G. BIERHALS.

NOZZLE FOR CALCINING FURNACES AND THE LIKE.

APPLICATION FILED JAN. 27, 1912.

1,046,726. Patented Dec. 10, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

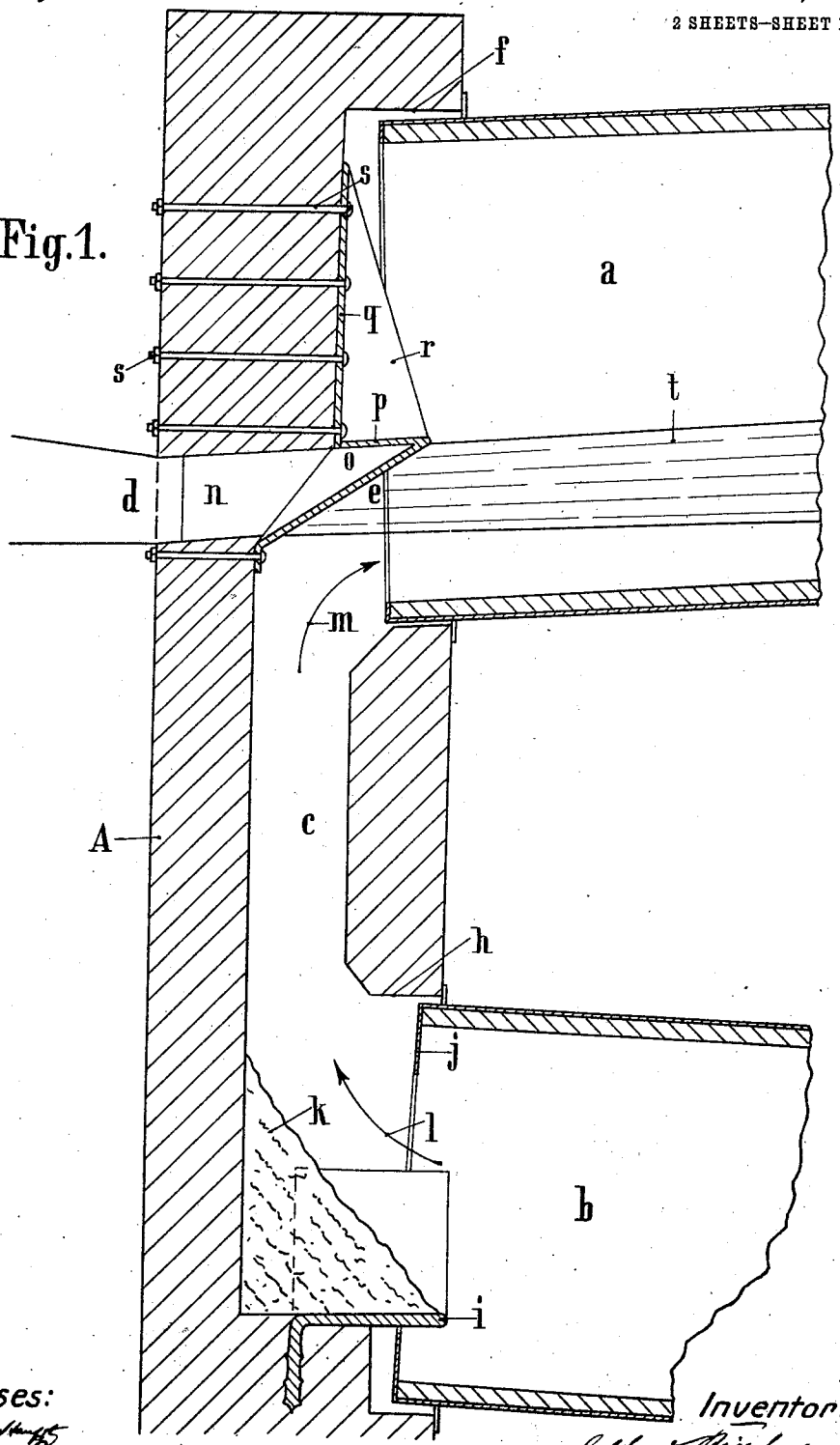

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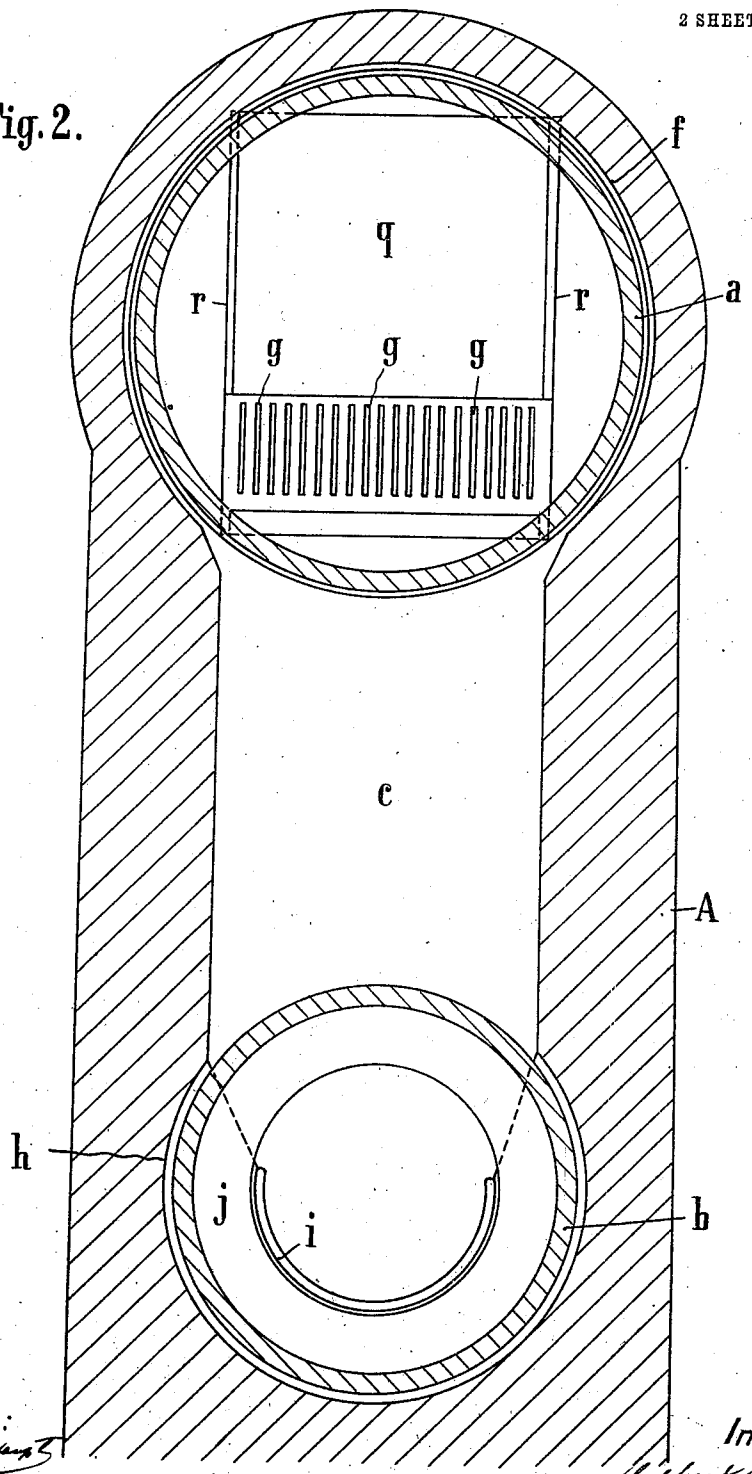
Fig. 2.



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UNITED STATES PATENT OFFICE.

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NOZZLE FOR CALCINING-FURNACES AND THE LIKE.

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To all whom it may concern:

Be it known that I, GEBHARD BIERHALS, a citizen of the Empire of Germany, residing at Berlin, in the Empire of Germany, have invented a new and useful Nozzle for Calcining-Furnaces and the Like, of which the following is a specification.

My invention relates to a nozzle for calcining furnaces or the like which furnaces consist of two nearly parallel rotary drums one serving for calcining or burning materials (lime for instance) and the other for cooling the calcined or burned materials, the air required for the combustion in the calcining or burning drum being first drawn through the cooling drum and therein preliminarily heated by the cooling off materials. In such furnaces hitherto the gaseous or powdery combustible was forced into the combustion chamber through one or a few tubular nozzles, which is objectionable for various reasons. When burnable gases are employed, it is not possible to obtain by means of the tubular nozzle or nozzles an intimate mixing of the gas with the preliminarily heated air which is absolutely necessary for the production of high temperatures. When a powdery combustible is employed, the tubular nozzle or nozzles presents or present the drawback, that at the most one third of the quantity of air required for the combustion can be supplied with the powdery combustible to the combustion chamber. The consequence of this is, that for coal very rich in gases (brown-coal) the particles of coal on entering the combustion chamber at once commence to discharge their gases, which envelop them and prevent them from immediately burning, so that the current of coal dust can only gradually burn from without inward, which means that the current passes through a long distance before attaining a high temperature. This however is objectionable, since for working the furnace economically or rationally the very high temperature should be attained after the passage of the current through a comparatively short distance. When on the other hand coals very poor in gases (anthracite, etc.) are employed, which coals are very difficult to ignite and should not be powdered before burning, it is necessary to force the powdered anthracite through a tubular nozzle as narrow as possible under a very high pressure, so as to throw the coal into the hottest part of the furnace and to prevent the particles of anthracite from at once dropping on the completely calcined or burned materials at the front end of the furnace, whereby otherwise the effect of the furnace would be destroyed. This manner of firing presents the drawback, that a very hot fine jet or flame is formed, whose point strikes the lining of chamotte-stone and strongly attacks it. In order to avoid frequent and expensive repairs thereby originated, it was hitherto necessary to mix the coal poor in gases with coal rich in gases so as to render the working of the furnace a little profitable. Moreover with the tubular nozzle it is not possible to at once and intimately mix the jet of coal dust with supplementary preliminary heated air from the cooling drum.

The nozzle according to my invention differs from the ordinary tubular nozzles in that it consists of a plate adapted to close a rectangular opening and provided with a series of parallel narrow slits, through which a current of gaseous or powdery combustible is forced, so that this current is divided into a number of parallel thin layers or jets, and the air preliminarily heated in the cooling drum is passed partly through the narrow spaces between the said thin layers or jets, so that in this manner a most intimate mixing of the current of combustible with the preliminarily heated air is already produced in close proximity of the plate-nozzle and consequently a short hot flame is obtained.

I will now proceed to describe my invention with reference to the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section through one end of a calcining furnace or the like, that is through a brick-wall encircling the ends of two superposed rotary drums and containing a flue and the novel nozzle, and Fig. 2 is a vertical cross section through this furnace, that is through the said brick-wall and the ends of the two drums.

Similar letters of reference refer to similar parts in both views.

The calcining furnace or the like of any approved kind is assumed to comprise two superposed rotary drums *a* and *b*, which are slightly inclined in opposite directions and may be made to turn by rolling on pairs of rollers (not shown). I do not further de-

scribe the construction of the two rotary drums nor of the furnace in general, as it is immaterial to my invention.

A is a brick-wall provided with a flue *c* and two superposed circular recesses *f* and *h* communicating therewith. Into the recesses *f* and *h* the ends of the two drums *a* and *b* are made to respectively engage. The upper drum *a* serves for calcining or burning the materials (lime for instance), which are charged into it at the other end, so that during the rotation of the drum *a* they are made to roll on the inside of the drum while describing a spiral line on the inside of the drum and slowly moving from the charging end downward to the other end shown, until they drop off from the drum and fall through the flue *c*. The lower drum *b* serves for cooling the calcined or burned materials. Its end engaging in the recess *h* is provided with an inner flange *j*. A semicircularly bent plate *i* concentric with the drum *b* and secured in any known manner in the brick-wall A passes through the opening of the flange *j* and projects a little into the drum *b*. The calcined or burned material falling through the flue *c* may first accumulate on the bent plate *i* until a heap *k* is formed, whereupon the following material will slide downward on the heap *k* into the corresponding end of the lower drum *b*, so that during the rotation of the latter the material will gradually move downward to the other end while describing a spiral line on the inside of the drum, until it drops off the drum. Air is sucked through the lower drum *b* in a manner to be hereinafter described from the end of discharge, so that by the constant contact with the material the air becomes gradually and preliminarily heated, while the material is gradually cooled. Of course, where so preferred, the corner in the flue *c* above the bent plate *i* may be filled with fire-clay or the like so as to form an inclined surface similar to that of the heap *k*. The preliminarily heated air leaving the drum *b* enters the flue *c* in the direction of the arrow *l* and leaves the same above in the direction of the arrow *m* for entering the upper drum *a*.

A nozzle or plate *e* is according to my invention disposed in the brick-wall A at the upper end of the flue *c* so as to face the drum *a* at a distance above its bottom. This nozzle *e* consists of a metallic plate with a horizontal series of vertical narrow slits *g g* so as to constitute a grate. Preferably the plate *e* is inclined, so that it may make an angle of 30° with the side of the drum *a* as is shown. The plate *e* is made to close the inner end of a rectangular opening *n* in the brick-wall A and may be provided with side walls *o* and a top *p*, so as to completely close the said opening. Where so preferred, the plate *e* and the top *p* may be made in one with a vertical metallic plate *q* and two side ribs *r r* as shown, the plate *q* being secured on the inside of the recess *f* by means of bolts *s s*. The opening *n* is made to extend over the greater part of the diameter of the upper drum *a* (see Fig. 2) and preferably the flue *c* is made of the same width.

A tube *d*, which is merely indicated by lines, may be made to engage in the opening *n* and is connected with the respective blower (not shown), which is adapted to force the gaseous or powdery combustible from some source at a great speed under a suitable pressure through the tube *d*.

It will be understood, that by means of the nozzle *e* the current of gaseous or powdery combustible will be divided into parallel thin jets *t*, which create the necessary draft for sucking in air through the cooling drum *b*, and that the preliminary heated air passing upward will partly engage in the spaces between the said thin jets *t*, whereby of course a rapid and intimate mixing of the combustible with the air is effected and a short hot flame is produced. This flame then will calcine or burn the material. The products of combustion leaving the drum *a* at the other end are made to pass up some chimney (not shown).

By means of the novel nozzle both coals rich in gases and coal poor in gases can be burned in a satisfactory manner. It is evident, that the small quantity of preliminarily heated air sucked in by the blower from the flue *c* and forced with the powdery combustible through the nozzle *e* is properly supplemented by the preliminarily heated air supplied directly from the flue *c*, whereby the complete combustion of the coal is insured. The lining of the upper drum *a* is also protected from excessive wear by fine flame jets.

The nozzle described can be varied in many respects without departing from the spirit of my invention. The plate *e* may make any other angle, for example one of 45°, with the side of the upper drum *a*. Where so preferred, the plate *e* may also be placed vertically, so that the current of preliminarily heated air passing up the flue *c* will strike the fine parallel jets *t* in a direction at right angles thereto. It is to be noted, that in the case of coals poor in gases the slits *g g* of the nozzle *e* should be made very narrow.

I claim:

In a furnace, the combination with two superposed rotary drums of which the upper drum is adapted to receive materials to be calcined or burned and the lower drum to receive the calcined or burned materials for cooling them, of a brick-wall encircling said two rotary drums at one end and provided with a vertical flue communicating

with said drums and with an opening in the brick-wall in front of the upper drum, a plate extending obliquely across the upper end of the flue opposite said opening and provided with a horizontal series of vertical slits, and means for forcing a current of combustible through said opening and the slits of said plate, whereby the current is divided into parallel thin jets which create a draft for sucking in air through the lower drum, so that the combustible is intimately mixed with the preliminarily heated air from the flue.

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