

March 27, 1956

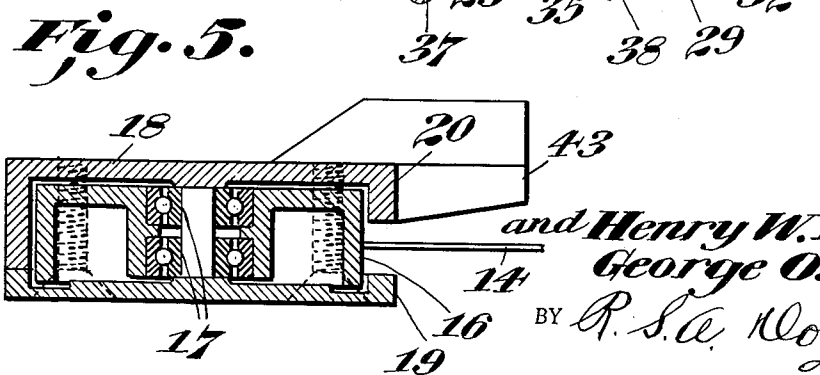
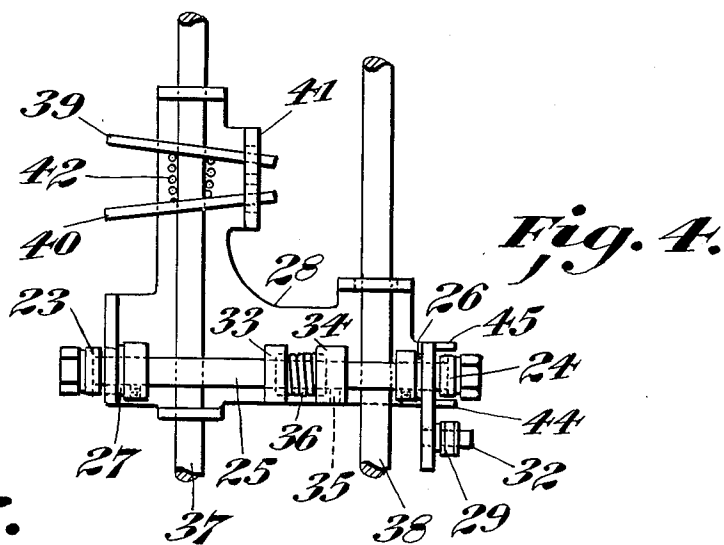
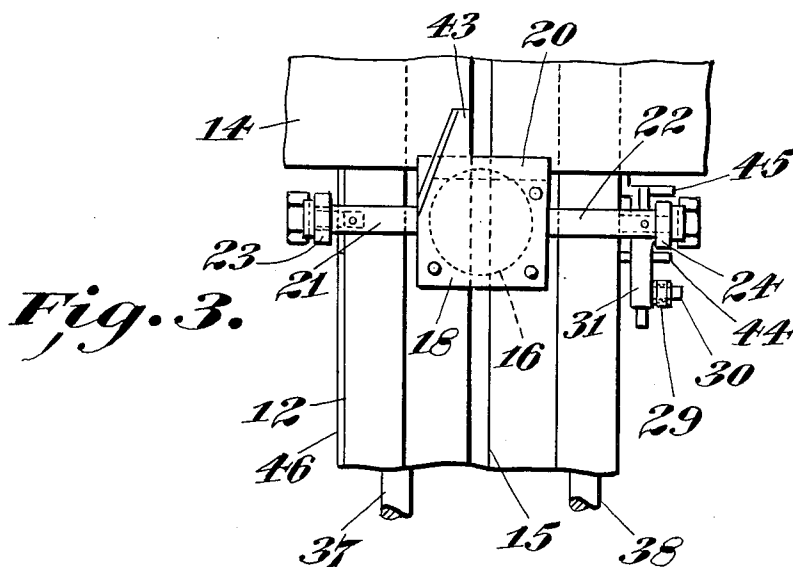
H. W. NIEMAN ET AL

2,739,503

INSPECTION DEVICE FOR MOVING STRIP

Filed Jan. 24, 1952

2 Sheets-Sheet 2



INVENTORS

and Henry W. Nieman
George O. Maish.

BY R. S. O. Wougherty.
ATTORNEY

1

2,739,503

INSPECTION DEVICE FOR MOVING STRIP

Henry W. Nieman and George O. Maish, Bethlehem, Pa.,
assignors to Bethlehem Steel Company, a corporation
of Pennsylvania

Application January 24, 1952, Serial No. 268,076

6 Claims. (Cl. 88—14)

This invention relates to shielding mechanism for use in connection with photo inspection device for strip metal particularly stock to be used for the production of tin plate. This inspection method is used for the detection of holes and operates on the principle of shining light on one side of the strip and detecting a hole by the passage of light therethrough. The equipment can be located at any point where the strip is travelling continuously, usually in conjunction with one of the latter stages of manufacture.

It has for its object the provision of edge shields which will prevent the passage of light around the edges of the strip by means which will permit inspection to within a very small distance from these edges. It has further objects of providing shields which are automatic in adjustment, practically free from wear and possessing other advantages which will be more fully understood from the description and drawings.

Figs. 1 and 2 show respectively the end and side elevations of the mechanism.

Fig. 3 is a top view of the upper portions of the mechanism.

Fig. 4 is a top view of the lower portions of the mechanism.

Fig. 5 is a cross section of a section of the mechanism.

Referring to the drawing, 11 and 12 are boxes containing light source and photo-electric equipment respectively, both mounted rigidly in place, the light passing through lens system 13, impinging on strip 14 of any opaque material which is to be inspected for holes, and hole, through lens system 15, and operatively affecting the photo-electric equipment indicates the presence of said hole. Shields are required at the edges of the travelling strip to prevent light from passing directly from the light source to the photo-electric equipment. Hitherto fixed shielding mechanism has been employed which has the disadvantage that since the strip weaves from side to side a large margin of safety must be provided to prevent inadvertent light leakage, and this large margin shields a considerable portion of the edges of the strip, so that these regions are not inspected. In operations it has been found impracticable without constant supervision to keep this uninspected region less than about $\frac{3}{4}$ inch wide on each edge. The present invention contemplates the use of roller shields on the edges so mounted and arranged that they follow the side movements of the strip always in contact and maintain a fixed and very small width of uninspected edge. Fig. 5 shows a cross section of the head of one of such roller guides where 16 is a wheel mounted on bearings 17 so as to be free to revolve in casing 18 and contacting the edge of strip 14 at the periphery of the wheel. Projecting lips 19 and 20 of casing 18 project over the strip edge and provide the light seals. Casing 18 is held by arms 21 and 22 pivotally mounted in side arms 23 and 24. Arms 23 and 24 are at their lower ends rigidly fastened to shaft 25, which is free to rotate in bearings 26 and 27 in

2

cradle 28. Link 29 is pivoted at its upper end at 30 to arm 31, the latter being a portion of arm 22. At its lower end link 29 is pivoted at 32 to a portion of cradle 28, the arrangement of arms 24 and link 29 constituting a parallel motion so casing 18 while free to move with the edge of the strip is always kept in a level position. Stops 44 and 45 attached to cradle 28 prevent over-movement of arms 24. Between member 33 which is a portion of cradle 28 and collar 34 rotationally adjustable on shaft 25 and held in desired position by set screw 35, spring 36 is operatively connected to apply a torque to urge wheel 16 against the edge of the strip with any predetermined degree of force.

Cradle 28 is mounted so as to be free to slide on bars 37 and 38 rigidly mounted on the frame of the machine and to be held in any desired position by clamping arms 39 and 40 pivoted in bracket 41 and urged apart by compression spring 42, the arrangement being such that when the free ends of these arms are squeezed together the cradle may be moved along the bars, but when the arms are released the spring forcing them apart causes them to clamp firmly on bar 37.

In order to enter the strip freely and to prevent any abrupt discontinuities in the edge of the strip from causing the strip to jump out of the space between lips 19 and 20, which for efficient sealing of light must be close together, nose 43 is provided with a tapering entrance section and large overhang, this nose being cut away at its inward end so that it does not interfere with the passage of light between the lens system.

It will be understood that two pieces of apparatus such as illustrated, must be used in conjunction, one for each edge of the strip. In operation the strip is first threaded through the apparatus, and the cradles on the two sides are adjusted so that the side arms 24 are approximately vertical. No close adjustment is necessary since the heads are free to move back and forth with the strip through a considerable distance.

It will be observed that motion of the head members in following the weaving of the strip is accomplished solely through the use of pivots, there being no sliding surfaces. This has been secured through the use of the parallel motion and is highly important since in the situation in which such equipment is used there is a large quantity of dust, especially metallic powder from the moving strip, which causes any sliding surfaces quickly to bind and seize.

Since badly torn or twisted edges or other edge deformities on the moving strip can destroy anything but the most rigid mechanism, means have been provided for furnishing support to the apparatus in such an eventuality. Along the edge of box 12, bar 46 is fastened allowing only slight clearance between bar and side arm 23. Then if any strip edge deformity tends to pull casing 18 out of position, the flexibility of the apparatus allows arm 23 to come against bar 46 and prevent further movement.

When inspecting narrow strip the combined widths of the strip and the two shield casings may not be sufficient to cover the entire optical system the width of which is designed for the widest strips which may be encountered. An additional shield 47 is therefore provided in the form of a thin opaque plate which is placed over the exposed portion of optical system 15 and lapping slightly under the casing 18.

We claim:

1. In apparatus for detecting imperfections in moving strip by photoelectric means, a shield for the edge of the strip comprising a roller adapted to contact the edge of the moving strip, a housing whereon said roller is mounted for revolution against the edge of the strip, said housing having a member adapted to overlap the edge of the strip, link means whereon said housing is mounted

3

for movement transversely of the normal path of the strip, and resilient means operatively connected to said latter means for urging said housing towards the strip.

2. In apparatus for detecting imperfections in moving strip by photoelectric means, a shield covering an edge of the strip, a housing carrying said shield, a roller mounted in said housing and adapted to position said shield with respect to the edge of the moving strip, a support positioned beneath the level of the strip, parallel link means pivotally connected to the support and mounting said housing for movement transversely of the normal path of the strip, and spring-actuated means on the support urging the housing towards the strip.

3. In apparatus for detecting imperfections in moving strip by photoelectric means, a shield covering an edge of the strip, a housing carrying said shield, a roller mounted in said housing and adapted to position said shield with respect to the edge of the moving strip, guide means located transversely beneath the strip, a support longitudinally adjustable on the guide means, parallel link means whereon said housing is mounted for movement transversely of the normal path of the strip intermediate the housing and the support, and spring-pressed means operatively urging the housing towards the strip.

4. In apparatus for detecting imperfections in moving strip by photoelectric means, the combination comprising a pair of guide bars extending laterally from beneath the strip, a cradle slidably mounted on said guide bars, means for clamping the cradle in position on the guide bars, upright side arms having their lower ends pivotally attached to the cradle, a casing pivotally mounted at the upper ends of said arms, light sealing means and a strip engaging roller on said casing, link means between the

4

cradle and the casing for permitting parallel sidewise travel of the roller following the sidewise weaving of the strip, and means for limiting the distance of said sidewise travel.

5. In apparatus for photoelectrically detecting imperfections in moving strip and including a casing carrying light sealing members and a roller engaging the strip edge, the means for mounting said casing comprising a pair of parallel spaced guide bars extending laterally in relation to the strip, a support member slidably mounted on the guide bars, releasable clamping means for holding the support member in desired position on the guide bars, a shaft pivotally mounted on the support member, upright parallel arms attached to said shaft and pivotally supporting the casing, a rotationally adjustable collar on said shaft, and a coil spring operatively connected between the collar and the support member to apply torque to the arms and thereby press the roller against the edge of the strip.

6. In the apparatus claimed in claim 5, said coil spring serving the additional function of a buffer for resisting sudden shocks produced by edge deformities or the like on the moving strip, and rigid means to prevent excessive deflection of the apparatus lengthwise of the strip by said edge deformities.

References Cited in the file of this patent

UNITED STATES PATENTS

1,437,895	Horst	Dec. 5, 1922
1,491,946	Crocker	Apr. 29, 1924
1,966,684	Pollock	July 17, 1934
2,395,181	Hags	Feb. 19, 1946
2,504,949	Foufounis	Apr. 25, 1950