A. G. McGREGOR.

CONVERTER PLANT.

APPLICATION FILED AUG. 26, 1920.

1,417,538.

Patented May 30, 1922.

4 SHEETS—SHEET 1.

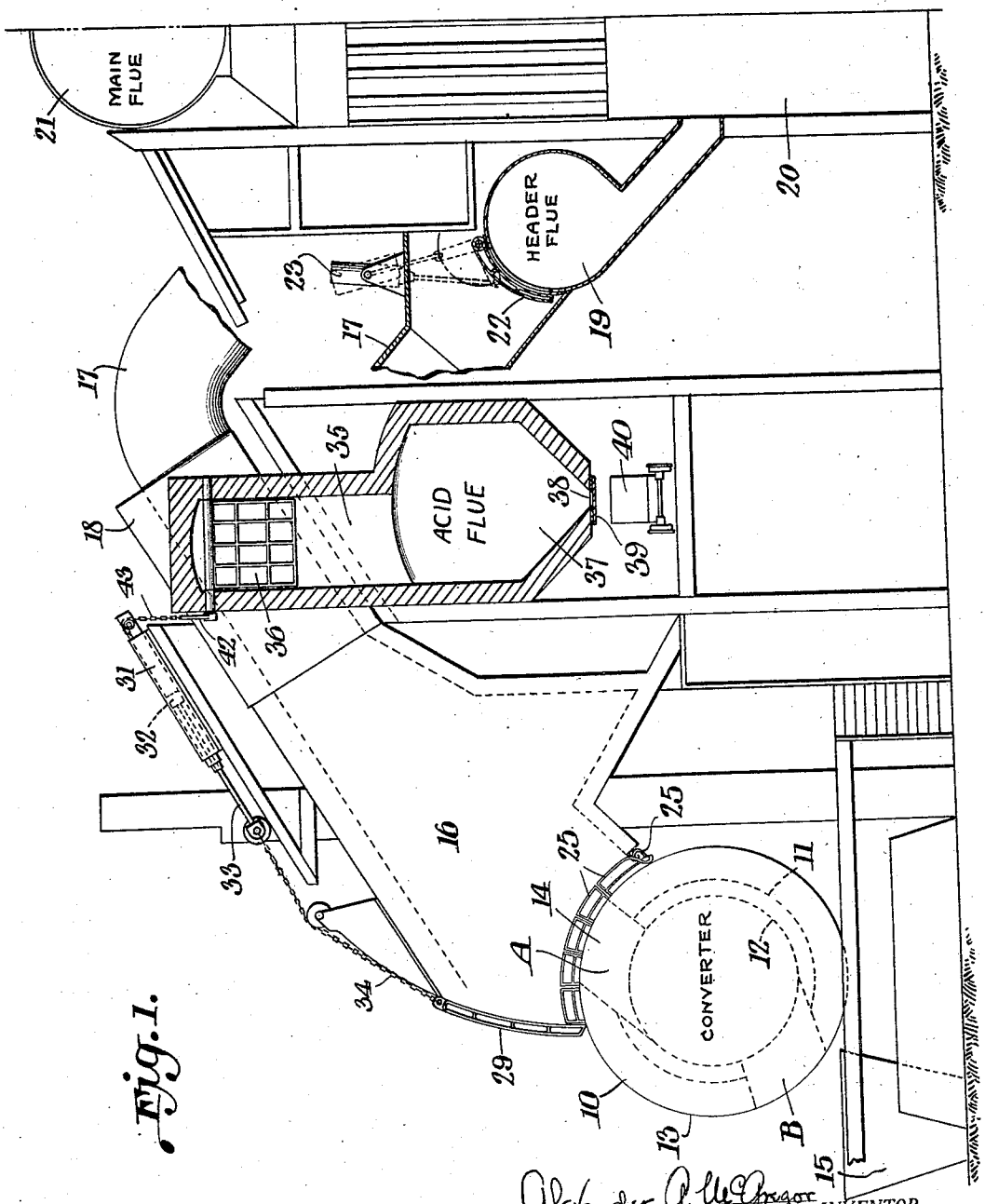


Fig. 1.

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BY

Edwards Calver ATTORNEYS

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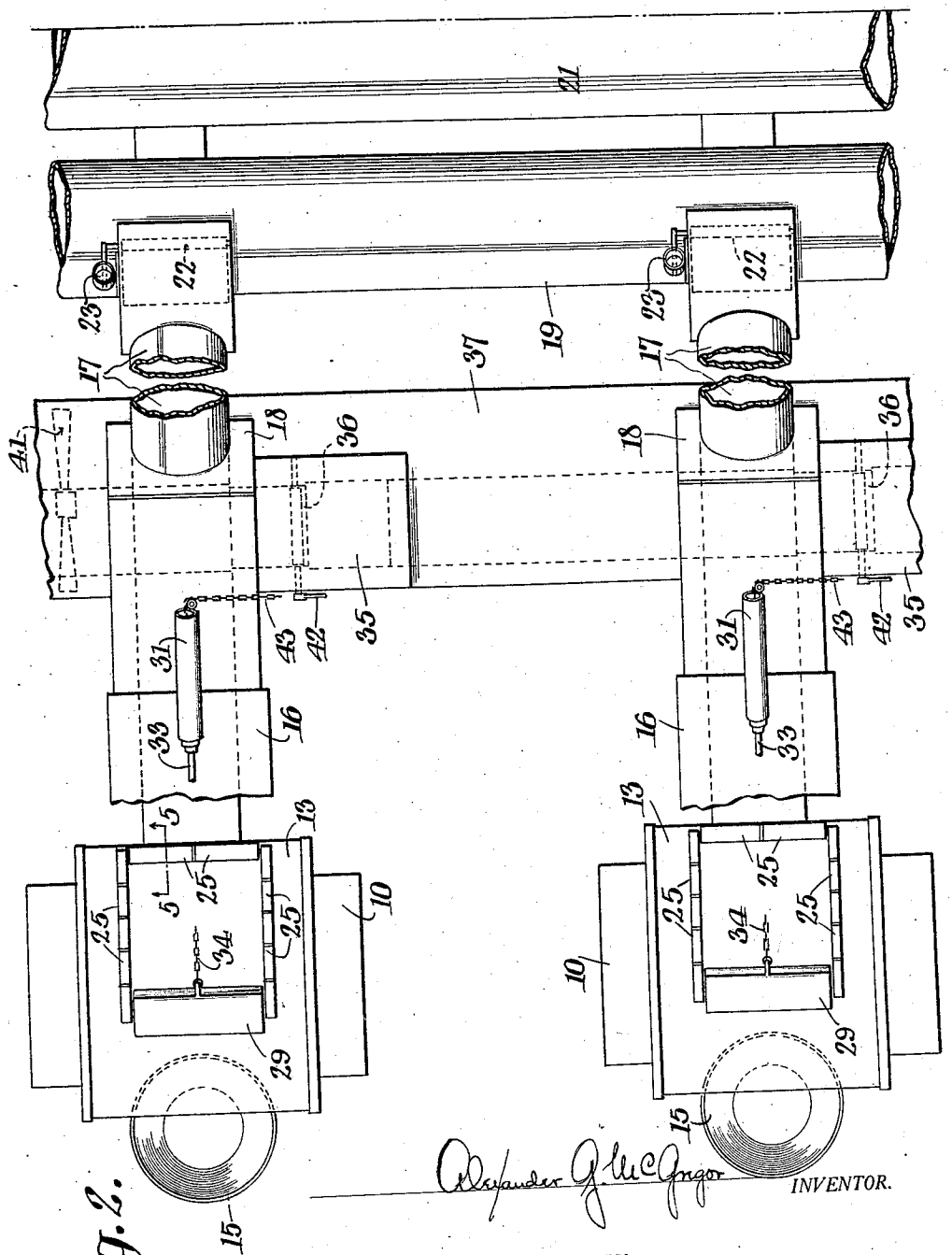


Fig. 2.

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4 SHEETS—SHEET 3.

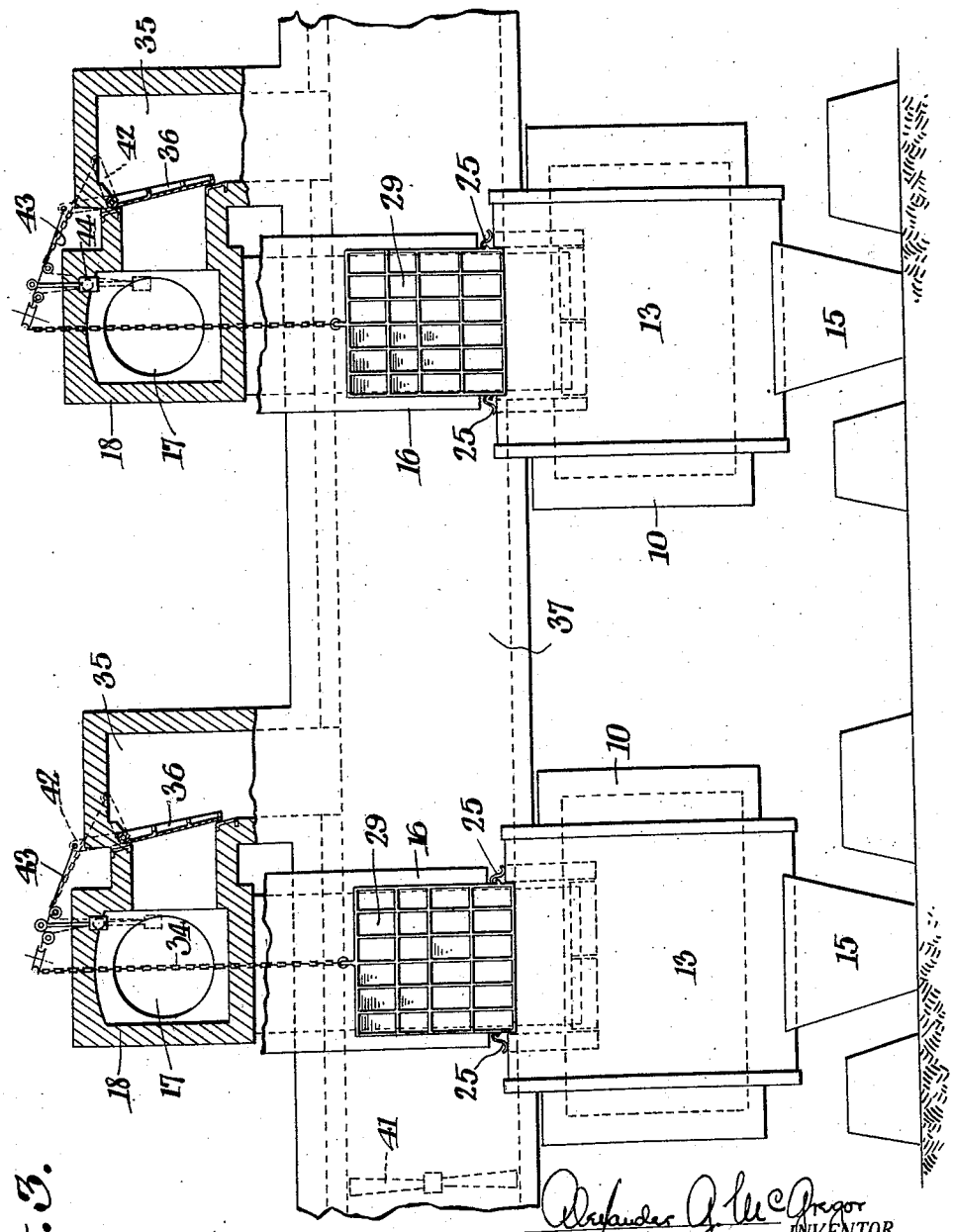


Fig. 3.

Alexander J. McGregor
INVENTOR.

BY

Adams & Adams
ATTORNEYS

A. G. McGREGOR.

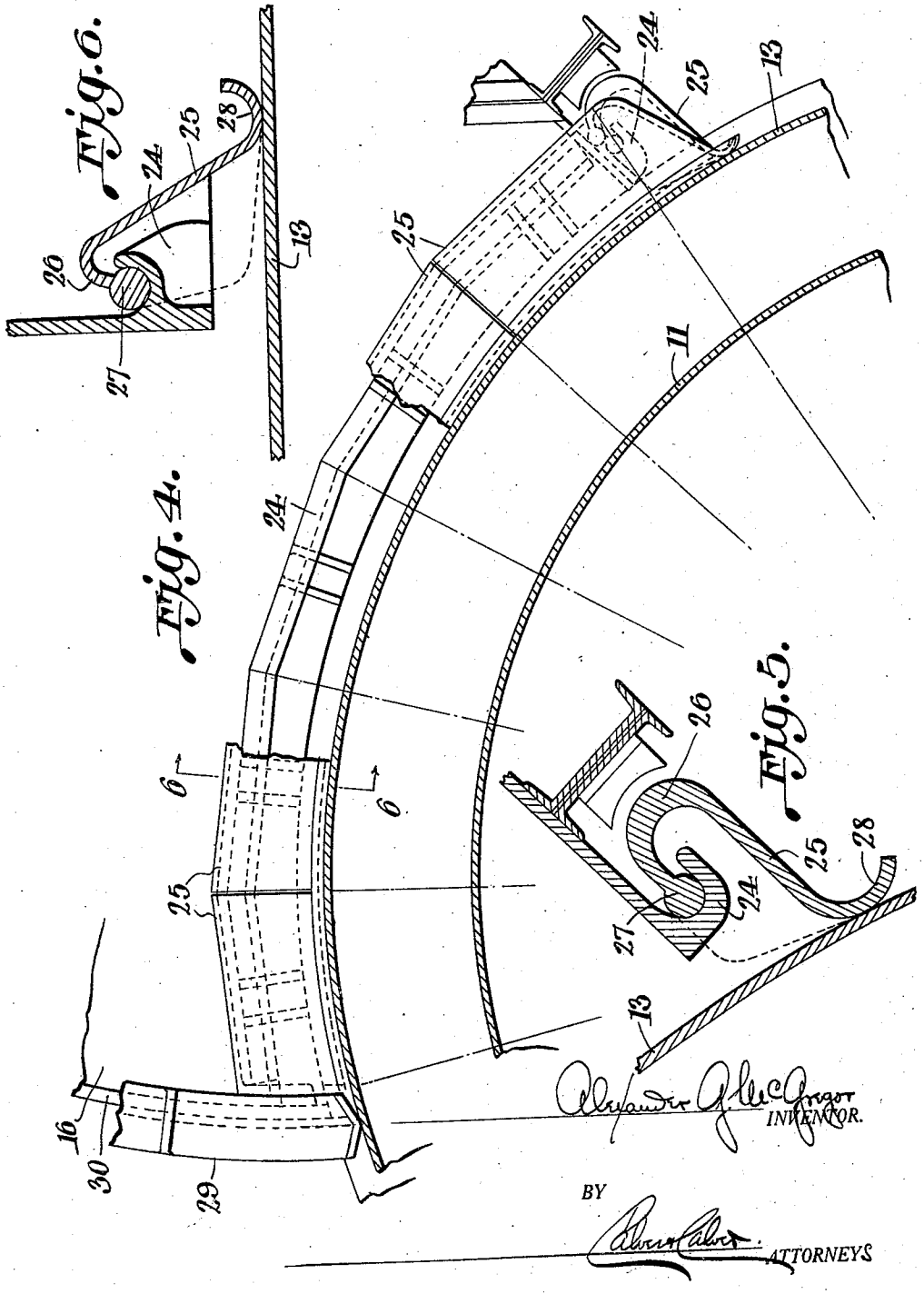
CONVERTER PLANT.

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4 SHEETS—SHEET 4.



UNITED STATES PATENT OFFICE.

ALEXANDER GRANT McGREGOR, OF WARREN, ARIZONA.

CONVERTER PLANT.

1,417,538. Specification of Letters Patent. Patented May 30, 1922.

Application filed August 26, 1920. Serial No. 406,119.

To all whom it may concern:

Be it known that I, ALEXANDER G. McGREGOR, a citizen of the United States, residing at Warren, in the county of Cochise and State of Arizona, have invented or discovered certain new and useful Improvements in Converter Plants, of which the following is a specification, reference being had therein to the accompanying drawings.

In the process of smelting or refining certain metals, particularly copper, the molten matte from the reverberatory or blast furnace is transferred to a tilting or rotary furnace, known as a converter, said converter being provided with tuyères, by means of which air can be blown through the molten matte, and having an opening or spout which, during the operation of the converter, is turned upwardly, but which, after the operation, may be turned downwardly in order to discharge the contents of the converter. Copper matte usually contains from 25% to 50% metallic copper, depending upon the nature of the ore smelted, the other elements being sulphur and iron.

The air blown in through the tuyères of the converter passes up through the molten matte, slag, etc., producing very dense sulphur fumes. In order to dispose of these fumes, a hood, communicating with a stack or flue, is usually located over the converter spout when the latter is turned upwardly, but as there is more or less warping and unevenness in the converter shell, and as accumulations of slag are likely to form in the hood and on the converter shell, it is impossible to make this hood fit very tightly over the shell while at the same time permitting the rotation of the converter, a clearance of three inches or more being usually necessary in practice. If there is not much draft in the hood, a great deal of the sulphur gas will therefore escape into the building in which the plant is located, while if there is an excess of draft in the hood, a considerable amount of outside air is drawn into the hood along with the gases from the converter, diluting and cooling said gases. If the latter are to be discharged from the stack directly into the atmosphere, such dilution and cooling is not objectionable, but when, in accordance with the coming practice, the sulphur fumes are to be saved for the purpose of making liquid sulphur dioxide, sulphuric acid, or other by-product, it is desirable to maintain these gases in as concentrated a form as possible, and that unnecessary cooling be avoided.

The present invention accordingly has for one object the provision of means whereby the sulphur fumes from a converter of the type above described may be prevented from escaping and may be delivered to an acid or other plant in which they are to be utilized with as little dilution and cooling as possible, said means comprising devices for substantially closing the space between the hood and the converter shell, so as to reduce leakage of air through said space, while permitting the free rotation of the converter.

From time to time in the operation of the rotary or tilting converter it is necessary to turn the converter spout part way down in order to skim off the slag. Also the converter is turned into the position last referred to in order to receive a charge of matte and is turned with its spout in the lowermost position in order to discharge the resultant product. In order thus to turn the converter spout from its uppermost to a lowered or partly lowered position, and vice versa, it is necessary that the devices last referred to be of such a nature as to permit the converter spout to pass, this, in the preferred form of the invention, being accomplished by so constructing the devices in question that a suitable portion thereof may be withdrawn into an inoperative position at the proper time. When this is done leakage of outside air into the hood is not prevented, and, particularly in the case of a plant employing a plurality of converters all communicating with the same acid flue, it is desirable that the hood co-operating with an inoperative converter be placed out of communication with said flue, while permitting a greater or less amount of draft therethrough in order to prevent escape of fumes.

The invention has therefore for another object the provision of a converter plant, preferably a plant comprising a plurality of converters provided with hoods all communicating with a common acid flue, said plant having means whereby the fumes from the converter, or any of them, or the gases drawn through a converter hood, if unsuitable for discharge into the acid flue, may readily be diverted therefrom and otherwise disposed of.

The foregoing and other objects of the invention, together with means whereby the

same may be carried into effect, will best be understood from the following description of one form or embodiment thereof illustrated in the accompanying drawings. It will be understood, however, that the particular construction and arrangement described and shown has been chosen for illustrative purposes merely, and that the invention, as defined by the claims hereunto appended, may be otherwise practiced without departing from the spirit and scope thereof. For convenience the invention is herein described with reference to its application to the conversion of copper matte, but it will be readily understood by those skilled in the art that its utility is not limited to the reduction of this particular metal, but that it may be employed in the refining of other metals wherever a similar process is applicable.

In said drawings:

Fig. 1 is an end elevation, partly broken away and partly in section, of a complete converter plant.

Fig. 2 is a plan view, partly broken away, of two of the converter units of such a plant.

Fig. 3 is a side elevation of the parts shown in Fig. 2, looking from the left in the latter figure.

Fig. 4 is an enlarged end elevation, partly broken away and partly in section, of a portion of the converter and the adjacent portions of the hood.

Fig. 5 is an enlarged detail section taken substantially on the line 5—5, Fig. 2.

Fig. 6 is a section on the line 6—6, Fig. 4.

As herein shown, the complete plant comprises a plurality of cylindrical, rotary or tilting converters 10 arranged in axial alinement, each of said converters comprising an inner shell 11 (Figs. 1 and 4) having a refractory lining 12 (Fig. 1), a cylindrical outer shell or apron 13 suitably spaced from said inner shell, and in its side an opening or spout 14 leading from the interior of the lining 12 to the exterior of the apron 13, each of said converters being rotatable through a sufficient arc to permit its spout 14 to be moved between the upper or operative position, designated by the letter A in Fig. 1, and the lower or discharge position, designated by the letter B in said figure, in which latter position the contents of the converter may be discharged into a suitable ladle or other receptacle 15. Only two converters are herein shown, but it will be understood that they may be of any desired number. Suitable means are provided for rotating the converters, but neither such rotating means nor the precise details of construction of the converters are shown herein, as they are well known in the art, specifically form no portion of the present invention, and may be of any usual or suitable form.

Associated with and located above each of the converters 10 is a hood 16 having its lower end or mouth shaped substantially in conformity with the outer surface of the apron 13 and disposed about the converter spout 14 when the latter is turned into its upper or operative position A. Each of the hooks 16 communicates at its upper end with a chamber 18 from which a conduit 17 leads to a header flue 19, the latter communicating, through a suitable dust collector 20 or other apparatus usual in plants of this character, with a main flue 21 leading to the stack. Preferably, and as herein shown, there is interposed between the header flue 19 and each of the conduits 17 a damper 22 having suitable fluid pressure or other operating means 23 of any well known form, whereby communication between the several conduits and the header flue may be controlled.

The lower end of each of the hoods 16, adjacent the corresponding converter 10, is formed at its sides and rear with a channelled flange 24 (see Figs. 4 to 6) which supports a series of segments or plates 25 formed at their upper ends with hooked flanges 26 having beadings 27 adapted to rest in the channeled flange 24, and having curved lower ends 28 adapted to rest by gravity upon the outer shell or apron 13 of the converter. The plates 25 are placed in close proximity to one another and are of such shape as substantially to close the space between the converter apron 13 and lower edge of the hood at the sides and rear of said hood, while by reason of their loose support on the flange 24 and their gravity engagement with the apron 13 are free to move up and down individually in order to permit the passage thereunder of any irregularities of or upon the apron when such irregularities are brought into engagement with the curved lower ends 28 of said plates. The space between the apron 13 and the lower edge of the hood 16 at the forward side of said hood is closed, when the converter is in operation, by a gate 29 mounted for vertical sliding movement on guides 30 (Fig. 4) on the forward side of the hood, said gate, when the converter is in operation, resting at its lower edge upon the apron 13, but being adapted to be opened or raised in order to facilitate the turning of the converter upon its axis. Any suitable means may be employed for raising and lowering the gate 29, said means as herein shown comprising a fluid pressure cylinder 31 containing a piston 32 connected by a piston rod 33 and chain 34 or similar connector with the upper edge of the gate 29.

It will be understood that, while the segments or plates 25 and gate 29 do not form an absolutely air tight joint between the hood and converter shell, they serve effectually to reduce the leakage of outside air to a negligible amount. By reason of the loose detachable connection of the segments

or plates with the hood, they may be readily removed to facilitate the cleaning of accretions of slag from the apron and hood.

Communicating with each of the chambers 18 is a conduit 35 controlled by a damper 36 and leading to an acid flue 37 common to all of said conduits 35, said acid flue being preferably provided with a clean out opening 38 closed by a suitable door 39, whereby matter accumulating in said flue may be discharged into a suitable car or other receptacle 40. A current of air, flowing from the converters and toward the acid or other plant (not shown) in which the sulphur fumes are to be utilized, is maintained in the acid flue 37 by any suitable means, such, for example, as a fan blower 41. Each of the dampers 36 is provided with an operating arm 42 which is preferably connected, as by a chain 43, with the piston 32, whereby when any gate 29 is opened the corresponding damper 36 will be closed, and vice versa. A suitable amount of slack is preferably provided in the chains 34 and 43 to ensure a complete closing of one of said members before the other commences to open, said slack being, if desired, controlled by suitable take-up weights 44 (Fig. 3).

When all of the converters of the series are in operation, the gates 29 and dampers 22 controlling the header flue are all closed, while the dampers 36 are all open. The spaces between the several converters and their respective hoods being closed by the segments or plates 25 and gates 29, the fumes from the converter spouts 14 are drawn, by the suction induced by the fan 41, into the hoods 16 and thence pass, through the chambers 18, conduits 35, and acid flue 37, to the acid or other plant, communication with the main flue 21 and stack being closed by the dampers 22. When for any reason it is desired to turn down a converter 10, the piston 32 is operated, by the admission of suitable motive fluid to its cylinder 31, to cause a movement of said piston in a direction first to close the damper 36 and thereafter to raise the gate 29. The corresponding damper 22 is at the same time opened. The raising of the gate 29 permits the converter 10 to be turned forwardly, either to skim the slag from the matte, or for the purpose of emptying or re-charging the converter. At this time the damper 36 closes communication between the hood 16 and the acid flue 37, while the opening of the damper 22 establishes communication between said hood and the main flue 21, so that air drawn into the hood is not permitted to enter the acid flue but is carried to the stack.

It will therefore be seen that by means of apparatus embodying the present invention, there is provided a multiple unit converter plant wherein objectionable dilution and cooling of the fumes going to the acid or other plant is avoided and a stream of practically uniform gas of the desired temperature and concentration maintained in the acid flue, wherein any converter unit may be rendered inoperative at proper times and turned into the position for discharging, recharging, or other necessary operations without affecting the operation of the others or of the plant as a whole, and wherein the escape of fumes into the building is entirely avoided, the latter result being accomplished, when any gate 29 is opened and the corresponding converter turned into inoperative position, by the draft in the main flue and stack, with which the corresponding hood is, at this time, in communication.

Having thus described my invention I claim and desire to secure by Letters Patent:—

1. The combination with a horizontally disposed, tilting or rotary converter having in its side an opening or spout, and a hood having a mouth disposed about said spout when said converter is in operative position, of means for closing the space between said hood and the outer surface of said converter, said means being adapted to permit rotation of said converter.

2. The combination with a horizontally disposed, tilting or rotary converter having an outer shell and having in its side an opening or spout, and a hood having a mouth spaced from said outer shell and disposed about said spout when said converter is in operative position, of means for reducing leakage of air into said hood between the same and said shell, said means being adapted to permit the free rotation of said converter notwithstanding relative unevenness of said shell and hood, or accretions thereon.

3. The combination with a horizontally disposed, tilting or rotary converter having in its side an opening or spout, and a hood having a mouth disposed about said spout when said converter is in operative position, of means having movable engagement with said converter and hood for closing the space between the same notwithstanding an unevenness on the adjacent surfaces of these parts due to accumulations of material.

4. The combination with a rotary converter having a spout, and a hood having a mouth disposed about said spout when said converter is in operative position, of means for closing the space between said hood and the outer surface of said converter; said means including a series of plates loosely supported by said hood and resting by gravity upon the surface of said converter.

5. The combination with a rotary converter having a spout, and a hood having a mouth disposed about said spout when said converter is in operative position, of means for closing the space between said hood and the outer surface of said converter, said

means including a series of plates loosely supported by said hood and having curved lower ends resting by gravity upon the surface of said converter.

6. The combination with a rotary converter having a spout, and a hood having a mouth disposed about said spout when said converter is in operative position, of means for closing the space between said hood and the outer surface of said converter; said means including a series of plates hinged at their upper ends to said hood and resting by gravity upon the surface of said converter.

7. The combination with a rotary converter having a spout, and a hood having a mouth disposed about said spout when said converter is in operative position, of a series of plates hinged at their upper ends to said hood and having curved lower ends resting by gravity upon the surface of said converter, said plates being disposed closely adjacent to one another.

8. The combination with a rotary converter having a spout, and a hood having a mouth disposed about said spout when said converter is in operative position, said hood having at its lower end a channelled flange, of a series of plates disposed closely adjacent one another and having hooked upper ends engaging and supported by said flange, said plates having curved lower ends resting by gravity upon the surface of said converter.

9. The combination with a rotary converter having a spout, and a hood having a mouth disposed about said spout when said converter is in operative position, of means for closing the space between said hood and the outer surface of said converter, said means including a series of plates loosely supported by said hood about the sides and back of the latter and resting by gravity upon the surface of said converter.

10. The combination with a rotary converter having an outer shell and a spout, and a hood having a mouth spaced from said shell and disposed about said spout when said converter is in operative position, of means for reducing leakage of air into said hood between the same and said shell, said means including a series of plates loosely supported at their upper ends on said hood and resting at their lower ends upon said shell, whereby the lower ends of said plates are free to move up and down as required by relative unevenness of said shell and hood or accretions thereon when said converter is rotated.

11. The combination with a rotary converter having an outer shell and a spout, and a hood having a mouth spaced from said shell and disposed about said spout when said converter is in operative position, of means for reducing leakage of air into said hood between the same and said shell, said means including a series of plates loosely supported at their upper ends on the sides and back of said hood and resting at their lower ends upon said shell, whereby the lower ends of said plates are free to move up and down as required by relative unevenness of said shell and hood or accretions thereon when said converter is rotated.

12. The combination with a rotary converter having a spout, and a hood having a mouth disposed about said spout when said converter is in operative position, of a gate carried at the front of said hood and adapted, when lowered, to engage the outer surface of said converter, said gate being adapted to be raised to permit rotation of said converter, and means for closing the space between said hood and the outer surface of said converter at the sides and back of said hood and adapted to permit rotation of said converter.

13. The combination with a rotary converter having a spout, and a hood having a mouth disposed about said spout when said converter is in operative position, of a series of plates loosely supported by said hood about the sides and back of the latter and resting by gravity upon the surface of said converter, and a gate carried by the front of said hood and adapted, when lowered, to engage the outer surface of said converter.

14. The combination with a rotary converter having an outer shell and a spout, and a hood having a mouth spaced from said shell and disposed about said spout when said converter is in operative position, said hood having at its lower end a channelled flange disposed about its sides and back, of a series of plates disposed closely adjacent one another and having hooked upper ends engaging and supported by said flange, said plates having curved lower ends resting by gravity upon said converter shell and free to move up and down as required by relative unevenness of said shell and hood or accretions therein when said converter is rotated, and a sliding gate carried at the front of said hood and adapted, when lowered, to engage said shell, said gate being adapted to be raised out of engagement with said shell when said converter is rotated.

15. A converter plant comprising, in combination, a plurality of tilting converters, a flue connected to receive gases from all of said converters, a second flue also connected to receive gases from all of said converters, and devices for independently controlling communication between the several converters and one of said flues.

16. A converter plant comprising, in combination, a plurality of converters, a flue connected to receive gases from all of said converters, a second flue also connected to receive gases from all of said converters, and devices for independently controlling com-

munication between the several converters and each of said flues.

17. A converter plant comprising, in combination, a plurality of converters, an acid flue connected to receive gases from all of said converters when the latter are operating normally and producing relatively rich gases, a main flue connected to receive weak or dilute gases from all of said converters, a series of dampers adapted respectively to control communication between the several converters and said acid flue, and a second series of dampers adapted respectively to control communication between the several converters and said main flue.

18. A converter plant comprising, in combination, a plurality of rotary converters each having a spout, a plurality of hoods having mouths disposed respectively about said spouts when said converters are in operative positions, means for closing the spaces between said hoods and the outer surfaces of said converters and adapted to permit rotation of said converters, a plurality of flues each connected to receive gases from all of said hoods, and devices for independently controlling communication between the several hoods and one of said flues.

19. A converter plant comprising, in combination, a plurality of rotary converters, a plurality of hoods associated respectively with the several converters, a gate carried by each of said hoods and adapted, when the corresponding converter is in operative position, to engage the outer surface of said converter, said gates being adapted to be raised to permit rotation of said converters, a plurality of flues each connected to receive gases from all of said hoods, and dampers for independently controlling communication between the several hoods and one of said flues.

20. A converter plant comprising, in combination, a plurality of rotary converters, a plurality of hoods associated respectively with the several converters, a gate carried by each of said hoods and adapted, when the corresponding converter is in operative position, to engage the outer surface of said converter, said gates being adapted to be raised to permit rotation of said converters, a plurality of flues each connected to receive gases from all of said hoods, dampers for independently controlling communication between the several hoods and one of said flues, and means for alternatively raising each of said gates and closing the corresponding damper, and vice versa.

21. A converter plant comprising, in combination, a plurality of rotary converters, a plurality of hoods associated respectively with the several converters, a gate carried at the front of each of said hoods and adapted, when lowered, to engage the outer surface of the corresponding converter, said gates being adapted to be raised to permit rotation of said converters, means for closing the space between each of said hoods and the corresponding converter at the sides and back of the hood and adapted to permit rotation of the converter, a plurality of flues each connected to receive gases from all of said hoods, and devices for independently controlling communication between the several hoods and one of said flues.

22. A converter plant comprising, in combination, a plurality of converters, a plurality of hoods associated respectively with the several converters, an acid flue, a header flue, a main flue communicating with said header flue, a series of conduits respectively connecting the several hoods with said header flue, a series of dampers respectively controlling communication between the several conduits and said header flue, a second series of conduits respectively connecting the several hoods with said acid flue, and a second series of dampers respectively controlling communication between the several conduits of said last-named series and the corresponding hoods.

23. In a converter plant, in combination, a rotary converter, a hood associated therewith, a gate carried by said hood and adapted to be closed or lowered into engagement with said converter, or to be opened or raised out of engagement therewith, a conduit leading from said hood, a damper controlling communication between said hood and conduit, and means for alternatively raising said gate and closing said damper, and vice versa.

24. In a converter plant, in combination, a rotary converter, a hood associated therewith, a gate carried by said hood and adapted to be closed or lowered into engagement with said converter, or to be opened or raised out of engagement therewith, a conduit leading from said hood, a damper controlling communication between said hood and conduit, and means for alternatively raising said gate and closing said damper, and vice versa, said last-named means being constructed and arranged to fully close one of said parts before commencing to open the other.

25. In a converter plant, in combination, a rotary converter, a hood associated therewith, a gate carried by said hood and adapted to be closed or lowered into engagement with said converter, or to be opened or raised out of engagement therewith, a conduit leading from said hood, a damper controlling communication between said hood and conduit, and means including a fluid pressure cylinder and piston for alternatively opening said gate and damper, respectively.

26. In a converter plant, in combination, a rotary converter, a hood associated therewith, a gate carried by said hood and adapted to be closed or lowered into engagement

with said converter, or to be opened or raised out of engagement therewith, a conduit leading from said hood, a damper controlling communication between said hood and conduit, a fluid pressure cylinder, a piston therein, and chains or the like connecting said piston with said gate and damper whereby movement of said piston in opposite directions causes opening of said gate and damper respectively, said chains being of sufficient length to permit said gate to fully close before said damper commences to open, and vice versa.

27. In a converter plant, in combination, a rotary converter, a hood associated therewith for receiving fumes therefrom when said converter is in operation, a flue into which the fumes received by said hood are normally discharged, and means for diverting the gases in said hood from said flue when said converter is turned into an inoperative position while maintaining a draft through said hood.

In testimony whereof I affix my signature.

ALEXANDER GRANT McGREGOR.