This invention relates to blast furnaces and more particularly to an improved apparatus for disposing of the gas which rises through the stock and is discharged from the top of the furnace.

Prior to the present invention it has been customary in blast furnace construction to provide from one to four outlets for gases at or near the top of the furnace. Pipes, commonly known as downcomers, extend from these outlets to the dust catcher in which a large amount of the dust carried from the furnace with the gas is separated out. These downcomers, in the present types of furnaces with which I am familiar, are sometimes extended to the dust catcher individually, sometimes in pairs and at times are all brought together into a common main or downcomer which then leads to the dust catcher. The length of the path of the gas from each of the furnace outlets to the dust catcher is different as is the contour of the paths. This results in an unequal resistance to the flow of gas through each of the separate pipes leading to the dust catcher and frequently causes difficulty with the furnace operation due to the fact that the gas passes upwardly through the furnace with different velocities in different parts of the cross section of the furnace. The portions of the furnace below the outlets to the passages having the lesser resistance will conduct more than their share of the gas. This not only causes uneven furnace operation but also results in the comparatively rapid wearing away of the walls of the passages carrying the greatest quantity of gas.

The pipes having greater length, larger number of bends, etc. produce a greater resistance to flow of gas and thereby allows less gas to flow. This lowers the velocity of the gas in the pipes and contributes to the rapid building up of dust, coke and other solids in the pipe. The withdrawing of unequal quantities of gas from different points on the cross section of the furnace top brings about a number of operating faults and disadvantages, among which may be mentioned unequal distribution of gas through the stock, causing channeling and resulting in unequal reduction of ores and unequal condition of heat and wear on the furnace lining.

It is among the objects of my invention to overcome the difficulties noted above and provide apparatus for carrying away the gas from the top of a blast furnace in which the volume and velocity of gas passing out of each outlet will be equal. Other objects of my invention are: the provision of means for reducing the resistance to flow of the gas from the top of the blast furnace; the provision of an arrangement of pipes for conducting away the gas from the top of a blast furnace which will permit of a considerable length of straight vertical pipe above the dust catcher; the provision of apparatus for carrying away the gas from the top of a blast furnace in which the wear on the pipes will be equalized, the tendency of the pipes to clog minimized and the flow of the ascending gases in the furnace equally distributed over the cross section of the furnace.

The above and other objects of my invention will appear from the following description of a preferred form thereof, reference being had to the accompanying drawings, in which—

Fig. 1 is a side elevation of a blast furnace and dust catcher incorporating my improved gas conducting means between the furnace top and the dust catcher.

Fig. 2 is a fragmentary view of the top of the furnace shown in Fig. 1 taken at 90° to the view of Fig. 1.

Fig. 3 is a plan view of the apparatus shown in Fig. 2.

Fig. 4 is a view of the apparatus of Figs. 2 and 3 taken on line 4—4 of Fig. 3.

I have found that equal pressure and velocities of the gas in each of the several outlet pipes can most advantageously be obtained by having all of the outlets and uptakes alike, by leading all of the uptakes to a common junction, preferably on the upwardly extended vertical center line of the furnace, and conducting the gas from the common junction by a single downcomer to the dust catcher.
Referring to Fig. 1, the blast furnace F is more or less diagrammatically represented. Its top is provided with four outlet openings, 1, 2, 3 and 4 (best seen in Fig. 3). Upwardly extending pipes or uptakes 5 extend upwardly from each of the outlets 1, 2, 3 and 4. The uptakes 5 from the outlets 1 and 4 join at 6 and extend further upward as a single pipe 7. In like manner the pipes 5 which extend from outlets 2 and 3 join at 8 and extend on upwardly as a single pipe 9. The pipes 8 and 9 are joined at 10 by suitable pipes 11 and 12 and the downcomer 13 extends from this junction point 10 to the dust catcher 14 which may be of any desired and suitable type.

As seen in Fig. 1 the above arrangement of pipes from the outlets 1, 2, 3 and 4 permits of a relatively long, straight, vertically extending portion 15 of the downcomer 13 directly above the dust catcher 14. This causes the gas to be directed into the dust catcher in a smoothly flowing stream, free from eddy currents, and increases the efficiency of the operation of the dust catcher.

Suitable bleeder valves 16 may be provided at the upper ends of the pipes 7 and 9 above the points where the pipes 11 and 12 lead therefrom.

It will be seen that gases passing from the furnace through each of the outlets 1, 2, 3 and 4, travel through paths identical in length and contour until they reach the common junction point 10 from which they are conducted by the single downcomer 13. This construction gives an equal distribution of gas pressure, volume and velocity in each uptake, reducing the tendency to clog and providing an equalized distribution of the ascending gases in the furnace. By taking all the uptakes to a common junction point 10 and using a single downcomer from this point to the dust catcher lower back pressure results with equal gas velocity than can be attained by the use of two or more downcomers because the single, relatively large downcomer pipe 13, offers less resistance than two or more pipes having a total area equal to that of the single large pipe.

By elevating the point at which the downcomer starts to a point above the top structure of the furnace a steeper slope of the downcomer pipe is attainable. This obviates the likelihood of clogging of the downcomer pipe and provides a considerable length of straight vertical pipe above the dust catcher which is advantageous for reasons above noted.

Although I have described the illustrated embodiment of my invention in considerable detail, it will be understood by those skilled in the art that modifications and variations thereof may be made without departing from the spirit of my invention.

For example, any desired number of outlets may be provided in the furnace top and the uptakes so arranged as to give paths of equal resistance which may be accomplished by making the pipes of equal length and contour from each outlet to the common junction point. I do not, therefore, limit myself to the exact form shown and described herein but claim as my invention all embodiments thereof coming within the scope of the appended claims.

I claim:

1. In a blast furnace having a plurality of gas outlets at its top, uptake pipes leading from said outlets to a common junction point on the upwardly extended vertical center line of the furnace, whereby substantially equal resistance is offered to the flow of gas therethrough, and a downcomer pipe extended downwardly from said junction point.

2. In a blast furnace having a plurality of outlets at its top, pipes extended upwardly from each of said outlets, adjacent pairs of pipes being joined into single pipes and the pairs of single pipes being joined at a common junction point on the upwardly extended vertical center line of the furnace, whereby substantially equal resistance is offered to the flow of gas from each outlet to said common junction point.

3. In a blast furnace having a plurality of outlet openings at its top, means for conducting gas from each of said outlets to a common junction point lying on the upwardly extended vertical center line of the furnace, said means comprising pipes forming paths of equal size, length and contour from said outlets to said junction point.

4. In combination with a blast furnace having a plurality of gas outlets at its top and a dust catcher, means for conducting gas from said outlets to a common junction point lying on the upwardly extended vertical center line of the furnace, said means comprising pipes of equal length and contour extending from said outlets to said common junction point, and a downcomer pipe extending from said common junction point to said dust catcher.

5. In combination with a blast furnace having a plurality of gas outlets at its top and a dust catcher, means for conducting gas from said outlets to a common junction point, said means comprising pipes of equal size, length and contour extending from said outlets to said common junction point, and a downcomer pipe extending from said common junction point to said dust catcher.

6. In combination with a blast furnace having a plurality of outlet openings at its top and a dust catcher, conduits extending from each of said outlets to a common junction point disposed on the upwardly extended vertical center line of the furnace, each of said conduits being adapted to offer equal
resistance to flow of gas therethrough, and a downcomer pipe extending from said common junction point to said dust catcher.

7. In combination with a blast furnace having a plurality of outlet openings at its top and a dust catcher, conduits extending from each of said outlets to a common junction point, each of said conduits having substantially the same internal contour and being adapted to offer substantially equal resistance to flow of gas therethrough, and a downcomer pipe extending from said common junction point to said dust catcher.

8. A method of blast furnace operation including the steps of conducting the blast furnace gases from the furnace top to a point thereabove and on the upwardly extended vertical center line of the furnace through paths having substantially equal resistance to flow, combining the separate streams at said point and thence conducting them in a single stream to another point.

9. In a blast furnace having a plurality of outlet openings at its top, means for conducting gas from each of said outlets to a common junction point lying on the upwardly extending vertical center line of the furnace, said means comprising pipes forming gas paths of substantially equal length from said outlets to said junction point.

10. A method of blast furnace operation which includes the steps of conducting the blast furnace gases from a plurality of points on the furnace top to a common junction point thereabove through paths having substantially equal resistance to gas flow, combining the separate streams of gas at said common junction point and then conducting the gas in a single stream to another point.

11. In a blast furnace having a plurality of outlet openings at its top, means for conducting gas from each of said outlets to a common junction point, said means comprising pipes forming gas paths of substantially equal length from said outlets to said junction point.

12. In combination with a blast furnace having a plurality of gas outlets at its top and a dust catcher, means for conducting gas from said outlets to a common junction point, said means comprising pipes forming gas paths of substantially equal length from said outlets to said common junction point, and a downcomer pipe extending from said common junction point to said dust catcher.

In testimony whereof I hereunto affix my signature this 23d day of January, 1932.

LUTHER B. WEIDLEIN.