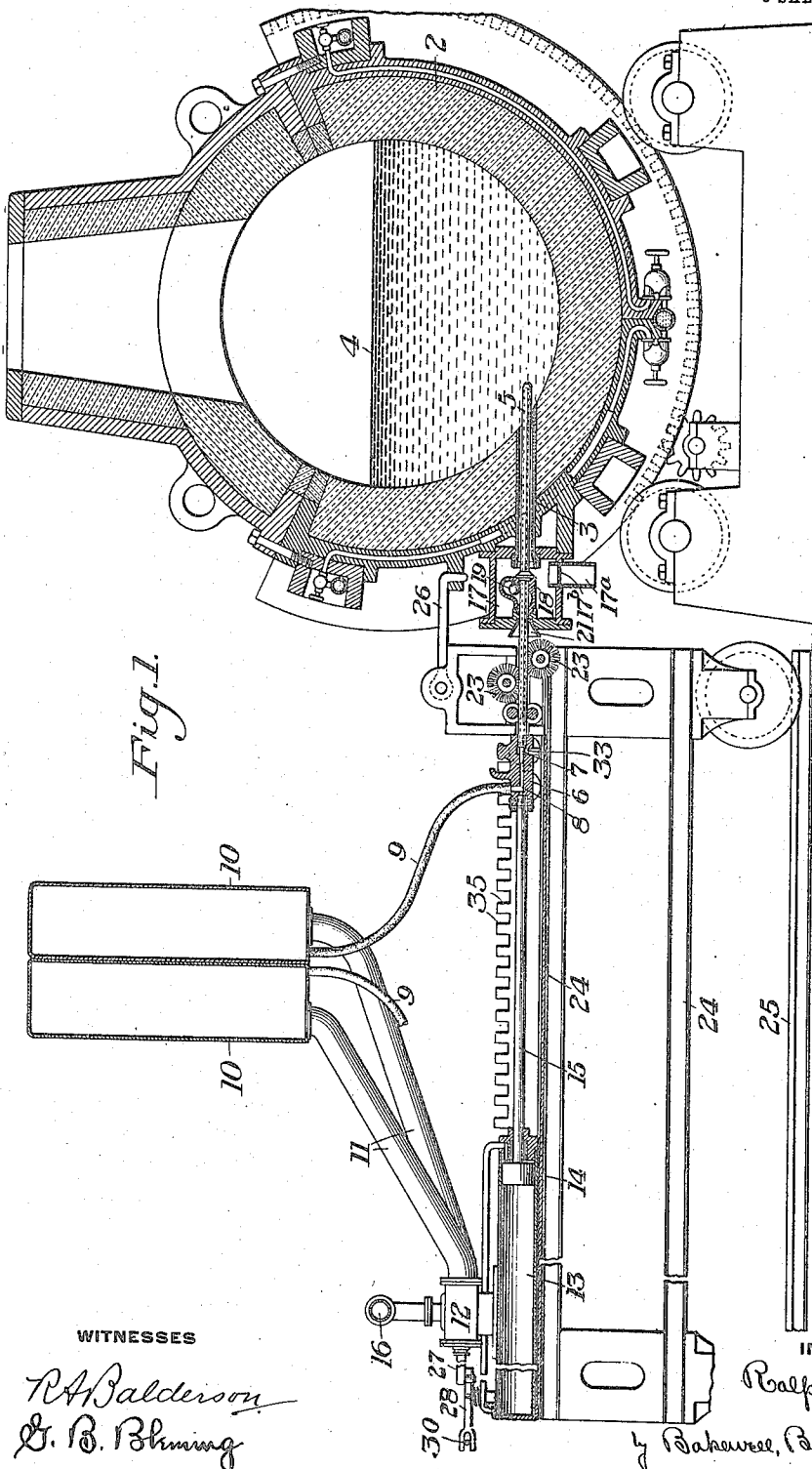


Fig. 1.

WITNESSES

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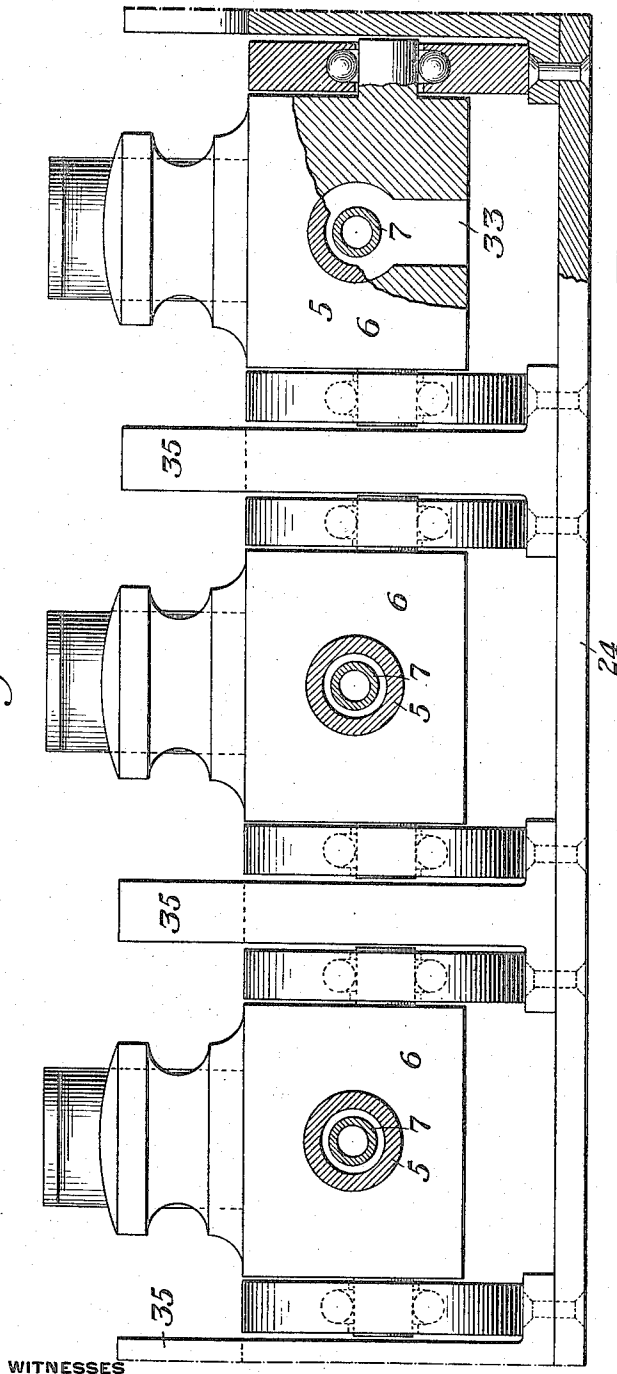
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3 SHEETS—SHEET 3.

Fig. 6.



WITNESSES

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Fig. 8.

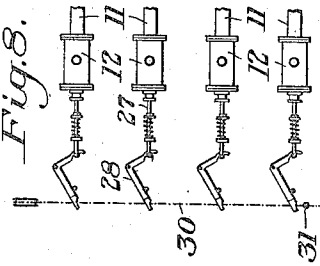
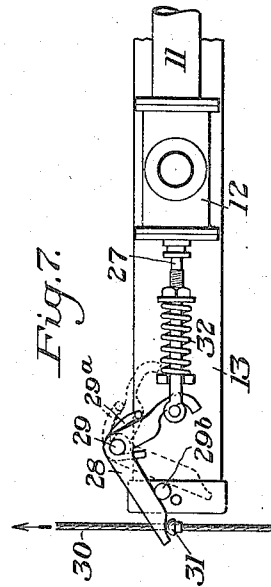


Fig. 7.



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UNITED STATES PATENT OFFICE.

RALPH BAGGALEY, OF PITTSBURGH, PENNSYLVANIA.

MEANS FOR INCREASING THE AIR-BLAST OF CONVERTERS AND FURNACES.

1,135,489.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, RALPH BAGGALEY, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in the Means for Increasing the Air-Blast of Converters and Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a sectional elevation of apparatus embodying my invention; Figs. 2, 3, 4 and 5 are detail sectional views of parts of the apparatus on a larger scale and hereinafter more fully described, Fig. 3 being a section on the line III—III of Fig. 2; Fig. 6 is a sectional view of the section on the line VI—VI of Fig. 2 looking in the direction of the arrow; Fig. 7 is a detail view showing the valve-actuating means; and Fig. 8 is a diagrammatic view showing the valve actuating means for a plurality of the motive cylinders.

My invention has relation to means for increasing the air blast of converters and furnaces, and more particularly converters and furnaces used in the treatment of copper mattes.

In the conversion of copper mattes under the present practice, the most exact and expensive portion of the work consists in punching the twyers of the furnaces or converters in order to provide the free and unobstructed entrance of the bessemerizing blast into the liquid body of matte. In the earlier practice, converters of this type were relatively small, usually having eight or ten twyers, and it was seldom that a converter contained more than twelve twyers. These converters were used for enriching what were called converter mattes, or mattes containing from 48 to 50 per cent. of copper and which has been produced by some of the various forms of concentration to that stage and up to what is known in the trade as blister copper. In the raising of a 50 per cent. converter matte up to blister copper, no carbonaceous fuel is employed, the heat resulting solely from the oxidation of impurities in the matte. As the process continues, and the impurities are gradually eliminated until they reach the vanishing point, the heats of oxidation necessarily become less. In order to finish a charge it is frequently found necessary to charge the

converter with blocks of wood, which float on the surface of the molten copper and assist in maintaining a sufficient heat until the refining process has been concluded. As the matte bath approaches blister copper, and the heats from oxidation are rapidly diminished, the entering cold air-blast forms what is called "copper noses" at the end of each twyer; that is to say, masses of chilled or solidified metallic copper. These, of course, obstruct the free entry of the bessemerizing blast into the liquid bath, and if they are not constantly removed by punching the twyers they will quickly bring the entry of the blast into the liquid bath to a full stop. This twyer punching work is one known around smelters as "killing work", and necessitates the constant employment of a considerable force of men.

Since the adoption and use of the new art of dissolving ores in a metallic bath of mattes solely by the heats of oxidation, and entirely without the use of carbonaceous fuel, which I have disclosed in numerous U. S. patents heretofore obtained by me, there has been a great change in the apparatus employed. It is much easier to retain the heats in a large body of matte or molten copper than it is in small bodies of the same, because the percentage of cooling area is much less when handled in large units. Under the modern practice, therefore, much larger converters are used. For instance, instead of the old fashioned converters containing eight, ten, or at the most twelve twyers, converters are now in daily use having forty-eight twyers, and some of them as many as sixty-eight. With this increase in converter size and in number of twyers, the problem of keeping the twyers free has very greatly increased, and the necessity for some mechanical means for doing this work has become urgent. Many attempts have heretofore been made to solve this problem, but so far as I know none of them have proved entirely successful, and at the present time there is not to my knowledge a single copper smelter in the world which is not forced to depend upon the old, unsatisfactory and expensive hand punching of the twyers.

In my Patent No. 871,079, of November 12th, 1907, I have described and claimed mechanical punching apparatus, which in so far as its mechanical arrangement is concerned is very satisfactory but the use of which has met with certain objections. It

has been found that the punching bars heat rapidly by reason of their penetration into the furnace or converter; and that as soon as the bar reaches a certain temperature the matte and slag fasten themselves firmly to it. The only known means then of removing the bar and putting the twyer into commission is by means of what are called "dogs" and heavy sledge hammers. This demands the services of at least three workmen, and the effect on the twyer orifice is, of course, very injurious. It has been attempted to overcome this difficulty by means of cold water applied to the external surfaces of the bars. When, however, the temperature of the bars has been reduced between successive thrusts of the machine to such an extent that matte and slag cannot adhere to them, the bar itself remains wet, and when the machine again drives this wet bar into the liquid body of molten matte, which is at a temperature of approximately 2400 degrees Fahrenheit, a very highly explosive gas is formed which results in serious consequences.

The object of my present invention is to overcome the difficulties that have been experienced in previous mechanical twyer-punching apparatus and to provide twyer punching mechanism which under any and all conditions may be maintained at any desired temperature and without wetting the exterior of the punching bars so as to cause the explosions hereinbefore referred to. To this end my invention comprises twyer-punching apparatus having a hollow punching bar or bars which are internally cooled. This cooling may be effected by the use of the exhaust air from the motive cylinders employed for propelling the punching bars.

By using air in these motors under a pressure of say seventy pounds to the square inch, and passing the exhaust into a much larger receiver, the rapid expansion of the air greatly reduces its temperature. This air is then allowed to continuously escape under a relatively low pressure and pass through the interior of the bars. If a greater and more pronounced cooling action is desired, this can be accomplished by allowing cold water to flow continuously through the interior of each punching bar at any desired speed, either by gravity from an elevated storage tank or by the use of water under other pressure.

In the accompanying drawings, the numeral 2 designates a copper converter of a well known type; and 3 the twyers through which the bessemerizing blast is forced into the body 4 of molten matte within the converter.

5 designates a hollow punching bar adapted to be reciprocated through the twyer 3. At its rear end this bar is removably secured to a connecting block or member 6. Within the bar 5, and of a consid-

erably smaller diameter, is a hollow pipe or tube 7 open at both ends, its rear end being also removably secured within the member 6, and its front end terminating near the front end of the bar 5. The member 6 has a port 8, which communicates with the open rear end of the pipe 7, and to which is also connected a flexible pipe or hose 9, which, in Fig. 1, is shown as connected to a receiver 10. This receiver is connected by pipes 11 with the valve casing 12 of a double-acting pneumatic motive cylinder 13. The piston 14 of this cylinder has its rod 15 connected to the member 6. Air under pressure is supplied to the cylinder 13 from any suitable source by means of a pipe 16, and its admission to an exhaust from the cylinder is controlled by any suitable valve device of well known character within the valve casing 12.

17 designates a wind box through which the punching bar is arranged to reciprocate, and which carries the twyer 3. This box is provided with a suitable wind valve 18 for the rod 5; and I preferably provide this valve with an anti-friction ball 19 which is capable of some play in the slot 20 of the valve 18, in order to prevent the escape of the blast. This wind box preferably has a flared or funnel-shaped guide entrance 21 at its forward end, which may be provided with a removable bevel-edged scraper 22 of any suitable character for the purpose of removing any matte or slag which may adhere to the outer surface of the bar 5. The wind box is also provided adjacent to each twyer with a removable sectional pipe or nipple 17^a, having clamped between its sections a destructible washer 17^b. This washer normally forms a closure for the pipe or nipple, but it is of such a character as to be quickly destroyed by contact with hot matte, some material, such as celluloid, being used in this construction. If for any reason, any of the matte should come back through the twyer into the wind box, it will fall directly into the open upper end of this pipe and will destroy the washer and flow out through the pipe. This prevents the wind box becoming clogged or filled with matte. This pipe or nipple is readily removable, and when removed it permits access to the interior of the wind box for the purpose of renewing the scraper 22, or for other repairs. I may also provide suitable cleaners, such as the revolving wire brushes 23, at the rear of this guide bearing (see Fig. 1) for the purpose of further cleaning the surface of the bar and keeping it in a free and bright condition.

I provide as many punching bars as there are twyers these punching bars being arranged side by side in parallel relation, and each having a separate actuating motor, these also being arranged side by side, as shown in Fig. 6. The entire apparatus is preferably mounted upon a movable car-

riage 24 arranged to travel on tracks 25. This carriage is movable toward and away from the converter body, and when in operating position may be temporarily fixed with respect to the converter by suitable holding means such as hooks on the carriage engaging the converter body. One of these hooks is shown at 26 in Fig. 1.

I preferably actuate the punching bars of the series successively. This may be effected by any suitable means which will cause the proper movement of the valves of successive motive cylinders. In Figs. 7 and 8 I have shown valve-actuating means of this character. The stem 27 of each valve is engaged with one arm of a bell crank member 28 pivoted at 29, the other arm of said member being forked to permit the passage therethrough of an endless operating rope or cable 30. This cable is provided with an actuating device shown as being in the form of a button 31. The cable is kept in continuous operation; and the button 31 will, as will be clearly seen by reference to Fig. 8, engage successive bell crank members 28, one after another to move said members sufficiently to actuate the valves to admit air to the rear ends of the respective motive cylinder. When a valve has been thus opened, the bell crank member has been moved to a position in which the button 31 will escape the end of the forked arm thereof; and the continued movement of the cable will cause it to engage and operate the next bell crank member, and so on successively throughout the series of motive cylinders. The stem of each valve is provided with a spring 32 for throwing the valve to its reverse position as soon as it is released. In this manner each punching bar is successively operated; and by regulating the movement of the actuating rope or cable 30 any desired interval may be made to occur between successive operations of each bar as well as between successive bars. In this manner each twyer can be punched at sufficiently frequent intervals so that it will never get out of order.

After any bell crank member has been released by the button 31 in the manner described, it can be manually moved to the position shown in dotted lines in Fig. 7, against the tension of the spring 29^a, and secured in this position by means of a removable pin 29^b. In this position it is disengaged from its valve stem 27, and so long as it remains in this position the motor is out of operation. During this inactive period of the motor any necessary repairs can be made to the particular punching bar actuated by this motor as well as to its adjuncts.

The exhaust air from each motor passes into the corresponding receiver 10, in which it expands and thereby has its temperature

reduced. The air passes out of the receiver through the pipe or hose 9; thence through the pipe 7 within the hollow punching bar, escaping into said bar near the forward end thereof. The air then passes back and out through the escape port 33 of the member 6.

If more pronounced cooling is desired, the pipe or hose 9 of Fig. 2 may be connected either to a gravity water reservoir or any suitable source of water under pressure.

If desired, rack bars 35 may be provided, as shown in Fig. 1, these rack bars being fixed to the frame of the carriage and providing means for the engagement and application of a pry bar in the event that for any reason the punching bar should become fixed or stuck while in operation.

My invention provides means of simple and effective character whereby the twyers of a copper converter or furnace may be kept free by mechanically operated means, thus obviating the use of the hand-punching method heretofore universally employed. The form of punching bars which I provide, with the arrangement for cooling the same interiorly, enables the bars to be kept at a temperature such that no slag or matte will adhere to them, and they will at all times work freely in and through the twyers. The outer surfaces of these bars being at all times dry, no explosions can take place.

I do not limit myself to the particular construction and arrangement of the parts which I have herein shown and described, as it is obvious that these may be varied considerably within the scope of my broader claims. Thus, any suitable type of motors may be employed for actuating the reciprocating punching bars; the means for providing for air or circulation of water within or through these bars may be changed, and various other changes in details may be made.

I claim:—

1. Apparatus for punching twyers, comprising a hollow twyer-punching bar having separate inlet and outlet passages for a cooling medium, a motive device connected to the bar for the purpose of reciprocating the same within the twyer, and means for supplying a cooling medium to the inlet passage of said bar during its reciprocation, substantially as described.

2. In apparatus of the character described, the combination of a furnace or converter having a twyer, of a punching bar adapted for reciprocation through the twyer, a motive device for reciprocating said bar, together with means for cleaning the exterior of the bar as it is reciprocated; substantially as described.

3. Apparatus of the character described, comprising a plurality of hollow reciprocating twyer-punching bars arranged side by side, a separate motor for reciprocating each

bar, and means for maintaining a separate circulation of a cooling fluid within the interior of each bar; substantially as described.

5 4. Apparatus of the character described, comprising a movable car or carriage, a plurality of hollow twyer-punching bars mounted thereon, a separate actuating motor for reciprocating said bar, said motors
10 being also mounted on the carriage, and means for effecting the circulation of a cooling fluid within the interior of each bar; substantially as described.

5. Apparatus of the character described, comprising a series of hollow twyer punching bars arranged side by side, a separate motor for reciprocating each bar, valve means for controlling the motors, and devices for successively actuating the valves
20 of the different motors; substantially as described.

6. Apparatus of the character described, comprising a hollow twyer-punching bar, a motor connected to said bar to reciprocate
25 the same, and means for circulating the exhaust from said motor within the interior of said bar; substantially as described.

7. Apparatus of the character described, comprising a hollow twyer-punch, a pneumatic motor for reciprocating said bar, a receiver connected to the exhaust of the motor, and a connection between the receiver and the interior of the bar; substantially as described.

8. Apparatus of the character described, comprising a series of hollow twyer-punching bars arranged side by side, a separate motor for reciprocating each bar, valve means for controlling the motors, devices
40 for successively actuating the valves of the different motors, and means whereby any motor can be temporarily thrown out of operation; substantially as described.

9. In apparatus of the character described, the combination with a furnace or converter having a twyer, and a wind box into which the twyer opens, of a punching

bar arranged to be reciprocated through the wind box and twyer, and means for closing the wind box against the escape of air when
50 the punching bar is withdrawn therefrom together with means for maintaining the circulation of the cooling medium within the punching end of said bar; substantially as described.

10. Apparatus of the character described, comprising a series of twyer-punching bars arranged side by side, separate means for reciprocating each bar, and devices for automatically controlling the operation of the
60 different reciprocating means; substantially as described.

11. Apparatus of the character described, comprising a series of twyer-punching bars arranged side by side, a separate motive
65 means for reciprocating each bar, a control device for each motive means, and devices for successively operating the controlling means for the different motive devices; substantially as described.

12. The combination with a copper converter having a twyer and a wind box into which the twyer opens, of a punching bar adapted to be reciprocated through the wind box and twyer, and cleaning means arranged to act upon the exterior of said bar as it is reciprocated; substantially as described.

13. In apparatus of the character described, the combination of a copper converter having a twyer, a wind box into which the twyer opens, and a punching bar arranged for reciprocation through the wind box and twyer, said wind box having a normally closed escape opening, the closing means for said escape opening being capable of being destroyed by contact with hot metal; substantially as described.

In testimony whereof I have hereunto set my hand.

RALPH BAGGALEY.

Witnesses:

L. A. GUEHL,
H. M. CORWIN.