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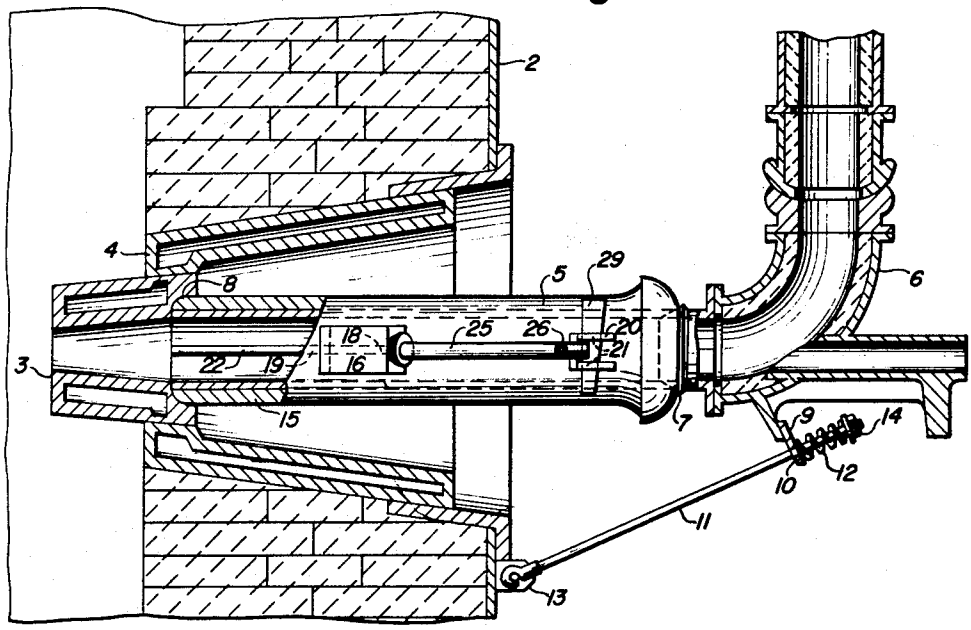
FLUID FUEL INJECTION APPARATUS FOR BLAST FURNACE

Filed Aug. 7, 1962

Fig. 1



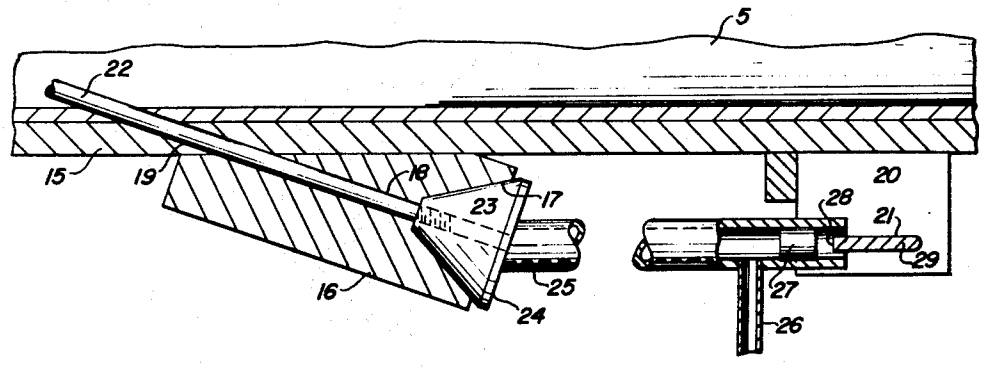


Fig. 2

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FLUID FUEL INJECTION APPARATUS FOR BLAST FURNACE

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3 Claims. (Cl. 158—76)

This invention is a device for the injection of fuel or other materials into a blowpipe of a blast furnace.

It is an object of this invention to provide a fuel injection device which functions satisfactorily in operation while enabling repairs or substitutions to be made quickly, safely, inexpensively and easily.

Another object is to provide an adjustable pressure seal.

Other objects, purposes and advantages of this invention will appear hereinafter in the specification and claims, and in the appended drawings.

In the drawings:

FIGURE 1 is a side elevation of our fuel injection device in operating position in a blast furnace blowpipe; and

FIG. 2 is a top sectional detail view of the invention.

In the conventional construction of a blast furnace for producing pig iron, the lower portion which serves a receptacle for the molten metal and slag is the hearth. This is built of firebrick and is externally reinforced by a circumferential metal jacket **2**. The hot air of the blast is admitted to the furnace through a plurality of tuyeres **3** which are hollow copper castings inserted in tuyere coolers **4** positioned symmetrically around the circumference of the hearth.

The blowpipe **5** thereto is usually a horizontal cast iron pipe, through which the hot blast is delivered to the tuyere **3** from the depending L-shaped tuyere stock **6**. The forward end of said tuyere stock **6** may be turned to fit closely into socket **7** in the blowpipe **5**.

The blowpipe is held in place with its forward or smaller end fitting into socket **8** of the tuyere by pressure from the tuyere stock **6**, which is suspended by conventional means attached to its upwardly extending portion and is provided on its lower portion with a depending lug **9** having a hole **10** through which an end-threaded connecting rod **11** provided with a heavy coiled spring **12** extends to another lug **13** on the hearth jacket **2** where it is anchored. A large nut **14** of stainless steel or brass on the outer end of the rod **11** will enable adjustment of the spring to create the desired pressure while allowing for motion due to contraction and expansion.

In the preferred embodiment of this invention, the shell **15** of the blowpipe **5** has mounted on its exterior side surface a sloping metal block or sleeve **16** having a rearwardly flared seat **17** and a forwardly inclined hole or passage **18** communicating with a correspondingly inclined hole or passage **19** in the forward portion of the shell, and a U-shaped lug **20**, having a slot **21**, in alignment with the block on the rear portion of the shell.

Insertable into said blowpipe **5** through the flared seat **17** and passages **18** and **19** is the pipe nozzle **22**. Said nozzle is a heavy stainless steel pipe of about ⅞" inside diameter, the forward end of which slidably projects inwardly at an angle of about 20° between the central axes of said pipe nozzle **22** and of the blow pipe **5**, and extends to the front end of the shell **15**, for a sufficient distance to inject the fuel at the center axis of the inner end of the tuyere **3**. The rear end of said nozzle **22** is externally threaded and screws into a conical collar or ferrule **23** which engages in the flaring seat **17**. The surface of seat **17** forms an angle of approximately 30° with the central axis of nozzle **22**.

Welded at an angle to the outer face **24** of said collar **23** is the oil supply pipe **25**, which later has a side nipple **26** before the closure plug **27** and a slotted end **28**. The assembly is held in place by the wedge key **29** which is driven against the slotted pipe end **28** into the slot **21** in the U-shaped lug **20**. During the operation of the furnace, lengthening of the blowpipe shell **15** due to expansion, such as may result from an increase in the hot blast air temperature or the like, can break the seal between seat **17** and ferrule **23**, because the fuel pipe **25** is normally at a lower temperature than said shell. The fluid seal may then be reformed by hammering wedge key **29** so as to force the ferrule and seat back into sealing contact.

To afford proper clearance from and access to other parts of the blast furnace, and also to diminish the discomfort to workmen from excessive heat, it will be found preferable in most installations for the apparatus to be mounted on the more accessible side of the blowpipe **5**, as shown, but the device may obviously be mounted on the top or bottom of the blowpipe where this is convenient or desired.

As the nozzle does not extend for more than about a third of the length of the blowpipe, it has a minimum of exposure to the hot blast, and is also a safe distance from the nose of the tuyere.

Fuel oil is supplied through a flexible hose (not shown), which may be attached to or removed from the pipe nipple **26** by any standard quick locking and disconnecting means. The oil feed must of course be entirely disconnected before the nozzle assembly can be safely installed or removed. Also, the blast air must be taken off the furnace so that no blow-by can escape through the sleeve **16** and thereby endanger the workmen. Accordingly, the preferable time for changing these assemblies is directly after a cast.

The above-described injection device can obviously be adapted to the use of other fluid fuels than oil, including gaseous, liquid, semi-solid, or solid-in-liquid fuels such as natural or artificial gas, pitch, tar or powdered coal, singly or combined, or with steam or oxygen, depending on their relative delivered costs at the particular location.

We claim:

1. A fuel injection device comprising:

(a) a hollow blowpipe shell,

(b) means forming a first cylindrical passage extending forwardly at an angle through the wall of said blowpipe,

(c) a sleeve mounted on said blowpipe shell having a second cylindrical passage therethrough in alignment with and communicating with said first passage and having a conically flared seat portion therein at the outer end of said second passage,

(d) a slidably insertable and removable pipe nozzle extending through both said passages,

(e) a conical collar concentrically attached to said pipe and seated in said conically flared end portion in fluid tight relation therewith, and

(f) adjustable wedge means pushing the conical collar into substantially gastight engagement with the flared end portion and releasably securing said collar within the flared portion.

2. A fuel injection device comprising:

(a) a hollow blowpipe shell,

(b) means forming a first cylindrical passage extending forwardly at an angle through the wall of said blowpipe shell,

(c) a sleeve mounted on said blowpipe shell having a second cylindrical passage therethrough in alignment with and communicating with said first passage and having a conically flared seat portion therein at the outer end of said second passage,

(d) slotted lug means mounted on the blowpipe shell in aligned spaced relation behind said sleeve,

(e) a slidably insertable and removable pipe nozzle extending through both said passages and said sleeve and having a conical collar concentrically connected to said pipe nozzle and seated in said conically flared end portion in fluid tight relation therewith,

(f) a fuel supply pipe integrally secured to the outer end of the pipe nozzle, and

(g) adjustable wedge means inserted in the slotted lug in engagement with the rear end of the fuel supply pipe and thereby holding the conical collar tightly in place in said conically flared end portion of the sleeve.

3. A fuel injection device comprising:

(a) a hollow blowpipe shell,

(b) means forming a first cylindrical passage extending forwardly at an angle through the wall of said shell,

(c) a sleeve mounted on said blowpipe shell having a second cylindrical passage therethrough in alignment with and communicating with said first passage and having a conically flared seat portion therein at the outer end of said second passage,

(d) lug means provided with longitudinally extending slots and mounted on the blowpipe shell in aligned spaced relation behind said sleeve,

(e) a slidably insertable and removable pipe nozzle extending through both said passages and said sleeve and having a conical collar integrally concentrically

attached to said pipe nozzle and seated in said conically flared seat portion in fluid tight relation therewith,

(f) a fluid fuel supply pipe integrally connected to the outer end of the pipe nozzle,

(g) said fluid fuel supply pipe extending rearwardly substantially parallel to the blowpipe shell,

(h) said fluid fuel supply pipe having a slotted rear end portion and an inner plug closure and a side connection for fuel, and

(i) wedge means insertable in the slots in the lug means and bearing against the slotted end portion of said pipe so as to maintain the fluid tight relationship between the conical collar and the conically flared seat.

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