This invention relates to improvements in cupola stock line indicators.

During cupola operation it is essential that the level of the stock in the cupola be maintained within predetermined limits for maximum efficiency. In addition, in conventional open type cupulas where there is a side charging opening, if the level of the stock is too high it may be difficult to withdraw the charging bucket from the cupola. In the closed type cupula of more recent design, the stock is likely to obstruct the exhaust gas ductile ports when the level is too high.

The present invention is an improvement over the construction shown and described in Gionet application, Serial No. 341,670, filed March 11, 1953. In the stock line indicator of the prior application the plungers are likely to be damaged by a falling or shifting charge, and to replace a plunger requiring a complete removal of the stock line indicator assembly. In addition, in the prior application the switches were too delicate.

It is a general object of the present invention to provide a stock line indicator which is so constructed and supported on the cupola that a damaged plunger may be replaced in a few minutes time.

A further object of the invention is to provide a stock line indicator as above described wherein limit switches are mechanically actuated in a foolproof and simple manner.

A further object of the invention is to provide a stock line indicator which is relatively simple and inexpensive in construction, reliable in operation, and otherwise well adapted for the purpose described.

With the above and other objects in view, the invention consists of the improved stock line indicator, and all of its parts and combinations, as set forth in the claim, and all equivalents thereof.

In the accompanying drawings, in which the same reference numerals designate the same parts in all of the views:

Fig. 1 is a fragmentary side elevation view of a cupola showing the improved stock line indicator connected thereto;

Fig. 2 is an enlarged side elevation view of the stock line indicator showing it attached to a portion of the cupola; and

Fig. 3 is a view taken on the line 3—3 of Fig. 2, parts being shown in section.

Referring more particularly to the drawings the numeral 5 designates a cupula of any suitable type which is adapted to be charged by the usual skip-carrigage (not shown). The cupula includes a metal shell 6 having a refractory lining 7. The shell 6 has an opening 8 cut therein of a size to receive a steel mounting plate 9. It is preferred to have the hole 8 and mounting plate 9 square. The edges of the mounting plate 9 are welded to the adjacent edges of the opening. Bolted to the mounting plate 9 by bolts 10 is a supporting plate 11. Suitably secured to and projecting horizontally outwardly from the plate 11 is an inverted channel-shaped bracket 12, there being a triangular gusset 13 connecting the inner end of the bracket 12 along one side thereof with the plate 11, as shown in Fig. 2. On the opposite side of the channel-shaped bracket 12 is an upright wall 14 which has its inner end also secured to the plate 11. The wall 14 supports limit switches 15 and 16. The limit switch 15 has a pivoted actuating arm 17 and the limit switch 16 has a similar arm 18. A small cover plate 19 is bolted to the plate 11. Said plate 19 has a central opening for slidably guiding the indicator plunger 20. The plunger also extends through an aligned opening in the plate 11, through a larger opening in the mounted plate 9, and through a flared opening 22 in the refractory lining 7 of the cupula.

Supported on the bracket 12 is a fluid cylinder 23 of the double acting type, having a fluid conduit 24 communicating at one end with its interior and having a fluid conduit 25 communicating at the opposite end with its interior. The cylinder 23 has a pushrod 26 slideable therein, there being a piston rod 27 which has one end projecting from the inner end of the cylinder where it is threaded into an internally threaded socket 28 of a special coupling 29. The opposite end of the coupling has a similar, reversely facing internally threaded socket 30. Intermediate the length of the coupling member is a disk which forms a switch actuating shoulder 31, the disk being of substantially larger diameter than the coupling portions proper. The outer end of the indicator plunger 20 is threaded into the coupling socket 30.

In use of the improved stock line indicator, inward movement of the plunger 20 is initiated manually in any desired manner to cause an actuating fluid under pressure to flow into the right hand end of the cylinder 23 through the line 24. This will move the plunger 20 and shoulder 31 toward the dot and dash line position of Fig. 3. If no obstruction is encountered within the cupola, the plunger 20 and shoulder 31 will travel to the dot and dash line position of Fig. 3, with the plunger fully projected into the cupula and the shoulder 31 in a position where it has moved the arm 17 of the limit switch 15 to the dot and dash line position of Fig. 3.

Through any suitable hook up such as is described in the accompanying application of Leo A. Gionet, Serial No. 341,670, actuation of the limit switch 15 will cause reversal of fluid pressure flow through the cylinder 33 and retractive movement of the plunger 20. Upon completion of its retractive stroke, the shoulder 31 will engage the arm 18 of the limit switch 16. Through any suitable hook up, such as is described in the above mentioned coupling application, Serial No. 341,670, this will stop the movement of the plunger and at the same time a suitable signal indicating that the stock level in the cupula is low enough for the cupula to take another charge may be operated or actuation of the limit switch may be used to initiate the operation of the skip-carrigage which is to load the cupula, as is fully described in the accompanying application. If on the other hand an obstruction stops the plunger from being projected its maximum distance into the cupula, then neither of the limit switches 15 or 16 will be actuated, and the operator will know that there will or can be no more charging of the cupula until the stock level has lowered to a proper point. The stock indicator is so positioned that if the stock height in the cupula is just below the reach of the plunger 20, then the cupula can take another charge without being loaded beyond the desired maximum stock height.

If the plunger 20 should become bent or otherwise damaged by the falling charge, or by shifting of the charge, it is merely necessary to take a pipe wrench and unscrew the outer end of the plunger 20 from the threaded socket 30. The plunger can then be pushed into the cupula and allowed to fall down with the charge. A new plunger...
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20 can then easily be pushed into the opening in the wall of the cupola, and then pulled outwardly enough so that its outer end can be screwed into the threaded socket 30 of the coupling member 29.

It is thus apparent that a very simple arrangement has been provided whereby plungers can be replaced in a matter of minutes. In addition, the novel coupling member is so constructed and arranged that it carries an actuating shoulder positioned to actuate the limit switches.

Various changes and modifications may be made without departing from the spirit of the invention, and all such changes are contemplated, as may come within the scope of the claim.

What we claim is:

In a cupola having a surrounding wall defining a stock chamber, a relatively thick lining on the inner side of said wall, said wall having a plunger-guiding opening and said lining having an opening which affords communication between the plunger guiding opening and the chamber, a projecting device having a reciprocable piston rod, means mounting said projecting device in spaced position from the exterior of said wall with said piston rod aligned with and movable toward the guiding opening in the wall, an indicating plunger having a free inner indicating end movable in said guiding opening of the cupola wall to a projected position within the stock chamber where it is subject to damage by the stock and having its outer end projecting externally, a coupling member detachably connecting the outer end of the piston rod to said outer end of the indicating plunger with the length of the plunger such that its inner end is in the opening of the lining when the piston rod is retracted, the mounting for the projecting device so spacing the latter from the cupola wall that there is a substantial exteriorly accessible space between the outer end of the piston rod and the guiding opening of the wall when the piston rod is retracted and so spaced that the coupling member stops short of the wall when the piston rod is fully extended whereby the coupling is always accessible from said exteriorly accessible space, said opening in the lining being inwardly flared to provide for movement of the plunger to an angular position with respect to the axis of the piston rod after the plunger has been disconnected therefrom, and said coupling member and guiding opening furnishing such support for the plunger that the latter is freely withdrawable from said guiding opening after the coupling has been disconnected to permit easy replacement after damage.

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