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BLAST STOVE APPARATUS.

APPLICATION FILED NOV. 19, 1910.

992,839. Patented May 23, 1911.

Fig. 3.

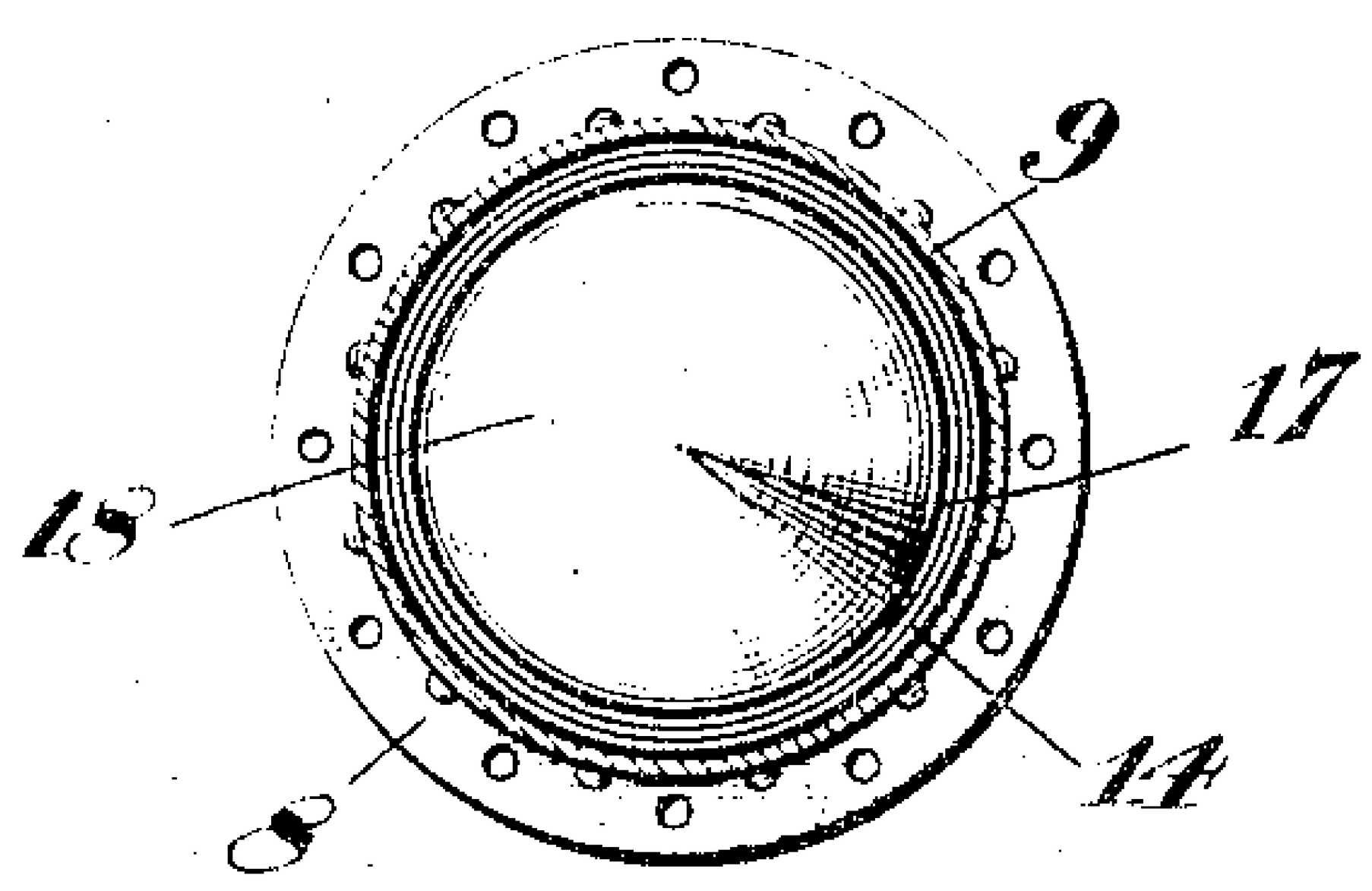


Fig. 2.

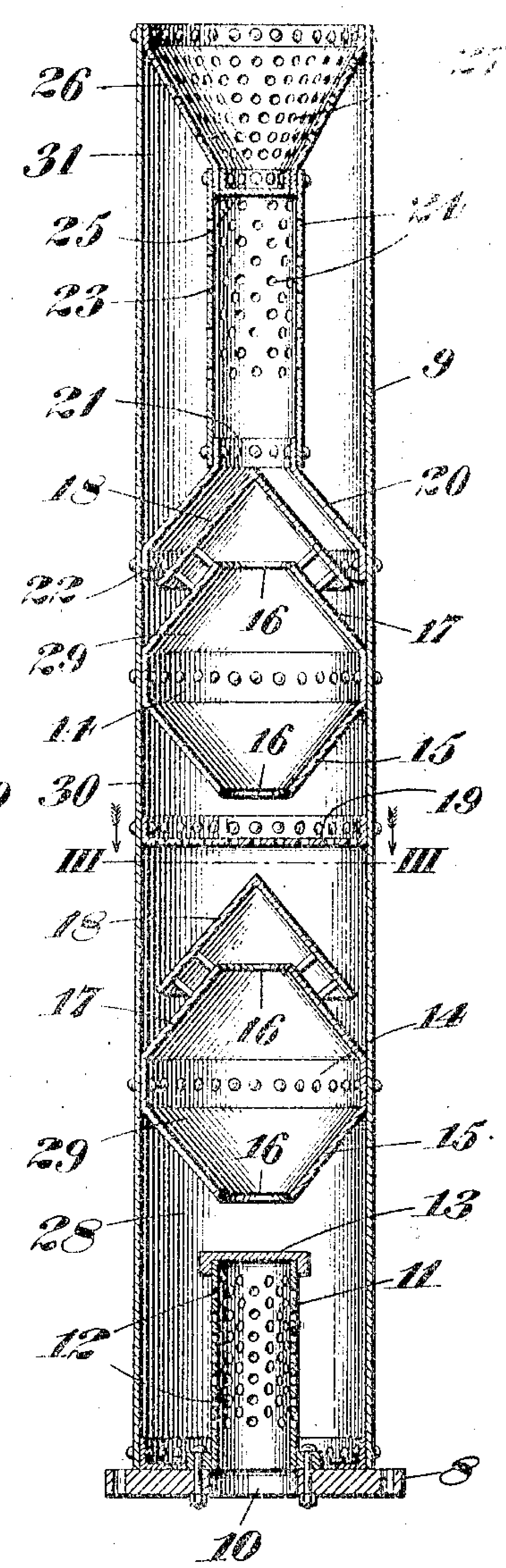
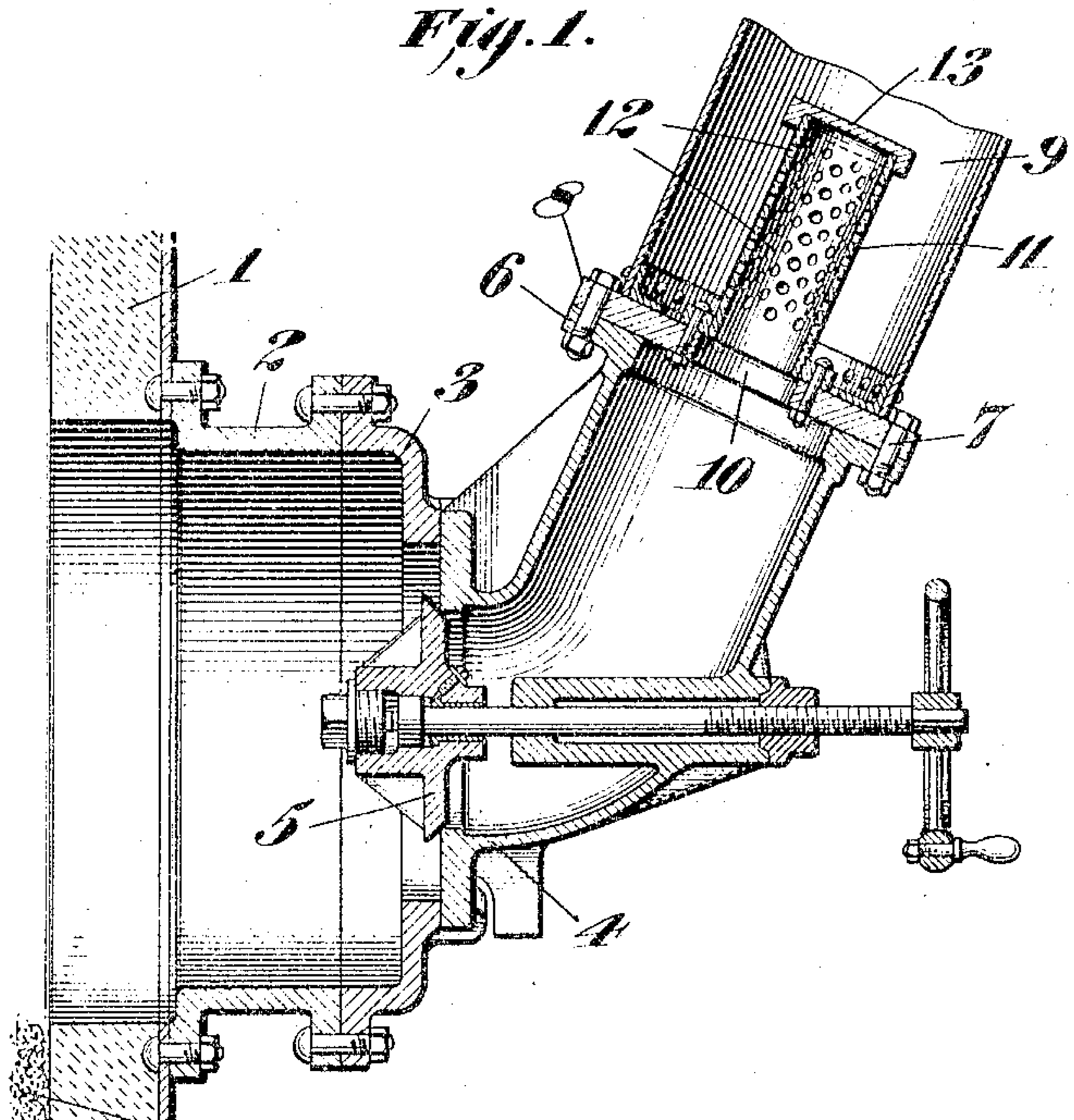


Fig. 1.



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UNITED STATES PATENT OFFICE.

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BLAST-STOVE APPARATUS.

992,839. Specification of Letters Patent. Patented May 23, 1911.

Application filed November 19, 1910. Serial No. 593,130.

To all whom it may concern:

Be it known that we, HARTLEY C. WOLLE and JOHNSON V. SYMONS, citizens of the United States, residing in the borough of Westmont, in the county of Cambria and State of Pennsylvania, have invented certain new and useful Improvements in Blast-Stove Apparatus; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to apparatus adapted for use on blow-off valves of blast-stoves, such as are connected with blast furnaces for heating the air blast thereof.

One of the styles of stoves in question, known as a hot-blast-stove, consists of a substantially cylindrical shell of iron or steel with closed ends, lined with refractory material, and having refractory material disposed in cellular form throughout a considerable portion of its interior. Such hot-blast-stoves are of large capacity and ordinarily contain many thousand cubic feet of air or gases, although they may be of greater or less size, according to the requirements of the blast furnace.

In practice, the refractory material in the interior of stoves is heated by the combustion of blast furnace gases, or in other manner, and after it has reached the required degree of temperature, the heating is discontinued and the stove is then ready to heat the air-blast which is then passed therethrough and ordinarily heated to a temperature varying from nine hundred to fourteen hundred degrees Fahrenheit, or to other temperature as may be desired.

After the stove has been used in heating the blast for a certain time, the refractory material cools down so that it no longer will give the required temperature to the air, whereupon the air-blast is shut off this stove, and before heating it up again, the large volume of hot compressed air contained therein, must be discharged, or released. This air is under pressures of from ten to twenty-five pounds per square inch, or thereabout, and has heretofore been discharged through an ordinary valve and pipe, and produces a loud, roaring noise in issuing therefrom and also carries with it a considerable amount of ore and other dust which has been deposited in the stove from the blast furnace gases.

One of the principal objects of our invention is to eliminate the excessive noise that accompanies the blowing-off of a hot-blast-stove, as above explained, as this noise is very annoying to the workmen and other people in the neighborhood, but it is also dangerous around blast furnaces in the respect that when the air is escaping and making loud, vibrating noises, other sounds, signals, instructions and conversation cannot be heard, thereby interrupting the regular operations and procedure during the time that said noise continues. In addition to this there are certain dangerous occurrences around blast furnaces that can only be detected by the noise warning given thereby, which cannot be heard when the loud noise from the blowing-off of a hot-blast-stove is being produced.

Another object of our invention is to prevent the excessive wear of the stove-valve parts, pipes and other fittings, due to the cutting effect of the ore and other dust that is blown out when the stove is emptied of its air, preparatory to its being heated again.

Still another object of our invention is to prevent the discharge of the dust particles into the atmosphere, to keep the bulk of them in the stove chamber, and to carry the hot, escaping air high enough to obviate danger from its heat.

With these objects in view, we have provided an apparatus that is simple and economical of construction and one that satisfactorily overcomes the objectionable features of the older practice above mentioned.

Although for simplicity of description and illustration we have referred to our apparatus as used with a hot-blast-stove of a blast furnace, we do not limit ourselves to this application thereof, but we may utilize it in connection with the discharge of air, gases or fluids under any other circumstances where so desired.

We have demonstrated by recent actual construction and use that our apparatus performs the functions heretofore described, end eliminates noise, danger, dust, and reduces the cutting of the parts by dust consequent upon the blowing-off of air from a hot-blast-stove.

Referring now to the sheet of drawings

forming part of this specification and in which like characters of reference indicate like parts:—Figure 1 is a vertical section of a blow-off valve located near the bottom of a hot-blast-stove and secured to the shell thereof, as shown; showing also a sectional longitudinal view of the lower part of our apparatus secured to the valve casing. Fig. 2 is a vertical central sectional view of our apparatus detached from the valve casing, for convenience of illustration. Fig. 3 is a transverse section taken on the line III—III of Fig. 2 being in the direction of the arrows.

Referring to the various characters of reference on the drawings 1 indicates the outer portion of a hot-blast-stove showing the shell and refractory lining thereof; 2 is an annular base secured to the shell of a hot-blast-stove and conforming thereto, while 3 is an intermediate portion of a valve casing; 4 is the valve casing proper, having a seat formed thereon as shown, in which the mushroom valve disk 5 is shown in its closed position, and 6 is an annular flange extending around the outlet or nozzle of the valve casing.

The parts heretofore mentioned, with the exception of the flange 6, comprise the old blow-off arrangement hereinbefore referred to, and which, on account of the noise and other difficulties mentioned, has led to our improved apparatus, which is mounted thereon.

Our apparatus consists of a shell or casing of considerable length indicated as 9 on the drawings, this shell or casing being secured to the valve shell by bolts 7 passing through the perforated disk or bottom 8 and an annular flange 6 formed on the valve shell as shown. In the disk 8 is an aperture 10 shown as of circular outline, but of considerably less diameter than the valve casing; above said opening 10, and connected therewith, is the inlet pipe section 11 provided with the perforations 12 and the cap 13. Within the shell or casing 9 and immediately above the inlet pipe section 11, is located a baffle which is composed of a lower hollow truncated cone 15 provided with an aperture 16 which aperture is of approximately the same diameter as the inlet pipe section 11, the upper portion of said baffle being composed of a reversely disposed hollow truncated cone 17 having a similar opening 16 at the top thereof, the two cones being held in position by the flat annular band 14 as shown, and surmounted by a closed, hollow, conical top 18 secured to the hollow conical frustum 17 by bolts or rivets and distance pieces as indicated.

Above the baffle just described, is located the perforated diaphragm 19 which is secured within the shell as indicated. The baffle composed of parts 14, 15, 16, 17 and 18 mounted in a shell or casing, constitutes what we call one unit of our construction, and in the illustration accompanying this specification, another unit is shown above the perforated diaphragm 19, although we may use any number of units as desired, to accomplish the purpose intended.

Above the upper hollow cone 18 is located the inverted funnel 20 having a lower flange 22 whereby it is secured to the shell or casing 9, and an upper flange 21 on which is mounted an upper perforated pipe section 23, provided with perforations 24 therein. The upper pipe section 23 is provided with a closing piece 25, and mounted on the upper end of the pipe 23 is an upright perforated funnel 26 having perforations 27 therein, through which latter the air or gases finally pass into the atmosphere. The space at the lower portion of our apparatus indicated by 28 we call the lower dead air or eddying space, while the spaces within the baffle units indicated as 29 we call the expansion chamber. Similarly, the space 30 is the upper dead air or eddying space, and 31 is the upper chamber.

We have indicated at 32 the ore or dust which is retained within the chamber of the hot-blast-stove by reason of the operation of our apparatus.

In illustrating our invention we have shown the nozzle or valve casing located at an angle of about sixty degrees from the horizontal, although this is not essential, as it could extend vertically, horizontally, or in fact, might be inverted, if desired.

Although we may vary the proportions and dimensions of our apparatus, we have shown the inlet pipe 11, having perforations 12 about equal in combined cross sectional area to the cross section of the pipe itself, and the diameters of the openings 16 are substantially equal to the diameter of the pipe 11. Although we may also vary the proportion of other parts of our apparatus, we have shown the diaphragm 19 provided with perforations about equal in area to the other openings, and the openings in the pipe 23 and the funnel 26 are similar.

The operation of our apparatus is substantially as follows:—The hot-blast-stove or other apparatus being full of air, gases, etc., under pressure, the valve 5 is opened, and the fluids are thence discharged from the valve casing into the inlet pipe 11, thence pass out through the perforations 12 in small streams, thence issue into the lower dead air space 28, where, on account of the conformation, eddying, whirling and back-action is occasioned, thereby dissipating a portion of the energy and lessening the velocity. The direction of the motion is then reversed by passing through the lower opening 16 into the lower expansion chamber 29 and eddies and countercurrents again

are formed and the velocity is lowered by the expansion therein. The fluid then passes through the upper opening 16 in the lower unit of the baffle, impinges against the cap or hollow cone 18 and is again deflected downward and escapes into the space surrounding the exterior of the cone 18 through the annular opening between the hollow conical frustum 17 and the conical cap 18, thereby again causing countercurrents, dissipation of the energy and slackening of the velocity, due to expansion, friction, eddying action, etc. The fluid then percolates through the perforated diaphragm 19 into the upper dead air space 30 and thence through the second baffling unit, with results as heretofore described in connection with the first. After leaving the second baffling unit through the annular space between the upper conical cap or deflector 18, passage is made into the inverted funnel 20, thence into the upper pipe section 23, thence through the perforations thereof, into the outer chamber 31 and finally through the perforations 27 in the upper upright funnel 26, the fluids issue into the atmosphere.

Although we have shown and described our apparatus with a hollow cylindrical casing, cylindrical pipes, and other portions of cylindrical cross section, we may make these of square, rectangular, oval or other forms, as may be expedient or desired.

For convenience of description and reference, the lower ends of the various portions of our apparatus are called the entering-ends, and the upper portions the discharge-ends, as our apparatus may be used in any position. We may use more or less baffles as desired, and in certain cases, may omit the upper parts, such as the upright perforated funnel, the upper pipe section 23 and the appurtenances thereof, as one or more baffle units may suffice under certain conditions.

Although we have shown and described our invention in considerable detail, we do not wish to be limited to the exact and specific details shown and described, but may use such substitutions, modifications or equivalents thereof as are embraced within the scope of our invention and pointed out in the claims.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. In apparatus of the character described, a hollow shell or casing, provided with inlet and outlet openings, one or more baffles within said shell, each baffle comprising a pair of hollow conical frusta with their bases adjoining, and secured together throughout the entire circumferences of said bases, thereby providing for the eddying and expansion of the fluids passed therethrough.

2. In apparatus of the character described, a hollow shell or casing provided with inlet and outlet openings, one or more baffles mounted within said casing, each baffle being composed of a pair of hollow conical frusta with their bases adjoining, the outlet frustum having a hollow conical cap secured at a slight distance therefrom, thereby providing for reversing the flow, the eddying and expansion of the fluids passed there-through.

3. In apparatus of the character described, a hollow shell or casing provided with a smaller inlet opening, one or more baffles within said shell, each baffle comprising a pair of hollow conical frusta with their bases adjoining, an inverted funnel secured beyond the baffles, a perforated outlet pipe connecting said funnel with the interior of said casing, and an upper upright perforated funnel secured to said casing through which the fluids finally pass to the atmosphere.

4. In apparatus of the character described, a hollow shell or casing provided with an inlet pipe of less diameter near the base thereof, a plurality of baffles mounted within said casing, each baffle comprising a pair of hollow conical frusta with their bases adjoining, the discharge frustum of each pair being surmounted by a hollow conical cap secured at a slight distance therefrom, a perforated diaphragm between each of said baffles, and an outlet opening beyond the discharge-ends of said baffles.

5. In apparatus of the character described, a hollow shell or casing provided with an inlet pipe of less diameter near the base thereof, a plurality of baffles mounted within said casing, each baffle comprising a pair of hollow conical frusta with their bases adjoining, the discharge frustum of each pair being surmounted by a hollow conical cap secured at a slight distance therefrom, a perforated diaphragm between each of said baffles; a hollow inverted funnel mounted within said casing beyond said baffles, a perforated pipe of less diameter than the casing, mounted between the discharge-end of said inverted funnel and an upright perforated funnel mounted within said casing providing a final outlet for the fluid therefrom.

6. The combination with the blow-off pipe and valve of a blast-stove, of a hollow casing mounted thereon and provided with a perforated inlet pipe of less diameter than said blow-off pipe, a baffle mounted within said shell, composed of a pair of hollow conical frusta with their bases adjoining each other and said casing and surmounted by a hollow conical cap spaced apart from the discharge frustum of said pair; a hollow perforated diaphragm mounted within the casing beyond the discharge-end of the said baffle; a second similar baffle mounted in said casing

and beyond which a hollow inverted funnel is mounted within said casing, the upper end of said funnel being connected with a pipe of smaller diameter than said casing, said pipe having perforations leading into the annular space around same, and a closure at its upper end, and an upright discharge funnel mounted within said casing and provided with perforations connecting with the atmosphere.

7. An apparatus of the character described, comprising a hollow shell or casing provided with a perforated inlet pipe of less diameter, a plurality of baffles, each composed of a pair of hollow conical frusta, with their bases adjoining, the areas of the openings at their apices each being substantially the same as that of the inlet pipe and the perforations thereof; a hollow cone mounted over the discharge frustum of said pair and spaced apart from the same, a perforated diaphragm mounted within said casing, between each pair of baffles, a hollow inverted funnel mounted within said shell beyond the last of said baffles, the upper end of said funnel being connected with a pipe of smaller diameter than said casing, said pipe having perforations leading into the annular space around the same, and a closure at its upper end, an upright discharge funnel mounted within said casing and provided with perforations connecting with the atmosphere, the areas of the openings through each of said pipes, baffles, perforated diaphragm, funnel, etc., being substantially equal and considerably less than the cross sectional area of the said shell or casing, thereby providing for the eddying, contraction and expansion of the fluids passed there-through.

8. An apparatus of the character described, comprising a hollow shell or casing, having an inlet pipe of less diameter, said inlet pipe being provided with an end closure, and side perforations approximately equal in areas to the cross sectional area of said pipe, a series of baffles mounted within said shell or casing, each baffle being composed of a pair of oppositely disposed hollow conical frusta with their bases adjoining each other and the interior of said shell, the discharge frustum of each pair being surmounted by a hollow conical cap spaced at a slight distance therefrom, a perforated diaphragm secured within said shell between each pair of said baffles, an inverted funnel mounted within the shell beyond the discharge-end of the last baffle, said funnel being connected with a perforated discharge pipe of less diameter than said shell or casing, the perforations therein communicating with the annular space between said discharge pipe and said shell; a top closure for said discharge pipe and an upright perforated funnel mounted at or near the discharge-end of said shell or casing, the perforations of which funnel connect the interior with the atmosphere.

9. The combination with a blast-stove, of an apparatus mounted on the blow-off outlet thereof, comprising a tubular casing, in which is mounted a series of baffles, so constructed and arranged that the fluids which pass through said apparatus are subjected to eddying and expansion, thereby lessening the energy and velocity thereof.

10. The combination with the blow-off outlet of a blast-stove, of an apparatus mounted thereon comprising a tubular casing of comparatively large cross-sectional area, an inlet of less area, the interior of said tubular casing being provided with a series of baffles whereby the fluids passed there-through are subjected to eddying and expansion, thereby lessening the energy and velocity thereof.

11. The combination with a blast-stove, of an apparatus mounted on the blow-off outlet thereof, comprising a tubular casing of comparatively large cross-sectional area, an inlet of less area, the interior of said casing having a series of baffles mounted therein, so arranged as to provide contractions, expansions and tortuous arrangement of the space within said casing, whereby the fluids passed there-through are subjected to eddying, expansion, and changes in direction of flow, thereby lessening the energy and velocity thereof.

12. The combination with a blast-stove, of an apparatus mounted on the blow-off outlet thereof, comprising a tubular casing and means therein for causing the fluids which pass therethrough to be subjected to eddying and expansion, thereby lessening the energy and velocity thereof.

In testimony whereof we hereto affix our signatures in the presence of two witnesses.

HARTLEY C. WOLLE.
JOHNSON V. SYMONS.

Witnesses:
ELMER SEAVEY,
ROBERT A. BEERS.