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[54] **DEVICE FOR DRIVING A SAMPLING OR SENSING
LANCE FOR A SHAFT FURNACE**
10 Claims, 5 Drawing Figs.

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266/34 LM
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LM, 1 R, 42

[56]

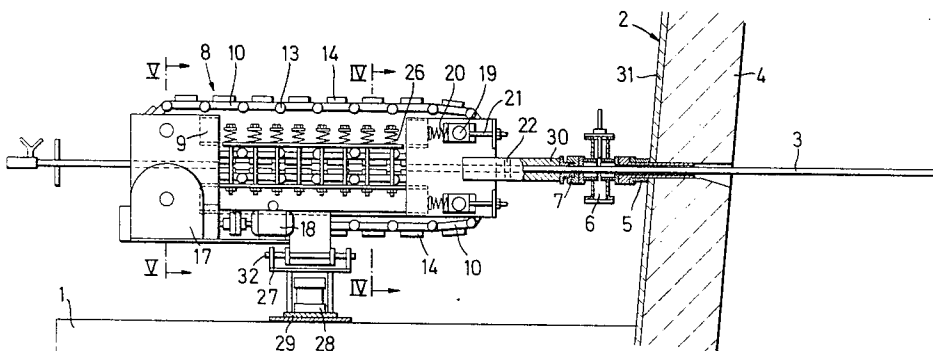
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ABSTRACT: The invention relates to a device for advancing and withdrawing a sampling or sensing lance into and out of a shaft furnace through an opening in the wall of the furnace. The device includes at least two driven endless chains which are equipped with gripping jaws. Parts of the runs of the chains are adjacent and parallel to one another and grip the lance between them.



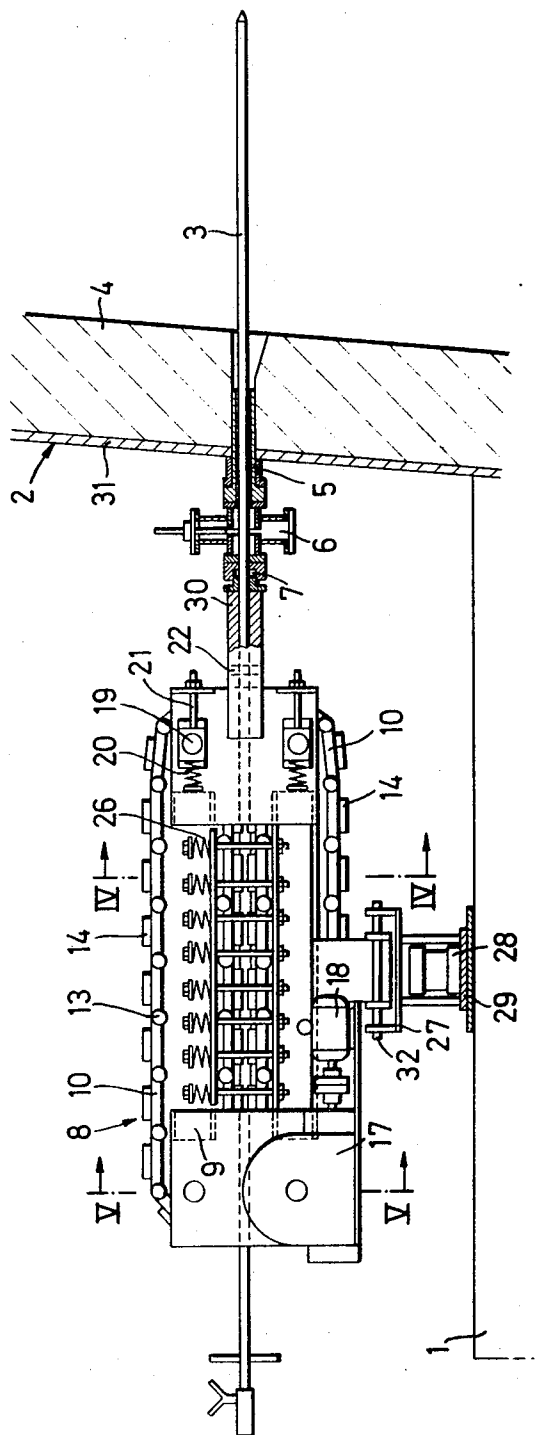


FIG. 1

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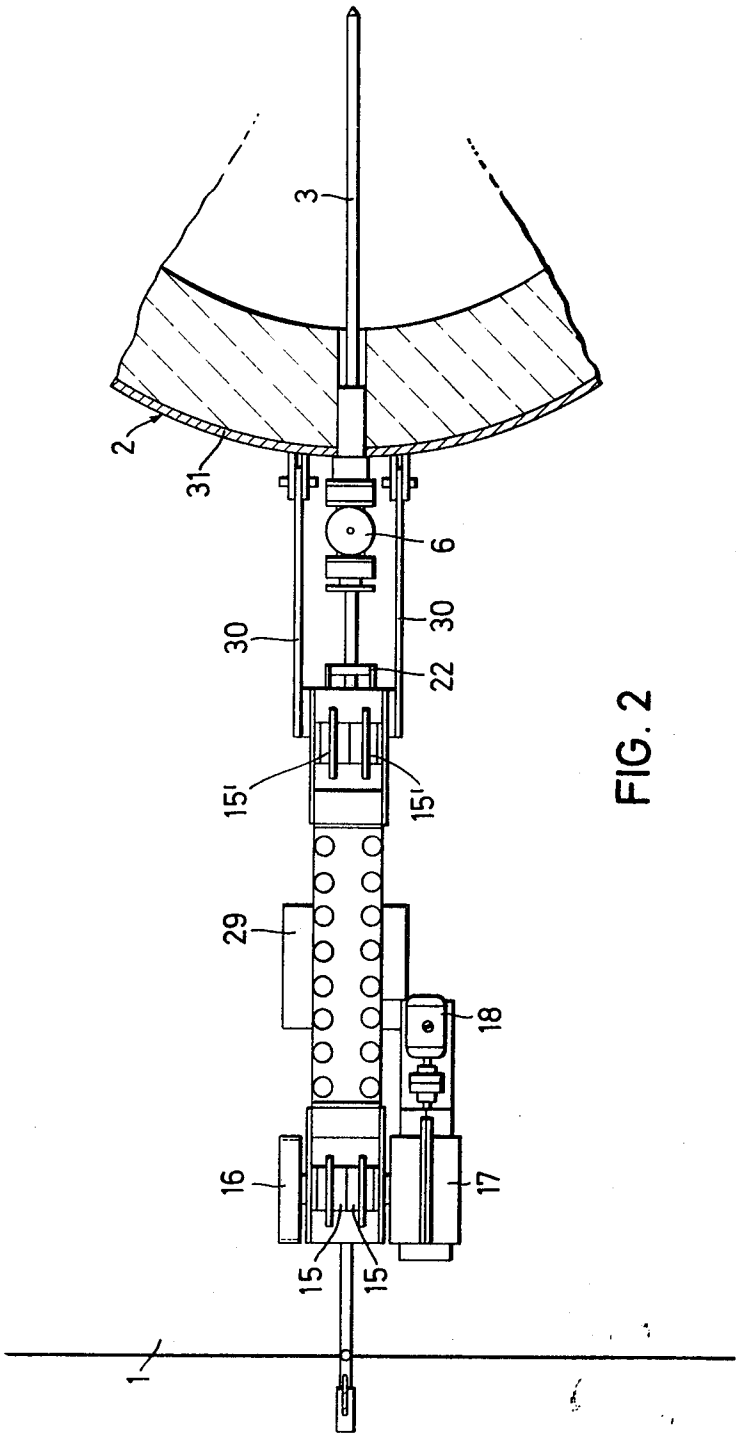


FIG. 2

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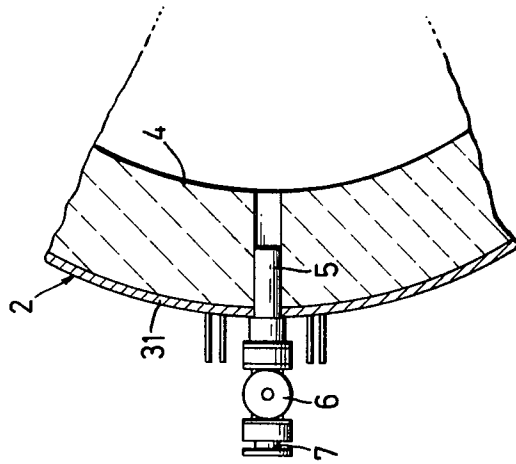
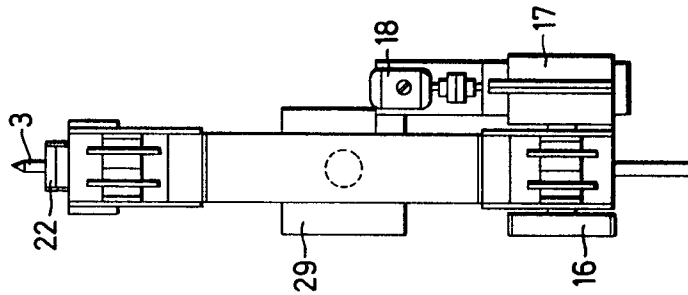


FIG. 3



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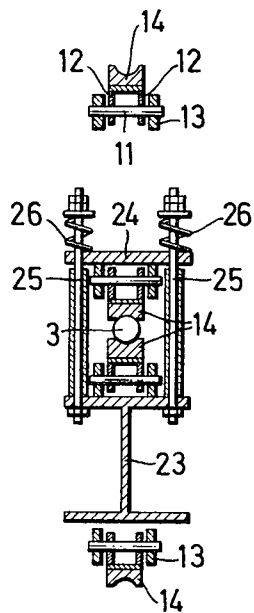


FIG. 4

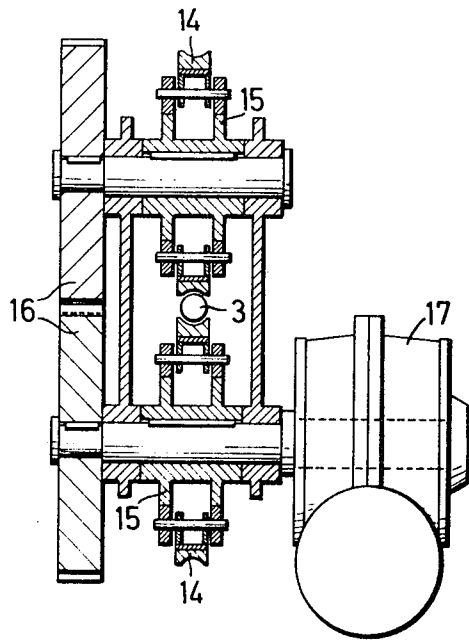


FIG. 5

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DEVICE FOR DRIVING A SAMPLING OR SENSING LANCE FOR A SHAFT FURNACE

The invention relates to a device for use in taking samples from a shaft furnace, particularly a blast furnace, and for measuring temperatures and gas pressures in the furnace, with a sampling lance mounted on a furnace platform and arranged so that it can be driven by a power drive into an out of the charge in the furnace, through an opening in the wall of the furnace equipped with a stuffing box seal and a shutoff valve.

In a device of this kind described in an older proposal the lance is driven by threaded spindles arranged on either side of the lance on the furnace platform, the spindles being powered by an electric motor. In another known proposal the lance has guiding rollers on its rear end, which travels in a guiding frame mounted on the furnace platform. A hydraulic ram mounted on the guiding frame drives the sampling lance, the hydraulic ram being supplied with hydraulic fluid by a variable pump. There are also known looped cable drives and chain drives for the lance.

All these arrangements have the disadvantage that they are excessively large and heavy. The lance has to be driven into the charge to a considerable distance, which in a modern blast furnace can easily be 5 m. or more, and it is desirable to drive the lance in as rapidly as possible. In penetrating the charge the lance encounters considerable resistance. The heavy and cumbersome machine required for driving the lance makes it necessary to construct a particularly robust furnace platform, which often has to be subsequently reinforced, all this being costly and tedious. A further difficulty which often arises is that the lance becomes bent. This is due to the fact that the lance is driven forwards by a driving device, for example a clamping fork or a crosshead or the like which grips the lance over a comparatively short part of its entire length, the gripping point being usually near the rear end of the lance. The arrangement applies excessive local stresses to the lance near the driving point, and the entire lance can become bent out of shape.

The same difficulty is encountered if a comparatively short lance is used, which is driven intermittently into an out of the charge. In this known arrangement the lance is driven by a compressed air cylinder, the lance being gripped by pneumatic jaws. After the lance has been driven forwards to a certain distance into the charge, the pneumatic jaws open and the driving piston is retracted, whereupon the jaws close on the lance again and it is driven forwards a further step. This intermittent movement of the lance is undesired. A continuous movement is preferable. Moreover the gripping jaws do not always grip effectively and often merely slide over the surface of the lance.

The object of the present invention is to remove these difficulties and to provide a device for driving a sampling and measuring lance into and out of the charge in the furnace at a practically constant speed, which is however variable at will over a wide range, the entire device being exceptionally short and very light and simple in construction, making it unnecessary to provide any special sort of furnace platform, particular care being taken to ensure that the gripping device used does not apply a bending or kinking stress to the lance and yet grips the lance securely enough to prevent any risk of slipping. A further object is that although the gripping device must grip the lance securely, nevertheless it must not apply such high local pressures to the surface of the lance that there is a risk of squashing it out of shape.

These problems are solved by the invention by using for driving the lance at least two endless chains, situated on opposite sides of the lance and equipped with gripping jaws with gripping surfaces which are concave curved to agree with the shape of the outer surface of the lance, the two chains gripping the lance between them from either side and driving it continuously into or out of the furnace charge.

It should be observed that the device does not merely grip the lance between two jaws, moving it intermittently, as happens in the case of the pneumatic ram drive mentioned above.

On the contrary, the lance is constantly trapped between, say, 8 to 10 gripping jaws on either side and advanced or retracted continuously, the constant, multiple gripping effect obtained being so secure that slipping is reliably excluded, and this without the application of excessive local pressures to the surface of the lance. In other words the lance is gripped continuously over a large area of its surface, preventing slip without giving rise to any danger of squashing the lance. Furthermore the entire device can be made exceptionally short overall, because the driving device as a whole remains stationary, the gripping jaws circulating around a closed circuit. This considerably simplifies the entire construction of the device, which can be made quite light in weight and does not require the construction of a special supporting platform.

In order to obtain an even gripping of the lance the jaws, attached to the chains, are preferably thrust against the surface of the lance by springs. For this purpose each chain is a roller chain and has rollers mounted to rotate on the ends of the link pins and running along plates or rails situated on either side of the lance, at least one of the plates or rails being spring loaded so that the gripping jaws are thrust resiliently against the surface of the lance. Alternatively or in addition, each clamping jaw may be individually spring loaded, or resiliently mounted, for example by interposing a rubber-metal insert between the jaw and its support. To improve still further the gripping effect between the jaw and the surface of the lance, each jaw can have a surface layer, on its working face, made of heat resistant, nonslip and wear resistant synthetic material, or the jaw itself can be made mainly of a material of this kind.

In regard to the drive for the chains, in order to drive the lance at a constant, even speed in its forward and backward movements, the chains are driven through a driving gear which is preferably steplessly variable, and through a pair of meshing gear wheels, one for each chain, the power being provided by a single motor. The drive is preferably situated at the end of the device away from the furnace, for protection against temperature, dust and other influences derived from the furnace. On the other hand the spring loaded tension pulleys for the other ends of the chains can be at the furnace end of the device. In order to facilitate the work which has to be done on the furnace platform after the lance has been withdrawn, the entire device may be mounted to rotate on a vertical pedestal, which can be constructed as a hydraulic cylinder so that the device can be raised and lowered. The introduction and retraction of the lance involves considerable longitudinal forces. To prevent the reaction forces from being transmitted to the pedestal there are preferably disconnectable straps for securing the furnace to the wall of the furnace, and the device is mounted so that it can slide longitudinally, between limiting stops, on horizontal bearing pins mounted on the vertical pedestal, or on a supporting plate which is free to rotate on the pedestal. For keeping the lance clean there is a cleaning bush near the furnace end of the device, through which the lance passes.

An example of a device according to the invention is illustrated in the accompanying drawings, in which:

FIG. 1 is a side elevation;

FIG. 2 is a plan;

FIG. 3 shows the device swung around through 90° from its working position;

FIG. 4 is a section taken on the line IV—IV in FIG. 1; and,

FIG. 5 is a section taken on the line V—V in FIG. 1.

As shown in FIGS. 1 and 2, the device is mounted on the platform 1 of a shaft furnace, for example a blast furnace. The device serves for driving a lance 3 into and out of the charge in the furnace, for obtaining samples and measuring gas temperatures and/or pressures. The lining 4 of the furnace 2 contain a guide bush 5 for the lance. Mounted on the guide bush 5 there is a shutoff valve 6 and a stuffing gland 7. The lance 3 is water cooled and in FIGS. 1 and 2 it is shown introduced into the charge.

The lance is driven by a roller chain drive 8 consisting of two roller chains 10 mounted parallel to each other above and

below the lance 3, in a frame 9. Mounted on the ends of the link pins 11 of each roller chain 10, on either side of the chain links 12, there are rollers 13. Attached to the chain links 12 between the link pins 11 there are gripping jaws 14 whose working surfaces are concave curved to agree with the outer surface shape of the lance 3. Although in FIGS. 4 and 5 the lance is circular in cross section, it can if desired be oval or of some other shape. The endless chains 10 pass at each end over chain wheels 15 (FIG. 5), those furthest away from the furnace 2 acting as driving wheels. The two driving wheels 15 are connected together by meshing gear wheels 16 and driven by a preferably steplessly variable drive 17 powered by a motor 18. The motor 18 can be an electric motor, or pneumatic or hydraulic and it is mounted, together with the drive 17 and the two gear wheels 16 near the end of the device furthest away from the furnace. At the furnace end of the device the chains pass over tension wheels 15', each tension wheel rotating in a bearing 19 which is thrust outwards by a spring 20 and retained by a bolt 21. At the furnace end of the device there is also a cleaning bush 22 through which the lance passes.

When the device is in operation the rollers 13 of the chains 10 roll along plates or rails 23, 24 situated above and below the lance 3. The lower rail 23 is fixed to the frame of the device, whereas the upper rails 24 is tied to the upper web of the rails 23 by tension bolts 25 loaded by compression springs 26, the rail 24 being free to move between limiting stops, under the influence of the springs 26, in such a way that the lance 3 is firmly gripped by spring pressure between the two groups of gripping jaws 14. To improve and even out the gripping action each jaw 14 can be constructed resiliently, for example interposing a rubber-metal insert between the jaw and its supporting chain link. The grip on the lance 3 can if desired be still further improved by giving the working surface of each jaw a nonslip layer of heat-resistant and wear-resistant synthetic material, or by making the entire jaw of this material.

To facilitate work on the furnace platform after the lance has been withdrawn from the furnace, the entire device is mounted on a turntable 27 which rotates on an axle stub 28 fixed to a baseplate 29. FIG. 3 shows the device on the furnace platform, after rotation through 90° from its working position.

When in its working position the device is secured to the outer shell 31 of the furnace by straps 30 which take the reaction forces during the movements of the lance. To ensure that these reaction forces are taken by the straps 30, and not trans-

mitted to the baseplate 29 of the turntable, the device is mounted to slide longitudinally on horizontal pins 32 which are themselves supported by the turntable 27.

I claim:

1. A device for advancing and withdrawing a sampling or sensing lance into and out of a shaft furnace through an opening in the wall of the furnace, the device comprising at least two driven endless chains which are equipped with gripping jaws with concave working surfaces, parts of the runs of the chains being adjacent and parallel to one another for gripping a lance between their jaws and carrying the lance to or from the furnace.

2. A device according to claim 1, in which the gripping jaws are thrust resiliently outwards, in use against the surface of the lance.

3. A device according to claim 2, in which the chains are roller chains and rollers mounted on link pins of the roller chains run along rails situated to the sides of the lance, at least one of the rails being influenced by springs so that it thrusts resiliently towards the lance.

4. A device according to claim 2, in which the gripping claws are resiliently constructed.

5. A device according to claim 1, in which the working surface of each gripping jaw is coated with a layer of or substantially constructed of nonslip, heat-resistant and wear-resistant synthetic material.

6. A device according to claim 1, in which the chains are driven reversibly by a common motor through a steplessly variable drive and through meshing gear wheels, one for each of the chains.

7. A device according to claim 6, in which the drive for the chains is situated near the end of the device to be remote from the furnace, spring-loaded tensioning wheels for the chains being mounted on bearings situated adjacent to the furnace end of the device.

8. A device according to claim 1, which is mounted to pivot on a vertical axle base.

9. A device according to claim 1, having disconnectable straps for securing the furnace end of the device to the furnace wall or to the furnace outer shell, and a sliding mounting which allows the device so slide longitudinally between limiting stops on horizontal pins supported by a turntable which rotates on a vertical support mounted on a baseplate.

10. A device according to claim 1, which is provided with a cleaning muff for surrounding the lance.

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