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Automatic Feed Device for Gas Producers

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AUTOMATIC FEED DEVICE FOR GAS PRODUCERS.


Translation from Jernkontorets Annaler.

It is a well known fact that Feed-Devices now generally in use on Gas producers, by which the coal is charged by hand through a Bell-hopper, or like apparatus,—do not evenly distribute the coal over the grates.

The body of coal will vary in thickness in the different parts of the producer and the composition of the gas will vary accordingly. Another objection to charging by hand is, the loss of gas at every charge; this gas being also very injurious to the workmen. My Feed-Device is designed to remedy these difficulties.

The apparatus is combined with the top of the producer, and consists of a rotating disk provided with one, two or more fan-shaped distributing blades.

Drawing No. 10 illustrates a continuous Feed-Device with producer for a seven tons open-hearth Furnace, constructed by me for the Stridsberg & Bjorocks Works at Trollhattan, Sweden.

Figures 1 and 2 represent an elevation and a plan of the producer and Feed-Device.

Figure 3 represents a vertical section taken on line A, B, and Figure 4, a horizontal section taken on line C, D.

Fig. 5, on an enlarged scale, is a plan view of the feeding
disk and the coal distributing blades.

Figures 6 and 7 are sections taken on lines E F and G.H. Figure 8 shows the spiral, according to which the distributing blades are constructed.

a- represents the rotating disk provided with distributing blades b and b', and the spiral J I I'K shows the line on which the coal, sliding down the blades at a certain moment is distributed upon the surface below.

As at the same time equally large quantities of coal pass equally large divisions on the surface of the disk, it follows, that those parts of the spiral intersected by equally large angles, with their vertices directed towards the rotary shaft of the apparatus, receive equally large quantities of coal during the same period.

If we now construct the distributing curve in such way that these equal parts shall in their motion round the axis at any moment cover equal surfaces of producer, the coal will naturally be evenly distributed.

A curve of this nature is constructed as follows: Divide the surface of the producer into any number of annular rings, by drawing concentric circles X', X'', X''' etc. so that the rings X', X'', X''', etc. are of equal area and also equal to the area of circle X'. Then divide the same surface by radii forming equal angles into as many parts as there are rings and by a
line connect the points of intersection between the circles and the radii as shown in Fig. 8.

When this spiral has been constructed of such dimension that the distance from the centre J of the circles to the extreme point K on the curve, is equal to the radius J K of the circular charging surface of the producer, the distributing blades or flange can be adjusted to the charging disk a.

The distance between the discharging surface and the disk, its blades, and also the diameter of the disk, are matters which are beforehand determined, and the parabolas which direct the coal in its discharge from the lower edge of the blade to the surface are also to be taken into consideration.

As the blades are arranged on the drawing, the blade b distributes the coal over the surface outside of the distributing disk a, and the blade b' discharges the coal directly under the disk a.

The disk a is secured by nut and check-nut to the lower end of the spindle c. This spindle is supported by a collar and set screw, which collar rests on the hub d.

The power for rotating the disk is conveyed by a belt from the main shaft to the worm wheel gearing f. The spindle rotates with the worm wheel but is free to move vertically through the hub d, and can be lifted or lowered by the differential pulley block g.
The receptacle h is filled with coal through a supply opening provided with a cover i. This receptacle can be made sufficiently large to hold any desired quantity of coal.

The amount of coal discharged from the receptacle is regulated by changing the speed of the disk a, and conepulleys J J' are provided for that purpose.

The distributor, in a position as indicated in the drawings, makes one revolution in 3 1/2 minutes.

The grates are adjusted or removed through the openings K K.

The blast is forced through the pipe l by means of a steam injector.

The gas is conducted through two opposite discharging pipes M and M, and the valve n to the main flue o.

The lower part of the producer is conical in construction, in order to prevent the blast having a free-play during the gradual settling of the coal.

A layer of coal of about 3 ft. in thickness, with a layer of 10 in. ashes beneath, has given the best result in general practice. This however, depends upon the quality of the coal.

The apparatus is in operation at the Stridsberg & Bjoreks Works, Trollhattan, Sweden, and according to the reports kept at these works, the consumption of coal is 15 per cent less than in the producers of the old type.
The apparatus is easily tended and distributes the coal uniformly and continuously over the surface. No poking is needed as klinkers are not formed. The gas is of an excellent quality.

A continuous Feed-Device of similar construction, has for about a year been in operation at the Washburn & Moen Works, Worcester, Mass., on a producer with a grate-area of 12 1/2 square feet.

This producer, coupled with three others of cone and funnel type but all of equal capacity, produce gas for one regenerative heating furnace.

The producer supplied with continuous Feed-Device required very little attention. The coal was distributed continuously and uniformly. No formation of klinkers took place, and consequently the usual "poking" was not required. The only loss of gas was the quantity which escaped in filling the receptacle three times daily, each filling requiring about a minute.

The other gas producers supplied with cone and funnel, required the work of one man to stir the mass with a bar and he could not entirely prevent the formation of klinkers which caused the air to cut passages through the layer of coal, resulting in partial combustion of the generated carbonic oxide.

I am not, in this case able to produce any figures showing the saving in fuel by using the continuous Feed-Device, because the four producers were combined and feeding the same furnace;
but I give herewith analyses of the gas generated by the different producers.

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<td>0.23</td>
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<tr>
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<tr>
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<tr>
<td>N</td>
<td>52.03</td>
<td>54.88</td>
<td>56.84</td>
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The first column shows an average of 12 analyses, taken at different intervals from the producer with the continuous Feed-Device.

The second column gives the average of the same number of analyses taken from the three producers with cone and funnel immediately after charging.

The third column gives the average of the same number of analyses from the latter three producers, fifteen minutes after the charging, or just previous to charging again.

The same quality of coal was used by the four producers and consisted largely of dust of poor quality. The gas from the producer, supplied with the continuous Feed-Device, varied but a trifle in its chemical composition while the gas from the other producers showed a considerable variation.
The apparatus after ten months was still in excellent condition. The distributing blades were only slightly impaired. If the producer has proper care, the disk with the distributing blades should endure for years.

Drawing 11 shows a continuous Feed-Device, applied to a heating furnace at the Washburn & Moen Works, Worcester, Mass.

Fig. 1 is a vertical section taken on line A B, and figure 2 a horizontal section taken on lines C D and E F, while figure 3 shows a partial elevation, and a partial cross section of the charging tower on line G H.

Fig. 4 and 5 represent a sheet iron cylinder, which serves as an outside support to the masonry work of the charging tower, and figure 6 a cast iron foundation, upon which the brick work is partly resting.

Fig. 7 - 8 and 9 represent in plan and sections the distributing disk with four distributing blades and figure 10 the spirals A A' and B B', according to which the distributing blades are constructed.

A number of distributing blades can be constructed in the same way as indicated by the dotted spirals. The whole arrangement gives a very satisfactory result. The producer generates uniform, clear gas, supplying the furnace throughout.

The blooms are heated to full welding heat, and yet the
edges do not scarcely show any sign of corrosion. Coal dust and coal of poor quality is used for fuel. The coal dust is carried to some extent by the flame over the bridge wall, but not sufficiently to affect the heating. There is no formation of klinkers upon the grates.

The coal leaves a residue of clean ashes. At the end of the week the blast is turned off, the damper is shut, and all the furnace doors are closed with mortar, in order to prevent cooling of the furnaces; the opening is uncovered so as to permit the gas to escape from the producer.

On Monday morning, when the furnace is started, there will be a sufficient heat for welding in about four hours after the blast is turned on. No firing up is necessary. The coal in the producer keeps up a glowing heat for several days.

The furnace, not being allowed to cool off at the end of the week— as is otherwise customary—will maintain its good condition for a greater length of time, and the producer will operate for years without repairs.

About forty tons cold 4 in. billets of .07 to 1.00 % carbon are welded in ten hours, at a consumption of 170 lbs. coal per ton.

The disk, with its distributing blades will not last over three months. This difficulty, however, can be obviated by placing the producer at a greater distance from the fire bridge, or
by conducting water through the shaft and the distributor.

Drawing # 12 represents a continuous Feed Device constructed with double disks.

Fig. # 1 and # 2 show this arrangement in elevation and horizontal plan, and figure 3 in vertical section.

The feeding disk a is mounted on the lower end of the hollow shaft or sleeve b, which is supported by a collar and resting on the upper part of the receptacle d.

The lower disk e with its distributing blades f and f' is secured to shaft g. This shaft rotates independently within the sleeve, and is supported by two set screw collars which are resting on the worm-wheel hub i, which in its turn is supported by the hub j. This hub j rotates in the stationary bearing k attached to stand l.

Each disk and its shaft rotates independently of the other, by the separate worm gearings m and n, but they are raised and lowered together.

By this arrangement the distributing disk can be run at increased rate of speed, which will feed the coal quicker than would be possible if the distributing blades were fastened to the feeding disk.

At Washburn & Moen Works, Worcester, Mass. a producer for a 15 ton Martin Furnace is being constructed, according to drawing # 12.
The advantages of my Feed-Device summed up in a few words are as follows:

Saving in coal and labor.

The apparatus operates equally well on a large or a small surface area of the combustion chamber.

The receptacle can be constructed to hold any desired quantity of coal, and after charging requires very little attention.

The coal is uniformly distributed over the entire surface, whereby light and even layers are formed, and the blast constantly encountering an equal resistance per unit of surface, does not cut any large passages through body of coal, which is a common occurrence in producers where the coal is not uniformly distributed.