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(54) Steel plate shearing installation.

(57) A steel strip shearing installation includes in series a pay-off reel for unwinding a steel strip therefrom, detectors for detecting defects and pin holes on the steel strip, a shearing machine for shearing the steel strip into predetermined sizes, a piling apparatus for piling the sheared and classified strips, and others. According to the invention, the installation comprises bridle rolls between the detectors and the shearing machine for exerting tensile force on the steel strip sufficient to maintain it in a horizontal position without its slack or upward or downward movement, thereby improving the accuracy of detecting defects on the steel strip and eliminating errors in measured length of the steel strip and therefore enabling electromagnet rolls at branching points of belt conveyors of the piling apparatus to be correctly operated in good timing to ensure the classification of acceptable and unacceptable products.

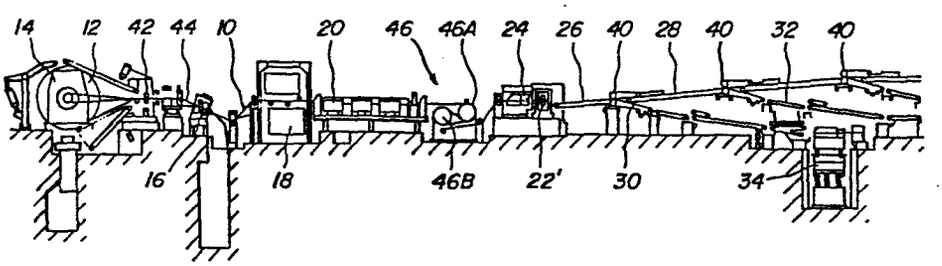

FIG_2

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STEEL PLATE SHEARING INSTALLATION

This invention relates to a shearing installation for steel plates or strips, and more particularly a steel plate shearing line in which steel plates or strips are sheared into predetermined lengths while their surface states are inspected and according to the inspected results the sized plates are divided into acceptable and unacceptable products which are then piled in a piling apparatus, respectively.

The term "plate" or "steel plate" used herein is intended to designate a relatively thin steel plate such as a steel strip which is able to be wound about a reel.

Fig. 1 illustrates a hitherto used steel plate shearing line installation. In this installation a coil 12 of a steel strip 10 is mounted on a pay-off reel 14 which is driven so as to unwind the steel strip 10 to supply it to the line. The unwound steel strip 10 is fed in its free loop to a side trimmer in which the strip 10 is treated such as trimming of edges of the strip. The trimmed strip 10 is fed again in a free loop into an automatic defect detector 18 and a pin hole detector 20 downstream of the side trimmer, where defects and pin holes on the surfaces of the strip are inspected or detected. The steel strip 10 which has passed these detectors 18 and 20 is directly fed into a shearing machine 22 so as to be cut into

steel strips of predetermined lengths. During the above processes, the steel strip 10 is forcedly pulled so as to be advanced by pinch rolls 24 incorporated in the shearing machine 22.

Downstream of the shearing machine 22 is arranged a piling apparatus in which the sheared steel strips are transferred by a plurality of branched belt conveyors 26, 28, 30 and 32 so as to be piled up in respective pilers 34 and 36. The pilers 34 and 36 are plural and steel strips having defects to be rejected are piled in exclusive pilers for unacceptable products.

In such a hitherto used steel plate shearing line, the steel strip 20 unwound by the pay-off reel 14 is advanced by the pulling action of the pinch rolls 24 incorporated in the shearing machine 22. As such a pulling action is provided for the purpose of feeding the steel strip into the shearing machine 22, its tensile force cannot be generally adjusted at will. Accordingly, the steel strip 10 being transferred in the automatic defect detector 18 and the pin hole detector 20 is not subjected to a tensile force sufficient to prevent the steel strip from moving upward and downward. In order to avoid such movements, it is conceivable to arrange support rolls 38 in contact with a lower surface of the strip 10 to maintain it at a constant level as shown in Fig. 1. However, the strip 10 being transferred tends to slack because the number of the support rolls is limited owing to the

requirement resulting from the performance of the automatic defect detector 18 in conjunction with the small tensile force acting upon the strip as above described.

On the other hand, the upward and downward movements of the strip 10 often give rise to malfunction of the automatic defect detector 18 because it detects defects or cracks or flaws on the surfaces of the strip with the aid of light beam reflections. Moreover, if the automatic defect detector 18 or the pin hole detector 20 detects on the strip, the sheared strips including such defects should be separated from remaining acceptable strips so as to pile in the pilers for the unacceptable products. For this purpose, a pulse generator (not shown) is arranged at one end of the pinch roll 24 so as to measure the lengths of the sheared strips to energize electromagnet rolls 40 selectively such that the defect including strips are introduced into the exclusive pilers for the unacceptable products. As above mentioned, however, from the fact that the strips are frequently slack or loosen and what is worse still the slacks of the strips are not uniform but various in extent, so that measured lengths change incorrectly to make improper the operating timing of the electromagnet rolls 40. As the result, the unacceptable steel strips to be rejected will be led to the pilers for acceptable steel strips rather than the pilers for rejected strips to give rise to

a prohibitively serious problem.

It is primary object of the invention to provide an improved steel plate shearing line which eliminates the disadvantages of the prior art and which is able to detect defects of steel strip with improved accuracy and ensures proper classification of acceptable and unacceptable products to prevent the unacceptable products from being mixed with the acceptable products.

The above object can be accomplished by the steel strip shearing installation according to the invention including in series downstream of a pay-off reel for unwinding a steel strip therefrom, inspecting means for detecting defects of the steel strip, a shearing machine and piling means for piling sheared and classified steel strips, said installation comprising bridle rolls between said inspecting means and said shearing machine for exerting tensile force on the steel strip, thereby preventing slack, loosening and upward and downward movement of the steel strip downstream of the inspecting means.

ln a preferred embodiment of the invention, the bridle rolls are arranged immediately upstream of the shearing machine.

The tensile force is preferably of the order of 0.1-2 kg/mm^2 sufficient to maintain the steel strip in a horizontal position, and is preferably adjusted by controlling load current of driving means of pay-off reel and the bridle rolls.

With this construction above described, the bridle rolls arranged between the inspecting means and the shearing machine exerts tensile force on the steel strip in the installation line so as to transfer the strip in a horizontal position without any slack or upward or downward movement, thereby greatly improving the accuracy of detecting defects on the steel strip by an automatic defect detector or a pin hole detector and eliminating errors in measured length of the steel strip by a pulse generator provided on pinch rolls adjacent to the shearing machine. As the result, electromagnet rolls at branching points of belt conveyors for pilers are correctly operated in good timing to ensure the classification of acceptable and unacceptable products.

In order that the invention may be more clearly understood, preferred embodiments will be described, by way of example, with reference to the accompanying drawings.

Fig. 1 illustrates an arrangement of the steel plate shearing installation of the prior art; and

Fig. 2 illustrates an arrangement of the steel plate shearing installation according to the invention.

Fig. 2 illustrates a steel plate shearing line according to the invention. As can be seen from this illustration, a coil 12 of a steel strip 10 is mounted on a pay-off reel 14 as in the prior art shown in Fig. 1, but entry pinch rolls 42 embracing the unwound steel strip 10 and deflector pinch rolls 44 are

arranged downward of the pay-off reel 14. Downstream of these pinch rolls 42 and 44 is arranged a side trimmer 16 where edges of the strip 10 are trimmed. Downstream of the side trimmer 16 are located an automatic defect detector 18 and a pin hole detector 20 for detecting various defects on surfaces of the strip 10. The steel strip 10 is therefore inspected to detect surface defects after it's edges are trimmed.

The steel strip 10 is then fed from the pin hole detector 20 to a shearing machine 22' including pinch rolls 24. According to the invention, bridle rolls 46 are arranged immediately upstream of the shearing machine 22' and between the pin hole detector 20 and the shearing machine 22' for the purpose of exerting tensile force on the steel strip 10 between the bridle rolls 46 and the pay-off reel 14. The tensile force is a unit force of the order of 0.1-2 kg/mm^2 sufficient to maintain in a horizontal position the steel strip 10 being transferred for inspection by the detectors 18 and 20. This adjustment of the tensile force is effected at will by controlling the load current of dirving motors (not shown) for the pay-off reel 14 and the bridle rolls 46.

The steel strip 10 which has passed through the bridle rolls 46 is fed to the pinch rolls 24 provided immediately upstream of the shearing machine 22' and then fed thereinto. In this case, the shearing machine 22' comprises length measuring pinch rolls 24

driven together with the shearing machine 22' in unison. The shearing machine 22' is numerically controlled by commands based on measured lengths in the pinch rolls to cut the steel strip into desired length strips without requiring any looping pit for accommodating loops of steel strips. The shearing machine 22 only mechanically controlled of the prior art requires the looping pit in order to compensate the deviation in speed from those of the other machines. In this manner, the steel strips of the predetermined lengths are then fed to properly selected pilers 34 by belt conveyors 26-32.

At branching points of the belt conveyors for the respective pilers are arranged electromagnet rolls 40 whose exciting effect determines directions of the steel strips to be transferred to the pilers. Accordingly, steel strips including defects detected by the above defect detectors are transferred to the pilers for unacceptable strips with the aid of the electromagnet rolls 40.

With the steel plate shearing line constructed as above described, as the bridle rolls 46 provided between the defect detectors and the shearing machine 22' exert tensile force on the steel strip 10 between the pay-off reel 14 and the bridle rolls 46, the steel strip 10 does not undergo any upward and downward movements and does not slack when passing through the automatic defect detector 18 and the pin hole detector 20', so that defects on the strip surfaces can be

exactly detected with improved accuracy even by defect detectors utilizing light beam reflections.

When any defect is detected, the length of the steel strip is simultaneously measured by a pulse generator provided on the pinch roll 24 immediately upstream of the shearing machine 22'. In this case, as the bridle rolls 46 are located upstream of the shearing machine 22', there is no tendency of the steel strip to slack or loosen thereat. Accordingly, the count number by the pulse generator to the detected position correctly indicates the length of the steel strip without any discrepancy so that the electromagnet rolls 40 at the pilers 40 are properly operated in good timing.

As can be seen from the above description, with the steel plate shearing installation according to the invention, there is no longer any errors in detection of defects and in operating timing of the electromagnet rolls 40 at pilers, thereby eliminating the mixing products to be rejected with acceptable products. Moreover, as free loops are removed from the line, the installation can be small-sized.

It is further understood by those skilled in the art that the foregoing description is that of preferred embodiments of the disclosed installation and that various changes and modifications may be made in the invention without departing from the spirit and scope thereof.

CLAIMS

1. A steel strip shearing installation including in series downstream of a pay-off reel for unwinding a steel strip therefrom, inspecting means for detecting defects of the steel strip, a shearing machine and piling means for piling sheared and classified steel strips, said installation comprising bridle rolls between said inspecting means and said shearing machine for exerting tensile force on the steel strip, thereby preventing slack, loosening and upward and downward movement of the steel strip downstream of the inspecting means.

2. A steel strip shearing installation as set forth in claim 1, wherein said bridle rolls are arranged immediately upstream of said shearing machine.

3. A steel strip shearing installation as set forth in claim 1, wherein said tensile force is of the roder of 0.1-2 kg/mm^2 sufficient to maintain said steel strip in a horizontal position.

4. A steel strip shearing installation as set forth in claim 1, wherein said tensile force is adjusted by controlling load current of driving means of said pay-off reel and said bridle rolls.

5. A steel strip shearing installation as set forth in claim 1, wherein immediately upstream of said shearing machine there are provided pinch rolls including a pulse generator for measuring length of the steel strip.

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FIG. 1
PRIOR ART

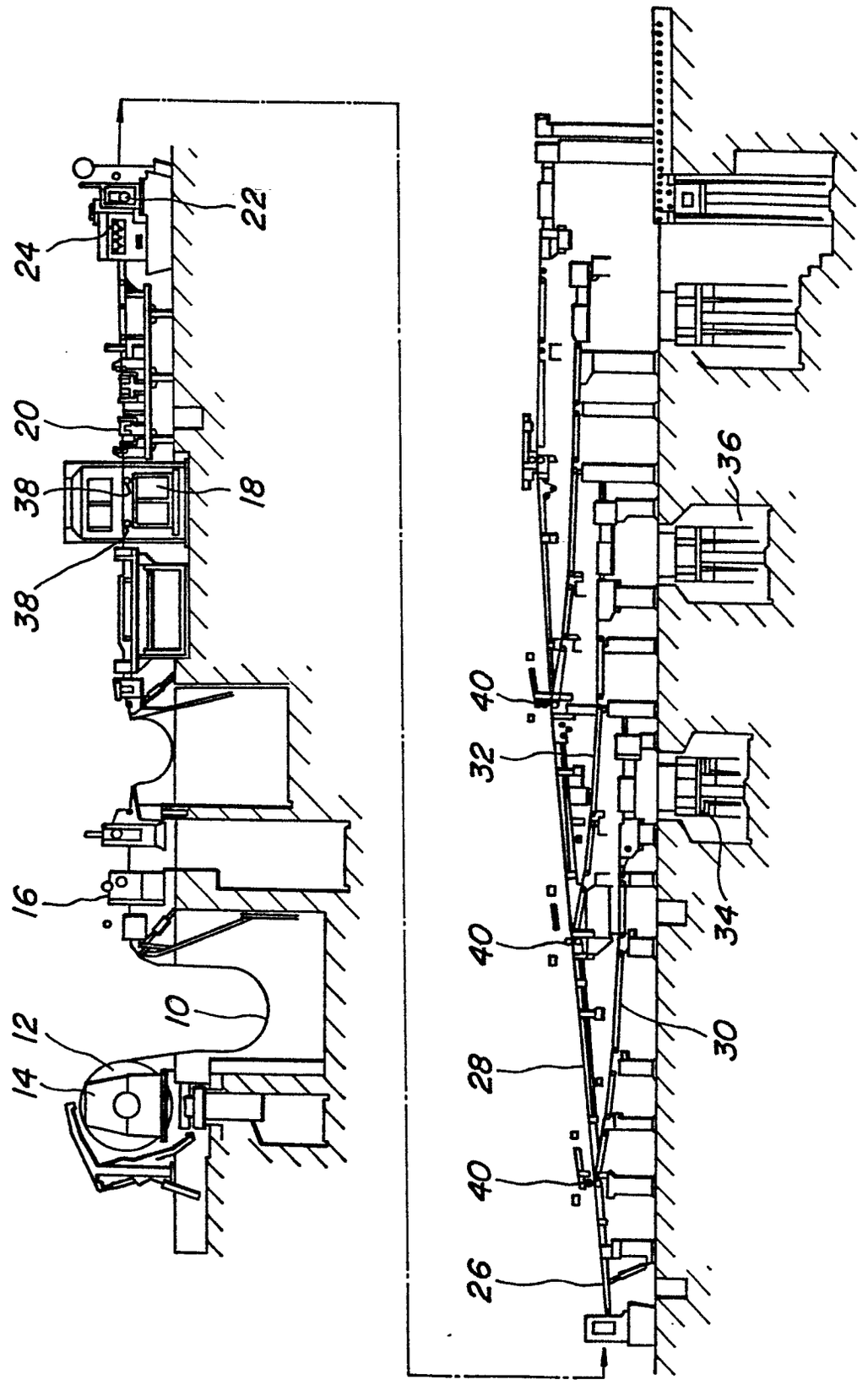

FIG.2