Jan. 24, 1956

J. A. JOHNSON

2,731,832

WATER-COOLED GAS SAMPLING DEVICE

Filed Jan. 5, 1954

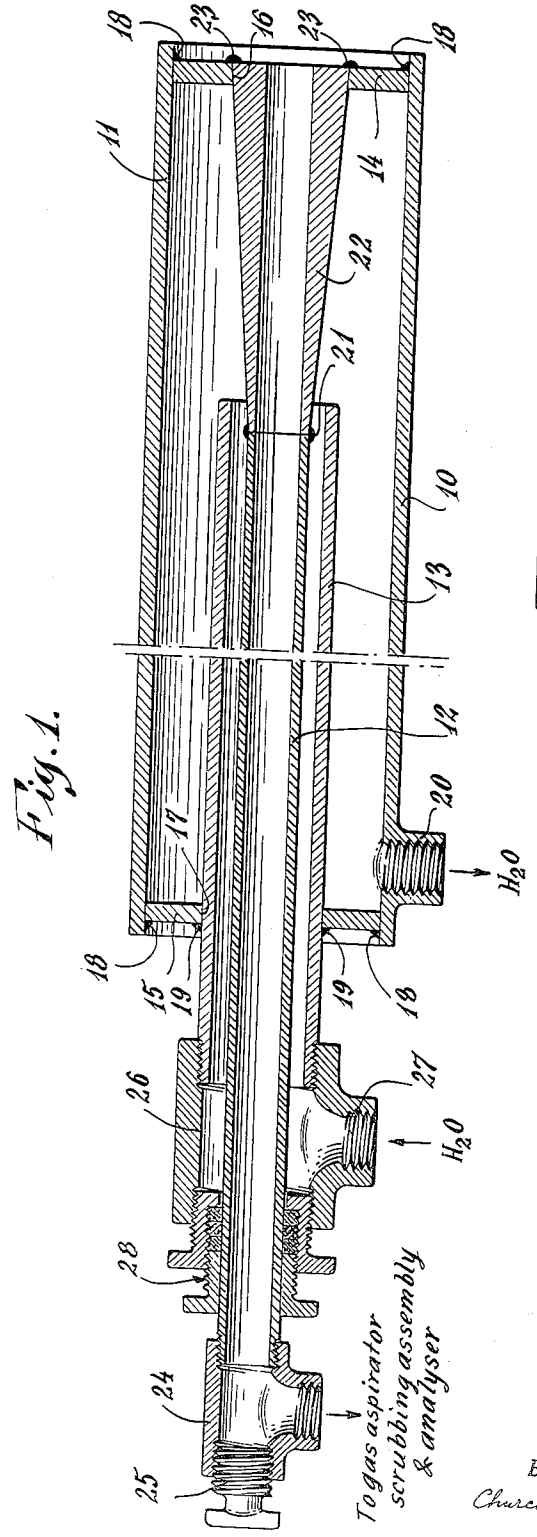


Fig. 1.

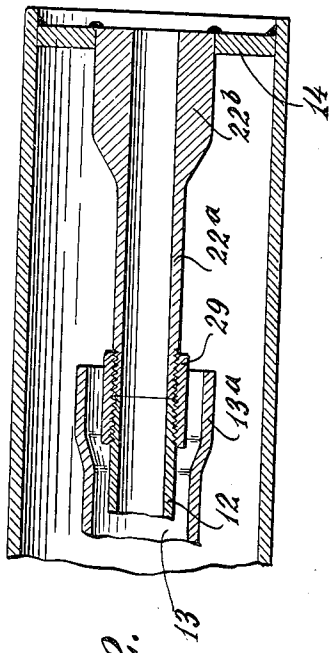


Fig. 2.

INVENTOR.
James A. Johnson

BY
Churchill, Rich, Weymouth & Engel
ATTORNEYS

United States Patent Office 2,731,832 Patented Jan. 24, 1956

2,731,832

WATER-COOLED GAS SAMPLING DEVICE

James A. Johnson, Rahway, N. J., assignor to The American Metal Company, Ltd., New York, N. Y., a corporation of New York

Application January 5, 1954, Serial No. 402,268

1 Claim. (Cl. 73—421.5)

The present invention relates to a gas sampling device for use in the periodic or continuous analysis of gases from reverberatory metal smelting furnaces and the like and aims to provide certain improvements therein.

The sampling of corrosive dust laden gases at elevated temperature, such as are present in the gaseous atmosphere of a reverberatory metal smelting furnace has been a problem of long standing. Such sampling is carried out with an apparatus which consists essentially of (1) a water-cooled device extending into the furnace; (2) a gas sample cooling, washing and purifying arrangement; and (3) a gas composition analyzer and/or recorder of appropriate design. Of the sampling apparatus, the water-cooled sampling device has been found to have but short life and required frequent replacement. The principal cause of the sampling device failure has been determined to be due to the corrosive action of the solutions formed by the condensation on the cold water-cooled tube when the temperature of the gases is lowered to their dew point, whereupon the water content in the gases mixing with the salts deposited on the surfaces and being in intimate contact with the corrosive constituents of the gases form a corrosive solution which attacks the metal of both the casing and the gas sampling tube.

It is accordingly the primary object of the present invention to provide a gas sampling device especially adapted for use with reverberatory metal smelting furnaces which will have a longer useful life than sampling devices heretofore employed.

A further object is to provide a device of the character set forth upon which the gases will not condense.

A further object is to provide a device of the character set forth in which the corrosion will be substantially eliminated at certain locations and the rate at which corrosion will take place at other points will be considerably reduced.

A further object is to provide a gas sampling device in which differential expansion and contraction of the component parts can take place without giving rise to sources of gas and water leakage and their concomitant detrimental effects upon the device.

A still further object of the invention is to provide a gas sampling device which will permit easy replacement of the gas sampling tube when required.

The foregoing and other objects of the invention not specifically enumerated are accomplished by forming a gas sampling device as hereinafter described and shown in the accompanying drawing, wherein:

Figure 1 is a diametrical section of a gas sampling device embodying the invention.

Fig. 2 is a fractional view similar to Fig. 1 showing a modification.

Referring first to Fig. 1 of the drawing, the gas sampling device may be said to consist of a tubular metal casing **10**, one end **11** of which is adapted to be located in the gaseous atmosphere of a reverberatory metal smelting furnace or the like, preferably by being mounted to extend downwardly through the top wall of such furnace, said

casing having mounted therein a central gas sampling tube **12** and a water supply tube **13** concentrically disposed in spaced relation between the sampling tube **12** and the casing **10**.

The casing **10** is preferably formed from a 4" extra heavy or thick wall steel pipe about four feet long and has thick end walls **14** and **15** which close off the casing except for passages **16** and **17** formed in said walls for accommodating the pipes **12** and **13**, respectively. Said end walls may be suitably welded to the casing, as shown at **18**, and to the water supply pipe, as shown at **19**. The casing adjacent its end opposite to that which is adapted to be located within the atmosphere of the furnace is formed with a branched, internally threaded nipple **20** for accommodating a water educt or discharge pipe (not shown).

The central gas sampling tube may be suitably formed of ¾" standard brass pipe to one end of which is brazed or otherwise suitably connected, as shown at **21**, a manganese bronze or other suitable metal section **22**, the free end of which extends through the opening **16** in the end wall **14** and brazed to said end wall, as shown at **23**. Preferably, the tubular section **22** has an internal diameter equal to that of the pipe **12** and an external diameter which progressively increases from the brazing **21** to the brazing **23**, thus providing a progressively thickened wall, the function for which will presently appear. The tube **12** at its end opposite to that which is connected to the tubular section **22** is suitably connected to one of the aligned arms of a T-fitting **24**, the upright arm of which is adapted for connection to the gas aspirator, scrubbing assembly and gas analyzer (not shown). Threaded into the other aligned arm of the T-fitting **24** is a screw plug **25** which is adapted for removal so that a ramrod may be inserted into the tube to clean the inner wall thereof or permit connection of a hose thereto for blowing-out the tube.

The water supply tube **13** may be suitably formed of 1½" standard steel pipe and at its end which projects outwardly of the casing **10** is fitted to one of the aligned arms of a T-fitting **26**, to the upright arm **27** of which may be connected a pipe (not shown) leading from a source of water supply. Connected to the other aligned arm of the T-fitting is a gland or stuffing box **28** which encompasses the gas sampling tube **12**. The water educt end of the tube **13** preferably terminates about 4 to 6 inches from the end wall **14** and the distance between said educt end and said end wall should be at least as large as the diameter of the casing **10**.

In Fig. 2, a manganese bronze section **22***a* is shown as detachably coupled to the inner end of the gas sampling tube **12** by a coupling sleeve or union **29** and the educt end of the water supply pipe **13** is expanded or flared outwardly, as shown at **13***a*, to provide an adequate educt passage around the coupling **29**. The tubular section **22***a* at its end portion opposite to that which is connected to the tube **12** is suitably thickened, as shown at **22***b*, and said thickened portion has a length at least equal to one-third the distance between the educt end of the tube **13** and the end wall **14** of the casing.

In use, the gas sampling device, after being installed so that one end extends into the corrosive gas atmosphere of a reverberatory metal smelting furnace and the like for a distance of from 18 to 24 inches, will be exposed to the heat and corrosive action of such atmosphere and would soon be melted away unless provision is made for suitably cooling said inserted end. Accordingly, water is circulated through the casing, the water entering the induct end of the water supply tube through the fitting **26** and discharging into the casing around the manganese bronze section **22** or **22***a*, and upon filling the casing, discharging therefrom through the discharge, nipple **20**. In the course of this flowing action the water will conduct

heat away from the inserted end of the casing and the tubular section **22** or **22***a*. The rate of flow of the water is so controlled that the temperature of the end **11** of the casing will not be cooled down to the dew point of the gases within the furnace and hence will preclude the condensation of such gases on the parts of the device exposed to the gases whereby a corrosive solution would be formed which would eat away the parts in question. By the same token, the thickened steel wall of the casing **10** provides a poor conductor of the heat from the furnace to the circulating water and hence the temperature at the outer surface of the casing in use is not cooled down to the dew point of the gases within the furnace. The thickened wall on the manganese bronze sections **22** and **22***a* provides increased life for said section of the gas sampling tube since it is said portion of the tube which is subject to the greatest corrosive action of the furnace gases.

Experience has taught that corrosion will slowly take place at the entrance end of the gas sampling tube which is disposed within the furnace and in the course of time, the inner wall of the tube will be eaten away along a conical path from the open end of the tube to about one-third the distance from the end wall **14** to the educt end of the water supply pipe **13**.

Should it become necessary to replace the gas sampling tube, this can be readily accomplished by removing the device from the furnace, disconnecting the sampling tube from the T-fitting **24**, melting away the brazed joints **23** and withdrawing the tube from the casing. Since it is only the short section of the gas sampling tube through which the gas enters that becomes corroded, it will be apparent that the section **22** or **22***a* only, will require replacement.

Experience has shown that, whereas gas sampling tubes heretofore used in the analysis of gases from reverberatory metal smelting furnaces had a useful life of from two to three weeks, the device of the present invention has shown a useful life of up to a year and more.

Although certain preferred embodiments of the invention have been disclosed, it is to be understood that changes in the specific construction, arrangement of parts and of materials used may be resorted to within the range of mechanical and engineering skill without departing from the spirit of the invention as claimed:

What I claim is:

A device for sampling gas from a reverberatory metal smelting furnace and the like comprising in combination, a tubular metal casing one end of which is adapted to be located in the gaseous atmosphere of the furnace, said casing having mounted therein a gas sampling tube the gas intake end of which terminates in and is secured to an end wall of the casing which is adapted to be located in the gaseous atmosphere and a water supply tube extending through and being secured to an end wall of the casing, said water tube being disposed in spaced relation between the gas sampling tube and the side wall of the casing and encompassing the gas sampling tube for the greater part of its length, the end walls closing off the casing except for passages for the tubes, one end of said gas sampling tube extending through the corresponding end of the water supply tube and adapted for connection with means for aspirating gas from the furnace atmosphere, the water supply tube having its water induct end spaced inwardly from the outlet end of the gas sampling tube and a packed gland at said end of said water supply tube engaging around the gas sampling tube whereby said sampling tube may move axially due to expansion and contraction, relatively to the water supply tube and to the casing.

References Cited in the file of this patent

UNITED STATES PATENTS

1,809,324	Austin et al.	June 9, 1931
1,890,592	Stein et al.	Dec. 13, 1932
2,356,845	Hines	Aug. 29, 1944
2,550,933	McEvoy	May 1, 1951