July 10, 1923. 1,461,614

G. H. HARRISON

CONTINUOUS STRAW GAS RETORT

Filed April 6, 1921 2 Sheets-Sheet 1

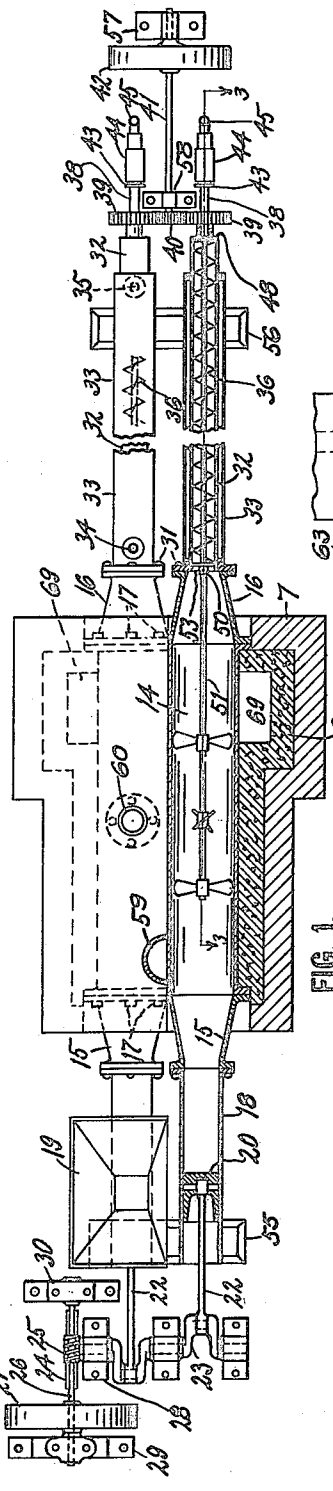


FIG. 1.

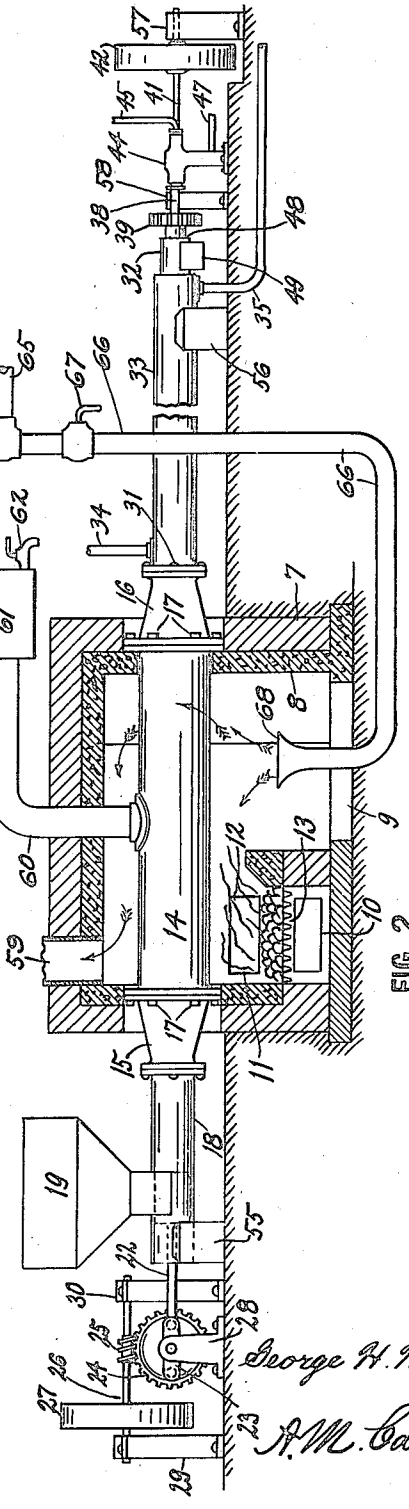


FIG. 2.

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2 Sheets-Sheet 2

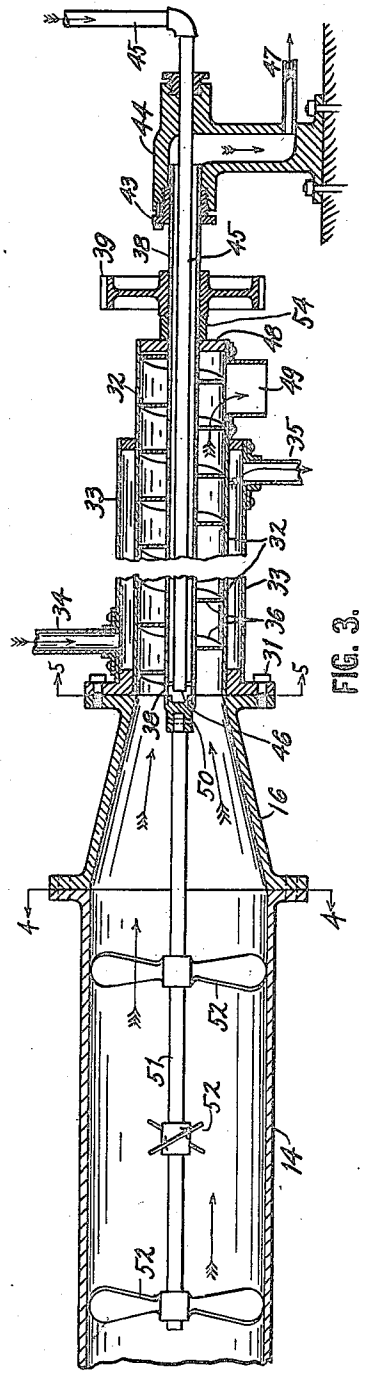


FIG. 3.

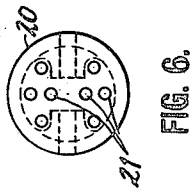


FIG. 6.

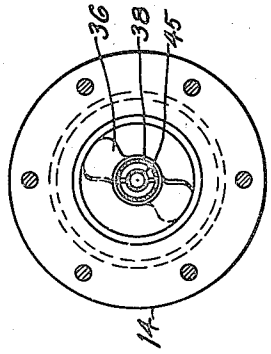


FIG. 5.

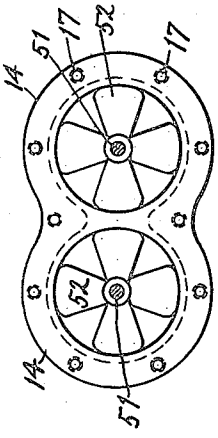


FIG. 4.

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Patented July 10, 1923. 1,461,614

UNITED STATES PATENT OFFICE.

GEORGE H. HARRISON, OF ST. PAUL, MINNESOTA, ASSIGNOR TO MANUFACTURERS CHEMICAL COMPANY, OF NEWPORT, MINNESOTA, A CORPORATION.

CONTINUOUS STRAW GAS RETORT.

Application filed April 6, 1921. Serial No. 458,964.

To all whom it may concern:

Be it known that I, GEORGE H. HARRISON, a subject of the King of England, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented a new and useful Continuous Straw Gas Retort, of which the following is a specification.

My invention relates to straw gas retorts, and the main object is to provide an apparatus of said kind which will operate continuously and will produce gas and several by-products out of straw. The invention also involves a certain process.

In the accompanying drawing:

Fig. 1 is a partly sectional top view of the apparatus.

Fig. 2 is a side elevation of the apparatus with the middle portion in section.

Fig. 3 is an enlarged section approximately on line 3—3 in Fig. 1 with the furnace omitted.

Fig. 4 is a section on the line 4—4 in Fig. 3 showing the two retorts and the stirrers within them.

Fig. 5 is an enlarged section on line 5—5 in Fig. 3.

Fig. 6 is a face view of one of the pistons that feed the straw into the retorts.

Referring to the drawings by reference numerals, 7 designates a furnace constructed of brick or other suitable material and may have a lining 8 of fire brick. It is provided with an air inlet 9, an ash door 10 and a firing door 11 for tending to a fire 12 upon a grate 13.

Arranged horizontally above the grate 13 are two parallel cylindrical retorts 14, which are preferably cast of steel and may be both in one casting (as best shown in Fig. 4 and understood also in Fig. 1). These retorts whether two or more in number are of such similar construction that a description of one will answer for all of them except as may be stated.

Each retort has one end reduced by a truncated cone 15 and the other end by a truncated cone 16, each cone removably secured by screws 17.

Secured to cone 15 is a horizontal cylinder 18 having its upper side provided with an intake opening supplied from a hopper 19. In said cylinder operates a piston 20 which in Fig. 6 is shown to have perforations 21. Said piston is reciprocated by a rod 22 and a crank shaft 23. The latter has a worm gear 24 rotated by a worm screw 25 fixed on a shaft 26 driven by a pulley 27 and a belt not shown, all of said shafts being mounted in suitable frame work 28, 29, and 30.

Secured at 31 to each cone 16 is a conveyor tube 32 having spaced about it a pipe or jacket 33 for cooling water which from a suitable scource enters through a pipe 34 and leaves through an outlet pipe 35.

Mounted to rotate within the tube 32 is a spiral conveyor 36 having its shaft 38 rotated by a gear wheel 39, driven by a pinion 40 fixed on a shaft 41 having a pulley 42 driven by a suitable belt not shown. Said shaft 38 is tubular and has its outer end journaled in a stuffing box 43 in a hollow stand 44. 45 is a pipe delivering cold water into the shaft 38 to keep it cool, the water flowing out of pipe 45 at the end 46 and returns thence through shaft 38 into the stand 44 and escapes at the outlet 47. The conveyor tube 32 has its outer end closed at 48 and provided with a downward outlet 49 (see Figs. 2 and 3).

Secured at 50 to the inner end of conveyor shaft 38 is a solid shaft extension 51 having a few radial wings 52 of the propeller type. These wings or radial arms may contact lightly with the inner surface of the retort cylinder.

In Fig. 1, 53 designates a spider-shaped bearing at the inner end of the spiral conveyor shaft, and in Fig. 3, 54 designates a third bearing for said shaft and also a hub to contact with the hub of gear 39 so as to prevent the spiral from working itself into the retort.

In Figs. 1 and 2, 55, 56, are supporting blocks and 57, 58, are bearings for shaft 41, while 59 is the smoke stack of the furnace; and 60 are the gas outlet tubes from the retorts. These tubes extend as 60^a into a scrubber 61 having a tar outlet 62 and a pipe 63 connected to a gas reservoir 64, from which gas may be supplied through a pipe 65 for general distribution and use; while a pipe 66 having a valve 67 serves to supply gas to a burner 68 arranged in the furnace. There may be several burners according to their size and the size of the retorts.

In the operation of the apparatus the pulleys 27 and 42 are supplied with driven belts, the fire on grate 13 is started so it heats the

retorts, the hot air from the furnace passing along at the under sides of the retorts, then up through passages 69 and along the upper side of the retorts and then up through the chimney 59. Meanwhile straw is constantly supplied into the hoppers 19 either by suitable machinery or by pitchforks.

The straw being now continuously pushed by the pistons 20 into the retorts, where it is changed by the heat to carbon and gas, the gas escaping through pipe 60 and scrubber 61 into the reservoir or holder 64 while the tar from it is let out at 62. The carbon is constantly stirred and impelled along by the devices 52, and then moved along at greater speed by the spiral conveyor 36 and cooled by the external and internal water cooled pipes 32 and 38 until ejected at 49 as a black powder. As soon as a sufficient supply of gas has been produced to serve as fuel the fire 12 is allowed to go out and the burner 68 is ignited and takes the place of fire 12, and now the apparatus is in continuous automatic operation as long as straw is fed into the hoppers.

During such operation little or no air is pumped into the retorts because practically all air in the straw escapes through the perforations 21 in the pistons. No gas can escape into the hoppers because the tubes 18 between the hoppers and the retorts are packed with straw moving toward the retorts. Neither can gas escape toward the outlet 49 because the long spiral conveyor full of carbon fills the conveyor tube 32.

The gas stored up in the reservoir is of a good quality for lighting, cooking and heating purposes, and the carbon I pulverize and use as a good ingredient in paints and varnishes. The tar being a creosote may be used for preserving lumber like fence posts, telegraph poles, etc.

What I claim is:

1. In a straw gas apparatus, a furnace, one or more cylindrical gas retorts extending horizontally through the furnace, a horizontal cylindrical feeding tube in central line with each one of the retorts and having a feed hopper opening into its upper side, a perforated piston in said feeding tube and means reciprocating the piston below the hopper; the discharge end of each retort having a comparatively long delivery tube extending axially from said end, a spiral conveyor in said delivery tube and means on the outer end of said conveyor for imparting rotation to it.

2. The structure specified in claim 1, and a shaft extending axially through the greater part of the retort and having flat radial arms inclined so as to not only break up the carbonized straw but also to drive the straw toward the delivery tube; said shaft having one end secured to the spiral conveyor, and means for circulating water through the shaft of the spiral conveyor.

3. The structure specified in claim 2, said circulating means consisting of a tube forming the shaft of the spiral conveyor and having its outer end normally open, a water supply pipe extending in through said open end and almost to the inner end of the hollow spiral shaft and being spaced from the inner sides of the latter permitting the water to return and flow out of the said tubular shaft, and means for guiding said returned water away from the apparatus.

4. In an apparatus of the kind described, the combination with a cylindrical gas retort having its ends contracted to form truncated cones, of two pipes extending outward one from the small end of each cone, and means for continuously feeding straw into one of said tubes, and means for continuously removing the carbonized straw from the other tube.

5. The structure specified in claim 4, said truncated cones being removably secured to the retorts.

In testimony whereof I affix my signature.

GEORGE H. HARRISON.