No. 898,071. PATENTED SEPT. 8, 1908.

M. J. SHANNON.

CHARGING APPARATUS FOR BLAST FURNACES.

APPLICATION FILED JUNE 29, 1907.

3 SHEETS—SHEET 1.

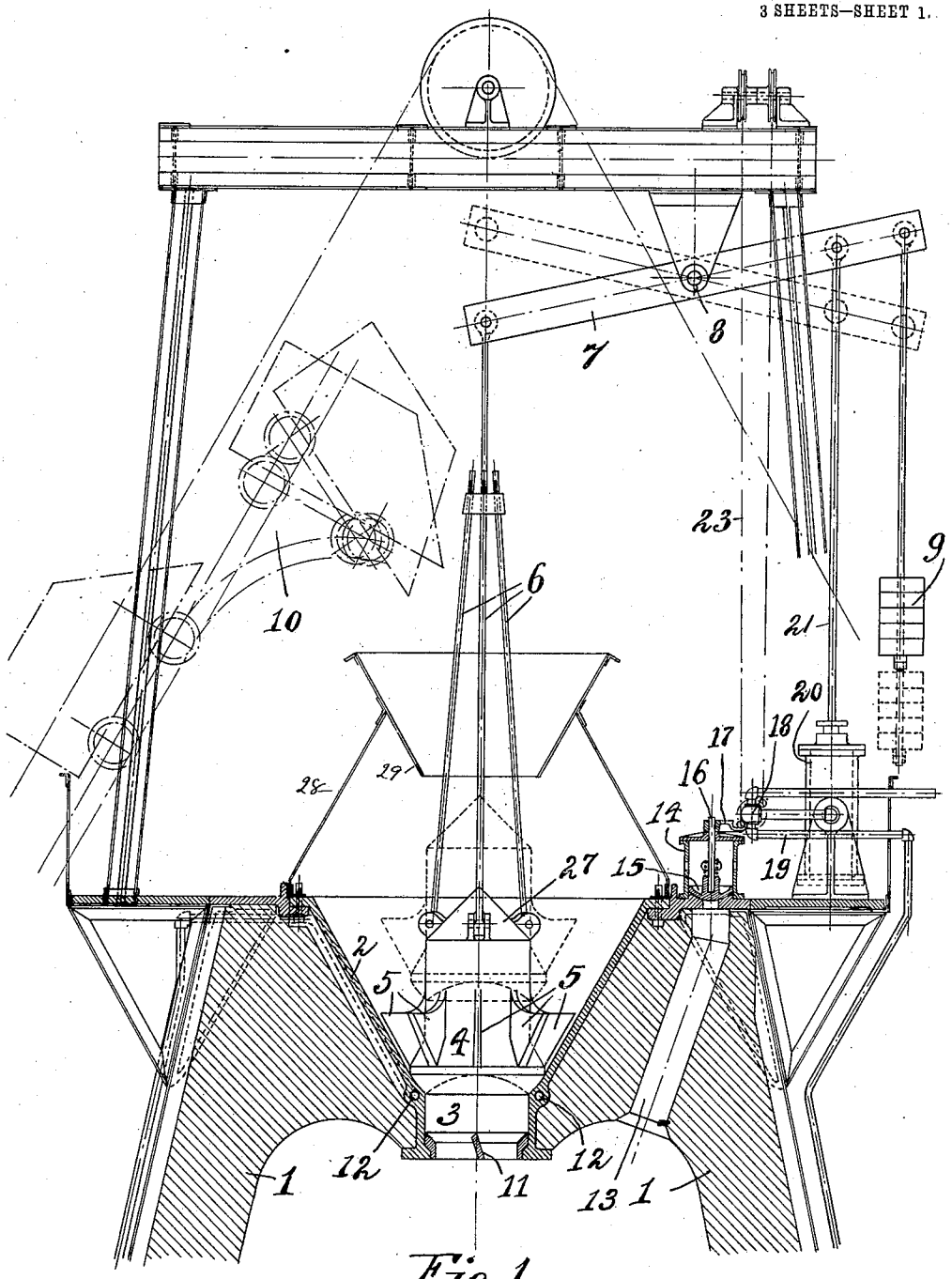


Fig. 1.

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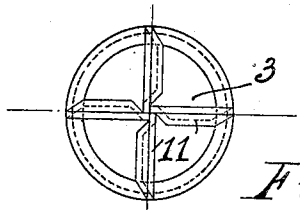


Fig. 4.

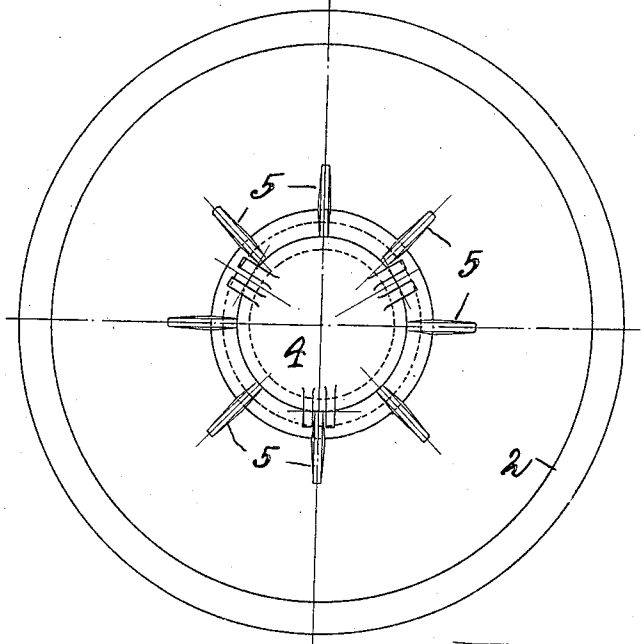


Fig. 3.

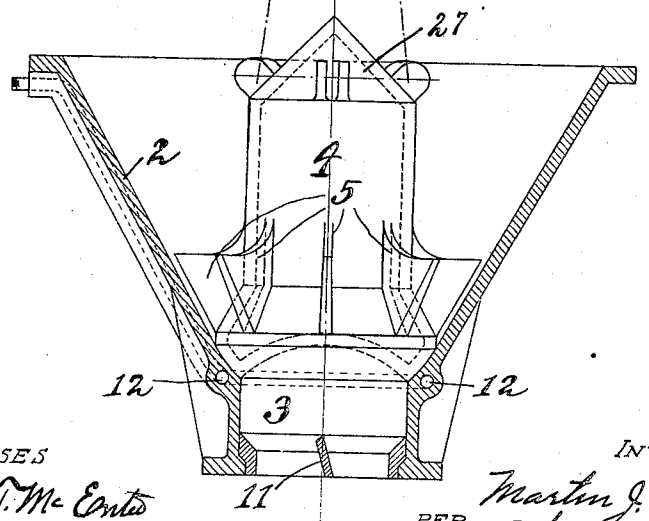


Fig. 2.

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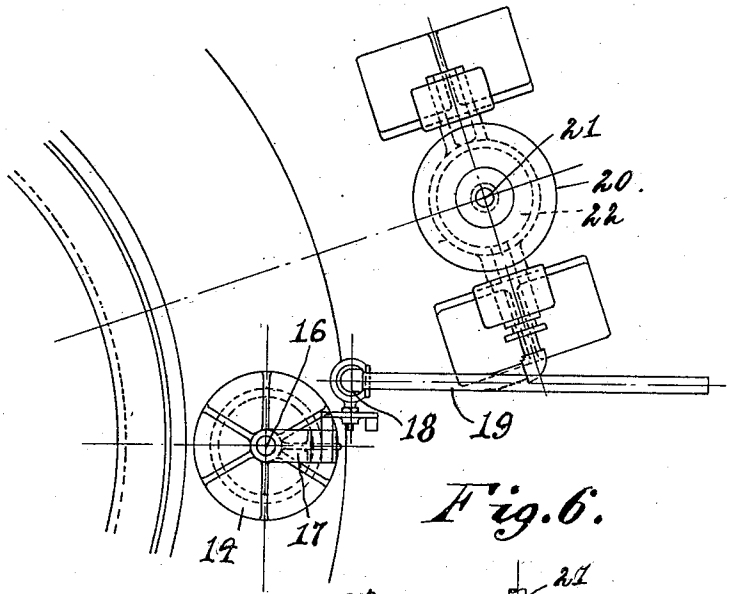


Fig. 6.

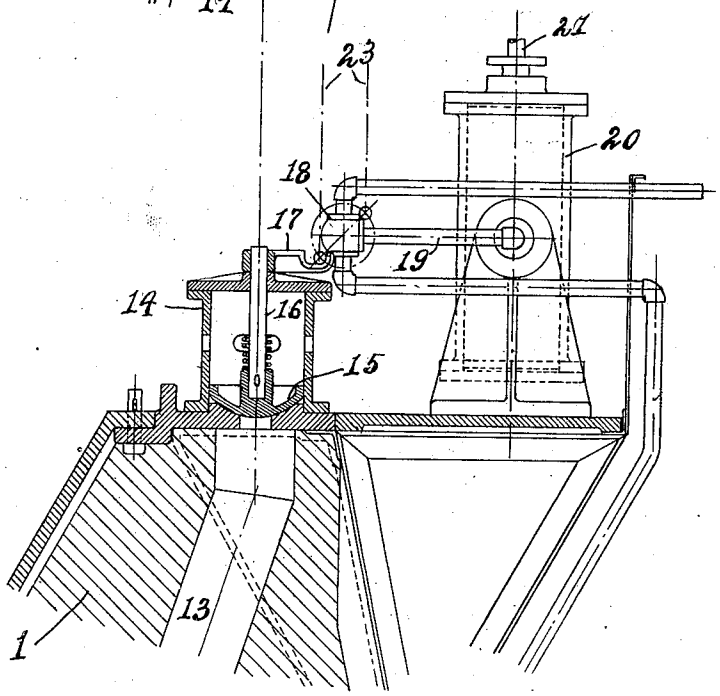


Fig. 5.

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CHARGING APPARATUS FOR BLAST-FURNACES.

No. 898,071. Specification of Letters Patent. Patented Sept. 8, 1908.

Application filed June 29, 1907. Serial No. 381,392.

To all whom it may concern:

Be it known that I, MARTIN J. SHANNON, a citizen of the United States, and a resident of Steelton, in the county of Dauphin, State of Pennsylvania, have invented certain new and useful Improvements in Charging Apparatus for Blast-Furnaces, of which the following is a specification.

My invention relates to improvements in blast furnace charging apparatus, and the object of my invention is to furnish a means to thoroughly mix the charge and to evenly distribute it in the furnace. The charge consists of the ore, a flux, and the fuel; to these may be added any other material or materials necessary.

While my invention is applicable in feeding evenly to a furnace any kind of ore, it is particularly adapted for use in connection with furnaces using soft iron ores in which it is of the utmost importance that there be a more even distribution of the charge than is possible with the bell system usually employed for this purpose.

In charging a furnace with the bell system the stock is dropped around the edges of the furnace, the larger parts of the charge, the lumps of fuel and flux, roll to the center of the furnace while the soft iron ores, usually in much finer condition than the fuel and flux, remain around the edges and under the action of the blast become a solid body which clings to the furnace walls and prevents the passage of the gases; by repeated chargings this cake becomes wider and heavier and presently it suddenly gives away causing such a disturbance within the furnace as to seriously reduce its yield and not infrequently the destruction of the furnace and the lives of the men who are employed at its top or around it.

The purpose of my invention is to thoroughly mix the charge and to evenly distribute it over the top of the furnace, and to furnish in connection with the means for sealing the top of the furnace and for mixing the charge a means for sealing the top of the hopper against escape of gas and heat when the sealing and mixing device is raised to charge the furnace.

A further feature of my invention is a means operated automatically by the pressure of gases in the furnace for lifting the sealing device and permitting their escape before their accumulation in sufficient quantity or pressure to cause any damage.

In the accompanying drawings forming part of this specification, and in which similar letters of reference indicate similar parts throughout the several views:—Figure 1, is a central sectional elevation through the top of a blast furnace equipped with my mixing and charging device, shown in side elevation, and my device for operating the sealing device in case of an excess pressure of gases; Fig. 2, a central sectional elevation, on a slightly enlarged scale, of the hopper and of the seal plug and mixing device, the latter shown in side elevation; Fig. 3, a plan of Fig. 2; Fig. 4, a plan of the deflecting plates placed in the throat of the hopper; Fig. 5, a side elevation, partly in section, of the apparatus controlled by the gas pressure in the furnace for lifting the seal plug; Fig. 6, a plan of Fig. 5.

1 represents the brick or masonry work at the top of a furnace. 2 a cast iron hopper furnished with a throat or opening 3 which opens centrally into the top of the furnace.

4 is my mixing and sealing device, the lower end of which is adapted to make a tight joint with the lower end of the hopper 2 when in contact therewith, as shown in the drawings, Figs. 1, 2 and 7. The part 4 is furnished with arms or teeth 5 and is swung from a lever 7 by rods or chains 6, Fig. 1. The lever 7 is pivotally carried at 8 and its outer end is counterweighted at 9 against the weight of the seal and mixer 4. The charge for the furnace is passed into the hopper 2 in any convenient manner.

In Fig. 1, 10, shown in broken lines, represents one of the well known skip hoists for automatically charging the hopper. When it is desired to charge the furnace the seal and mixer 4 is lifted, the arms or teeth 5 tearing through the materials in the hopper mix them and they fall from the hopper to the throat 3 where they strike the deflecting plates 11, which are inclined plates of metal, shown in plan in Fig. 4, which scatter them evenly and with a whirling motion over the top of the contents of the furnace. The contents of the hopper having been discharged the seal 4 is lowered and tightly closes its bottom.

It will be observed that the arrangement of my sealing and feeding device is opposite to that of the usual bell and hopper. If leaks occur in this latter device it is almost impossible to stop them and it is not infrequent for these leaks to become so great as to

permit the escaping gases to burn away the supports of the bell which then falls into the furnace occasioning great loss. The most serious defect of the bell is, however, due to its manner of feeding the charge to the furnace resulting, as before described, when soft iron ores are used, in frequent cakings at the top of the furnace followed by explosions which sometimes blow its top off.

12, Figs. 1, 2 and 7, is a hole in the hopper casting, adjacent to the point that the seal plug 4 engages it, through which a stream of water may be passed in order to keep the joint cool.

The apparatus for automatically lifting the seal 4 in case of a dangerous accumulation of gases is as follows: 13 is a flue passing from the inside of the furnace top to the bottom of a cylinder 14 which is fitted with a piston 15, the rod 16 of which is furnished with an arm 17 which is connected with the operating lever of a valve 18 which is in a steam or air pipe 19 leading to a cylinder 20, the piston rod 21 of which is connected with the outer end of the lever 7. Should the pressure of gas in flue 13 be great enough it will lift the piston 15 which will, through rod 16 and arm 17, open the valve 18 which will admit steam or air to cylinder 20 driving down the piston 22 in this cylinder and through rod 21 will draw down the outer end of lever 7, lifting the inner end of this lever and the seal.

23, shown by broken lines in Figs. 1 and 5 indicates a rope or chain by means of which the valve 18 may be thrown by hand for the purpose of actuating the mechanism above described to lift the seal when the furnace is to be charged.

The upper end of my hopper 2 carries, or is surrounded by, walls 28 which form an upper extension of the hopper. At the upper end the walls 28 are furnished with an inwardly extending lip 29, which is conveniently formed by a small conical shaped hopper secured to the upper end of the wall 28 as shown in Fig. 1, or by an inwardly projecting flange or lip forming part of the casting 28 as shown in Fig. 7. When fully raised the conical head 27 of the sealing plug 4 enters and closes off the opening formed between the lower ends of the lip 29 and prevents gas and heat from escaping through this opening while the charging of the furnace is taking place. As soon as the hopper 2 is emptied the plug 4 is lowered until its lower end closes off the throat 3 of the hopper as shown.

I may here remark that it is well known that the use of inferior grades of fuel results in the excessive formation of gases; the same result is produced by an excessive blast. The action of an excessive gas pressure upon the ordinary form of bell is to tightly close it against the bottom of the hopper and if the pressure be heavy enough the furnace is strained. This cannot happen with my arrangement for an exceedingly high pressure would itself, without the safety arrangement that I have described, lift the seal from its seat and permit the gases to blow off before any damage was done. The pressure of the seal upon its seat may be regulated by means of the counterweight 9.

The deflecting device is not necessary when all of the material fed to the furnace is in a coarse state; it is only particularly useful when some of the material is finely divided.

Having thus described my invention, I claim as new and desire to secure by Letters Patent;

1. The combination with a blast furnace top of a hopper, a sealing plug within, making a tight joint at, and closing the opening in the bottom of said hopper and furnished at its lower end with projecting arms or teeth, and means whereby said sealing plug may be lifted from its seat.

2. The combination with a blast furnace top, of a hopper, a sealing plug within and closing the opening in the bottom of said hopper, means for unseating and seating said plug, and inclined deflecting plates placed in the throat of said hopper beneath said plug seat.

3. The combination with a blast furnace top of a hopper, a plug vertically movable within and closing the opening in the bottom of said hopper, and means operated by the action of an excess gas pressure in said furnace for lifting said plug from its seat.

4. The combination with a blast furnace top, of a hopper, a plug vertically movable within and closing the opening in the bottom of said hopper, a pivotally mounted beam from one end of which said plug is suspended, a steam or air cylinder, a piston and a piston rod carried by said cylinder the latter of which is attached to the end of the beam opposite to that carrying the plug, a valve for controlling the admission of the actuating fluid to said cylinder, a second cylinder, a piston and a piston rod carried by said second cylinder, said piston rod being connected to the operating lever of said valve, and a flue connecting the interior of said furnace and the bottom of said second cylinder.

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