March 17, 1970 O. SCHWENG ET AL 3,501,136

DEVICE FOR LIFTING AND LOWERING OXYGEN LANCES FOR TOP-BLOWING CONVERTERS

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FIG. 1

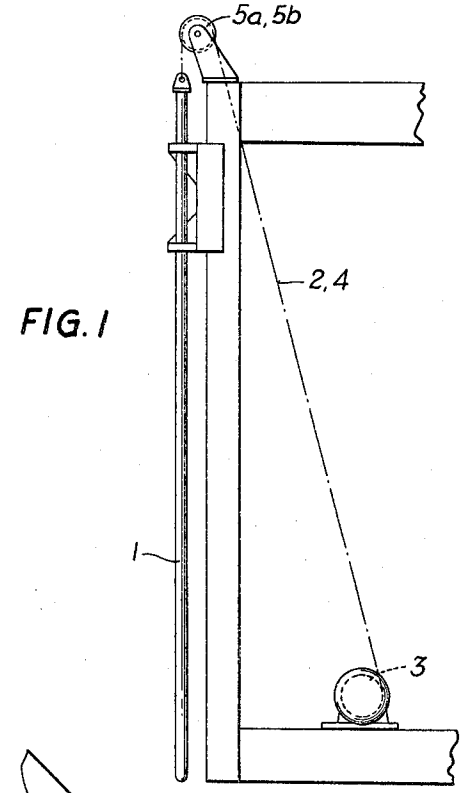
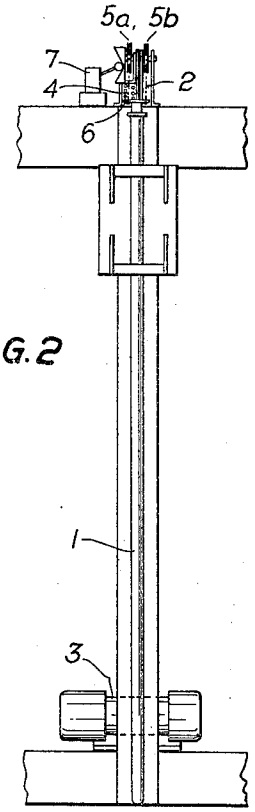
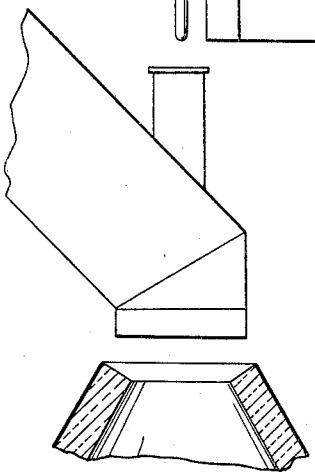
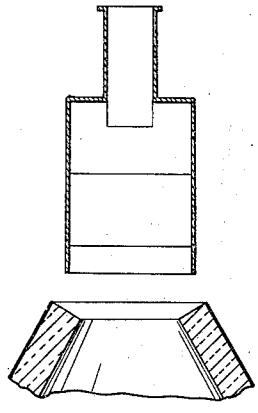


FIG. 2







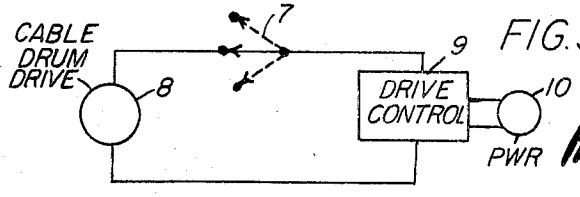


FIG. 5

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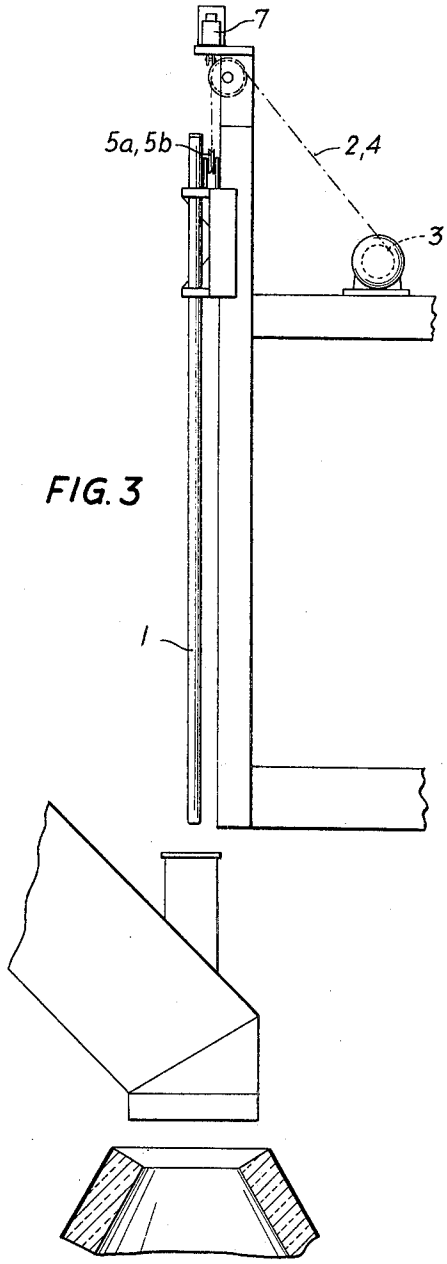

FIG. 3

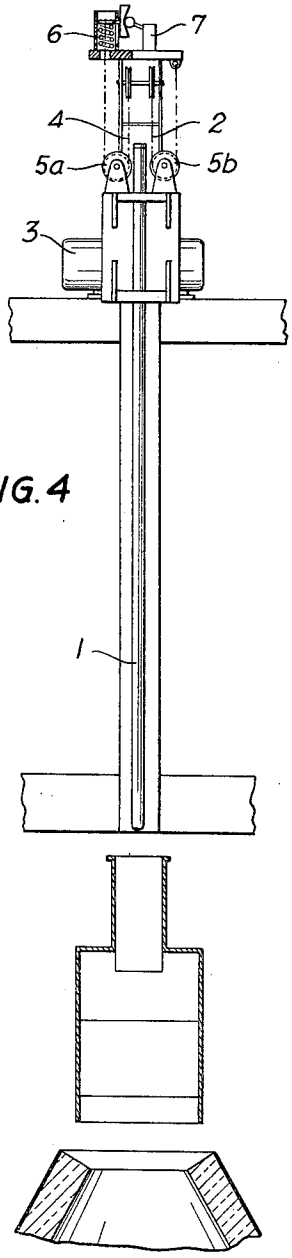

FIG. 4

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United States Patent Office 3,501,136 Patented Mar. 17, 1970

3,501,136

DEVICE FOR LIFTING AND LOWERING OXYGEN LANCES FOR TOP-BLOWING CONVERTERS

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Filed Oct. 16, 1967, Ser. No. 675,513
Claims priority, application Austria, Nov. 4, 1966, A 10,214/66
Int. Cl. C21c 7/06; B66d 1/54; B66b 5/02
U.S. Cl. 266—34 1 Claim

ABSTRACT OF THE DISCLOSURE

The invention comprises a means for safeguarding against cable breaks including a service cable carrying the load during normal operation and a spring-mounted auxiliary cable which takes over the load when said service cable breaks, both cables being wound on a common drum. A limit switch is arranged so as to be actuated by said spring when the load is transferred to said auxiliary cable, whereby movement of the lance is arrested.

The invention relates to a device for lifting and lowering oxygen lances for top-blowing converters, said device comprising a means for safeguarding against cable breaks.

In top-blowing processes for the production of steel, oxygen lances are used which can be inserted into the crucible or converter from above. Such lances must retain their functioning ability even when a cable breaks during a heat, and it is not sufficient that a safeguarding means prevents the lance from dropping into the converter, but provision must also be made that the heat can be finished, whereupon the lance is lifted, e.g. by means of a hand-operated winch, and the charge is subsequently teemed off.

A safeguarding means against cable breaks is already known from British patent specification No. 943,110, where the lance or lance carriage is suspended on an auxiliary cable as well as on the service cable, said cables being passed over two wheels mounted on a common drive shaft, one of said wheels being in stress-transmitting connection with the shaft while the other wheel is idling during normal operation, and where a clutch is provided, which positively connects the latter wheel with the drive shaft, when the service cable breaks. In that known arrangement, the auxiliary cable automatically takes over when the service cable breaks.

In smaller converter plants, a device is frequently used which is also provided with a service cable and an auxiliary cable, each having separate cable drums. The service cable winds up on the electrically driven drum (electric hoist), while the auxiliary cable runs over an auxiliary cable drum and is stressed by means of a counterweight. The auxiliary cable drum is provided with a shoe brake, which locks when the service cable breaks and thus arrests the load. A transmission, a ratchet catch and a handcrank on the auxiliary cable drum ensure its function as an emergency hand winch.

While the first-named device having two endless cable hauls and a clutch is rather expensive, the second-named device requires a separate auxiliary cable drum as well as a counterweight.

The invention has as its object to avoid these drawbacks and, in particular, to provide a device including a lance safety means requiring only one single cable drum. The device of the invention for lifting and lowering an oxygen lance for crucibles or converters comprising a means for safeguarding against cable breaks which has a service cable and an auxiliary cable, is characterized in that both cables are wound on a single drum and that during normal operation the load, owing to the limitedly resilient spring support of the auxiliary cable or its return means, is carried mainly by the service cable and only to a minor extent by the auxiliary cable.

According to a further advantageous characteristic of the invention, the spring reaction serves to operate control means.

In order that the invention may be more fully understood, embodiments in accordance therewith will now be described by way of example with reference to the accompanying drawings, in which:

FIGS. 1 and 2 show a lateral and a front view, respectively, of a single-track embodiment,

FIGS. 3 and 4 are similar lateral and front views showing a double-track embodiment, and

FIG. 5 is a schematic diagram of a drive control circuit for either of the two embodiments.

In all figures, numeral **1** denotes the lance which is guided along a vertical guidance by means of a lance carriage. Numeral **2** denotes the service cable and **4** the auxiliary cable. Both cables are wound up on drum **3**.

In FIG. 5, the drive **8**, e.g., an electric motor, for the cable drum **3** is energized from power source **10** for normal lifting and lowering operations by a suitable drive control **9**. A switch **7**, to be described more fully hereinafter, is normally closed as shown to complete the circuit.

In the single-track embodiment according to FIGS. 1 and 2, the guide pulley **5***b* of the service cable is stationarily mounted, while the guide pulley **5***a* of the auxiliary cable is movable in vertical direction and is influenced by a spring **6**. Thus, the auxiliary cable carries only a minor part of the load, depending on the resiliency of the spring **6** and on the resulting position of the guide pulley **5***a*, as long as the service cable is in order. When the service cable breaks, however, the whole load is transferred to the auxiliary cable; the spring **6** is further stressed, it is compressed and, when a certain limit is exceeded, the limit switch **7** is operated, primarily for switching off the lifting gear and for operating the brakes acting upon the drum, whereby the movement of the lance, which is now suspended on the auxiliary cable, is arrested. A handwheel or crank arranged on the cable drum enables manual lifting of the lance.

The embodiment according to FIGS. 3 and 4 works in a similar manner: In this instance, the guide pulleys **5***a* and **5***b* are arranged on the lance carriage forming a double roller haul. The cables are fixed to the drum **3** with one end, on the other side, the service cable is fixed to the upper end of the lance carriage, while the auxiliary cable is suspended on spring **6**. This results in a load on the auxiliary cable corresponding to the resistance of the spring, which load amounts to a fraction of the live load. The load is thus carried almost exclusively by the service cable. When, however, this cable breaks, the auxiliary cable takes over the whole load, whereby the spring **6** is compressed accordingly, and, when a certain adjustable distance is exceeded, actuates, e.g., a limit switch **7**, which controls the brakes of the cable drum, as indicated in FIG. 5.

Also as shown in FIG. 5, by arranging a further limit switch lug operating the limit switch when the spring **6** expands, the arrangement can also be used as a slack rope safeguarding means which comes into effect for instance when the lance meets with a solid obstacle during lowering. In that case, both cables are relieved of their load, the service cable slackens completely, due to its fixed mounting, while the spring-mounted auxiliary

cable enables complete expansion of the spring 6, whereby the limit switch is operated.

By a suitable choice of the spring characteristic, the shock stress on the auxiliary cable, which will occur upon a break of the service cable, can be reduced to a tolerable and controllable measure.

What we claim is:

1. For use with a top-blowing converter, apparatus for lifting and lowering an oxygen lance vertically into and out of said converter comprising, a service cable and an auxiliary cable supporting said lance, a cable drum, both said service and auxiliary cables being wound on said drum, said auxiliary cable being supported by means including a limitedly resilient spring so that during normal operation, the load is carried mainly by said service cable and only to a minor extent by said auxiliary cable, and control means responsive to both predetermined compression and predetermined expansion of said spring beyond its normal operating condition for stoping movement of said lance.

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HARVEY C. HORNSBY, Primary Examiner

U.S. Cl. X.R.

187—71; 254—144