Feb. 3, 1959 H. W. LYNN ET AL 2,872,039

STRIP INSPECTING APPARATUS

Filed Nov. 5, 1954

2 Sheets-Sheet 1

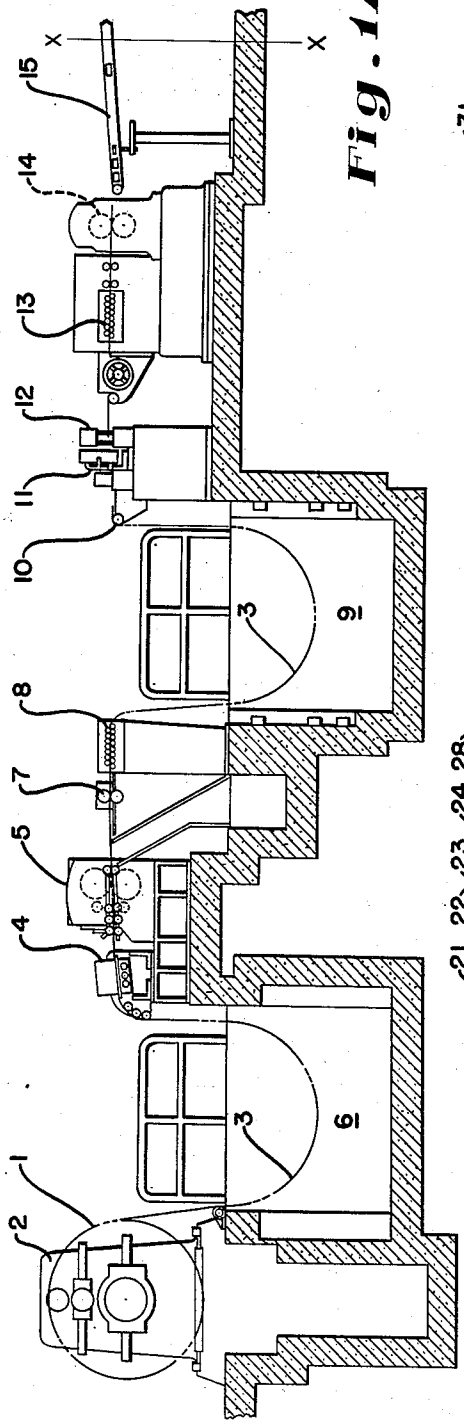


Fig. 1A.

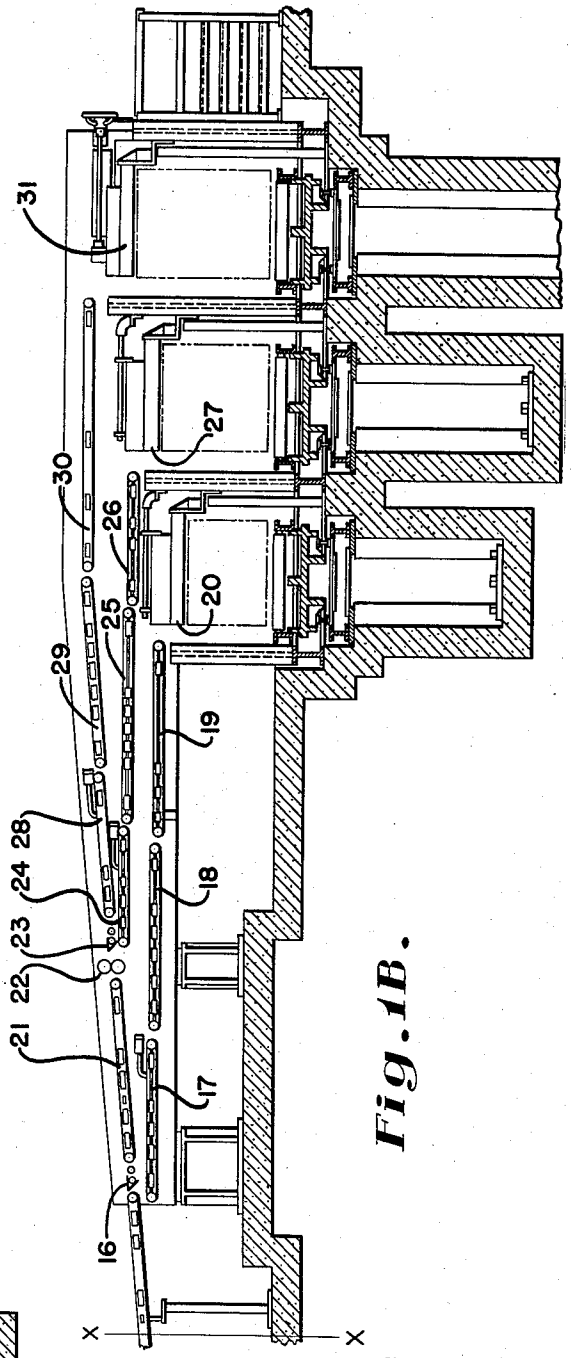


Fig. 1B.

INVENTORS
HOLMES W. LYNN
ALBERT R. GEISZLER
BY
Hoopes, Leonard & Buell
their Attorneys

Feb. 3, 1959

H. W. LYNN ET AL

2,872,039

STRIP INSPECTING APPARATUS

Filed Nov. 5, 1954

2 Sheets-Sheet 2

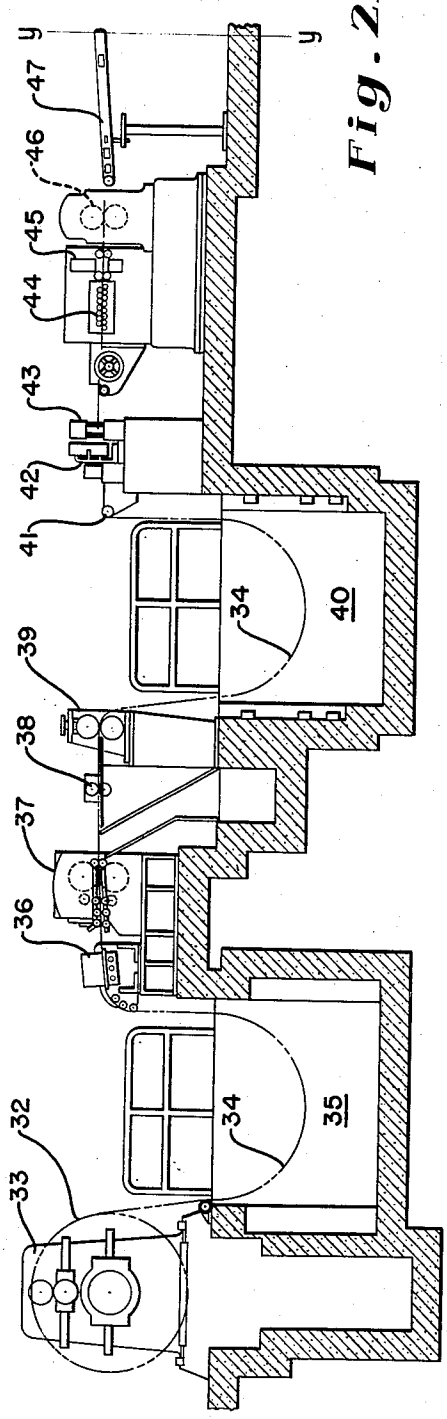


Fig. 2A.

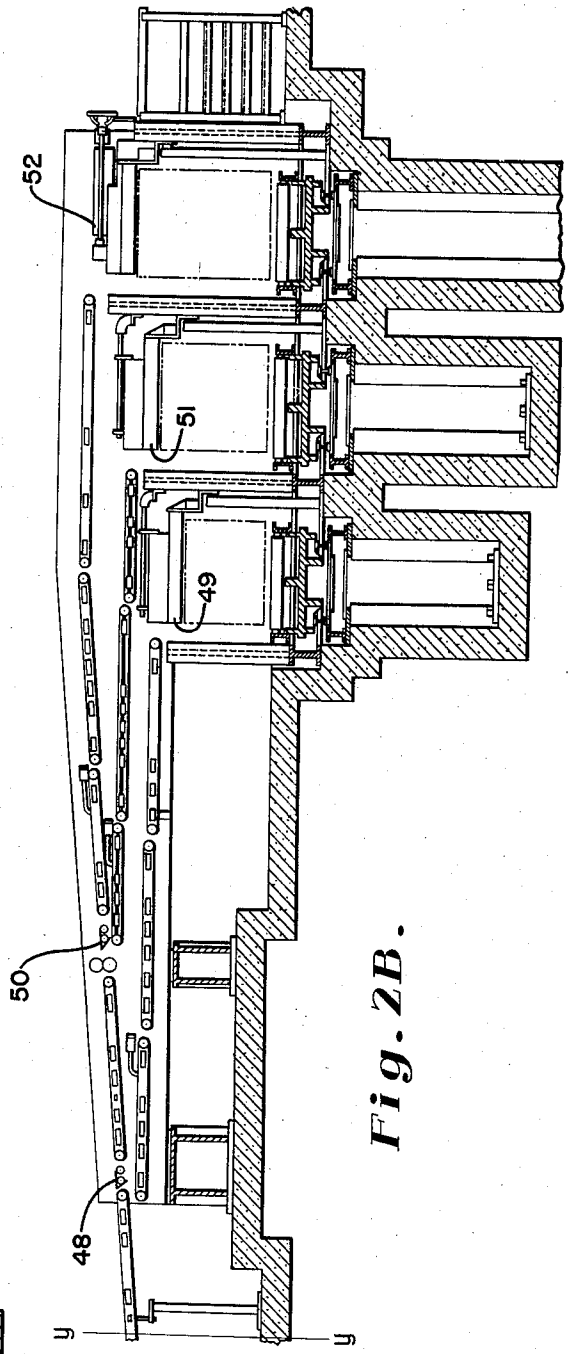


Fig. 2B.

INVENTORS
HOLMES W. LYNN
ALBERT R. GEISZLER
BY
Hopgood, Leonard & Bulkley
their attorneys

United States Patent Office

2,872,039

Patented Feb. 3, 1959

2,872,039

STRIP INSPECTING APPARATUS

Holmes W. Lynn and Albert R. Geiszler, Warren, Ohio, assignors to The Wean Engineering Company, Inc., Warren, Ohio, a corporation of Ohio

Application November 5, 1954, Serial No. 467,042

4 Claims. (Cl. 209—111)

This invention relates to the inspection of strip. It relates particularly to the inspection of continuously moving strip for perforations in the strip.

In the manufacture of strip, particularly of very thin strip, perforations may appear in the strip due to flaws in the material or in the rolling process.

When strip has been manufactured, but before using it, it is desired to inspect the strip for perforations and other imperfections. This has commonly been done before the strip is cut into sheets for further processing. It has been found, however, that many perforations which should have been detected by the inspecting means have remained undetected and that sheets containing such flaws have not been segregated from the prime sheets coming out of the shear.

We have discovered that by flexing strip, existing perforations which were heretofore too small to be detected by conventional detecting means, particularly in the case of tin plate, appear to be enlarged, and the inspecting means are better able to detect the perforations existing in the strip.

We provide a plurality of rollers over which the strip is passed and so arranged that each portion of the strip is flexed a number of times in passing over the rollers. We have found that when a strip is handled in this fashion such flexing apparently tends to open and enlarge existing perforations so that they may be more readily detected by the inspecting means. We further provide inspecting means which will inspect the strip after it has passed through the flexing means.

For purposes of illustration we will describe a line in which strip, perhaps electrolytically plated with tin, is inspected and cut into sheets. As a matter of convenience, after the strip has been coated with tin, it may be wound into coils. These coils may then be moved to an uncoiler at some convenient time, and the plated strip again uncoiled. The strip is put through a side trimmer to cut off the two edges which may be irregular or where the plating is likely to be uneven. Following the side trimmer it is pulled through a fin masher to flatten the edges where they may have been turned by the knives in the side trimmer. Following this we lead the strip through a flexing apparatus comprising a plurality of rolls. The strip is led through the rolls being bent first one way and then the other. This flexing causes perforations, some of which may be partially covered with tin from the electro-plating process, to be apparently opened or enlarged. After such flexing, conventional pin hole detectors will detect perforations which they would not have detected had the strip not been flexed. Other objects and advantages of our invention will become apparent as the following detailed description of the preferred embodiment of our invention and of a modification thereof proceed.

In the following figures are shown the preferred embodiment of our invention and a modification thereof in which:

Figure 1A is a partial side elevation of a cut-up and inspection line incorporating the preferred embodiment of our invention;

Figure 1B is a continuation of the view shown in Figure 1A from line X—X;

Figure 2A is a partial side elevation of a cut-up and inspection line incorporating a modification of the preferred embodiment of our invention; and

Figure 2B is a continuation of the view shown in Figure 2A from line Y—Y.

Referring particularly to Figure 1A, we have shown an inspection and cut-up line to which strip is brought in coils. The coil is placed on an uncoiler and the strip is fed into the line. At the exit end of the line it is cut into sheets and classified into piles containing prime sheets and reject sheets. The coil **1** is placed on an uncoiler **2** and the strip **3** is fed through the line. The strip is fed from the uncoiler **2** throuugh a guide **4** to a side trimmer **5** where the edges are trimmed. The side trimmer has driven rolls and rotary knives which pull the strip through. It cuts off the edges which may be of irregular size or be unevenly plated. A looping pit **6** is interspersed so that the speed of the uncoiler may be adjusted to the speed of the side trimmer. It is desired to keep a loop of medium length in the looping pit, and the speed of the uncoiler is adjusted according to the size of the loop in the looping pit by photo-electric or other means which are well known in the art. As the strip passes beyond the side trimmer it is drawn through a fin masher **7** to flatten the edges where they may have been turned by the knives of the trimmer. The strip proceeds through the fin masher between a plurality of driven rolls, driven at the same speed as the side trimmer rolls, wherein the strip is flexed backwardly and forwardly. Conveniently, the flexing device **8** may comprise a roller leveler having a pluarlity of rolls whose axes are in two diverging planes and wherein the strip is caused to flex or change its direction at each roll. The strip is passed through a second looping pit **9**, over a guide roll **10**, through a gauge **11**, and a photoelectric pin hole detector **12** to a roller leveler **13**. The rolls of the roller leveler are driven and draw the strip from the looping pit **9**. The flexing device **8** and side trimmer **5** are driven together and their speed is adjusted so that a loop of medium length is kept in looping pit **9**. This may be done by photoelectric means or by other means well known to those skilled in the art. Gauge **11** is sensitive to the thickness of the strip passing through it. Pin hole detector **12** is sensitive to perforations in the strip. Commonly, photoelectric cells are mounted on one side of the strip and lights are mounted on the other side of the strip so that in case of a perforation the light will shine through, and the photoelectric cells will be activated. Any conventional pin hole detector may be used. A rotary shear **14** beyond leveler **13** is driven at the same speed as the roller leveler and cuts the strip into sheets.

Beyond the shear, in a position to receive sheets cut by the shear, is a conveyor belt **15** which carries the sheets to a classifier. At the end of conveyor belt **15** is a gate **16** operated by the pin hole detector **12**. When a portion of the strip is discovered to have perforations the pin hole detector causes gate **16** to be raised by appropriate means well known in the art, and deflects the resultant sheet having the perforations onto conveyor belt **17**. The thus rejected sheet is carried by belts **18** and **19** to a perforate sheet piling station **20**. When gate **16** is not activated a sheet delivered on conveyor belt **15** will move onto conveyor belt **21** and between pinch rolls **22**. Gate **23** is responsive to gauge **11**. When gauge **11** detects portions of the strip which are of improper gauge, it will, through

appropriate means, cause gate 23 to be raised, deflecting the resultant sheet onto belt 24.

When gate 23 is raised and a sheet delivered from conveyor belt 21 is deflected to conveyor belt 24, the sheet will be carried by conveyor belts 25 and 26 to an off-gauge piling station 27. When gate 23 is in the lower position a sheet delivered from conveyor belt 21 will pass beyond gate 23 and be carried by conveyor belts 28, 29 and 30 to a prime piling station 31.

Referring now to Figure 2A, in which we have shown a modification of the preferred embodiment of our invention, a coil 32 is mounted on an uncoiler 33. A strip 34 is led out through a looping pit 35 to guide 36, from which the strip is drawn into side trimmer 37. From side trimmer 37 the strip is drawn through fin masher 38. All of these devices are similar to those used in the preferred embodiment of our invention. The strip is drawn through the fin masher between a set of pinch rolls 39 which are driven at the same speed as the side trimmer. The function of the pinch rolls is to pull the strip through the fin masher from the side trimmer. Beyond the pinch rolls the strip passes through a looping pit 40 and over a guide roll 41 to a gauge 42. After leaving the gauge the strip passes through a pin hole detector 43 and into a roller leveler 44. Beyond the roller leveler a second pin hole detector 45 is located which inspects the strip between the time it leaves the roller leveler 44 and enters the shear 46. Sheets cut by the shear are delivered to conveyor belt 47 which carries them to a classifier. A gate 48 in the classifier is operated by the two pin hole detectors through appropriate means and when operated will deflect a sheet to a perforate sheet piling station 49. A second gate 50 is operated by gauge 42 through appropriate means and when operated will deflect any sheet which reaches it to an off-gauge piling station 51. When neither gate 48 nor gate 50 is operated sheets will be carried to a prime sheet piling station 52.

In operation a coil of steel 1 (Figure 1A) is placed upon the uncoiler 2. It is fed from there through the guide 4 to side trimmer 5. Appropriate control mechanism rotates the uncoiler allowing strip to run out until there is a loop in the looping pit 6. A control mechanism will maintain the speed of the uncoiler so that a loop of proper length will remain suspended in the looping pit. The strip will be pulled out of the looping pit by the rolls of the side trimmer. The guide 4 will center the strip as it enters the trimmer so that both edges of the strip will be trimmed. The side trimmer will remove the edge of the strip having irregularities of edge and plating and produce a strip having a constant width and a regular plating depth. The fin masher 7 will then flatten the edges where they have been turned by the knives of the side trimmer. Passing through the fin masher the strip will be drawn through the roller leveler and flexed backwardly and forwardly a multiplicity of times. The roller leveler is used as a convenient means of flexing the strip a multiplicity of times, but any device which would flex the strip a multiplicity of times would be equally effective. The flexing has the result of opening up perforations in the strip to a size where they can be detected with conventional pin hole detectors. Conveniently, the flexing means may be a roller leveler which will simultaneously flex the strip and flatten the strip so that it will not tend to resume a coil-like position when it is released. From the flexing means the strip is allowed to fall into looping pit 9 before passing over guide roll 10. The strip is drawn over guide roll 10 and through gauge 11 and pin hole detector 12 by the driven rolls of roller leveler 13. As the strip passes through pin hole detector 12 perforations in the strip will be detected. As the strip passes through the roller leveler 13 it is flattened so that when it is cut into sheet form, the sheets will be absolutely flat. As the strip passes through the rotary shear 14 it is cut into sheets and the sheets are delivered to conveyor belt 15.

As a sheet reaches the end of conveyor belt 15 it will be adjacent gate 16. If a perforation has been detected in the moving strip by pin hole detector 12 the pin hole detector will, through appropriate means, cause gate 16 to be raised. This will deflect perforate sheet onto conveyor belt 17 so that the sheet will be carried to the perforate sheet piling station 20. Other sheets will pass over gate 16 onto conveyor belt 21 and will move to a position adjacent gate 23. If gauge 11 has detected a portion of the strip which is too thick or too thin it will, through appropriate means, cause gate 23 to be raised. This will cause an off-gauge sheet to be deflected onto conveyor belt 24 and carried to off-gauge piling station 27. Sheets which are neither perforate nor off-gauge will pass over gates 16 and 23 and will be delivered to the prime sheet piling station 31.

Referring now to the modificatoin of our preferred embodiment, a strip is unwound from uncoiler 33, carried across looping pit 35, and trimmed by side trimmer 37. The speed at which coil 32 is unwound by uncoiler 33 is regulated by well-known means to keep a loop of medium length in looping pit 35. Pinch rolls 39 pull the strip through fin masher 38 and deliver it to looping pit 40. The speed at which side trimmer 37 and pinch rolls 39 are driven is regulated to keep a loop of medium length in looping pit 40. The strip is pulled out of looping pit 40 over guide roll 41 and through gauge 42. If a portion of the strip is found to be off-gauge, gate 50 will be caused to operate, deflecting the resultant off-gauge sheet to the off-gauge sheet piling station 51. From gauge 42 the strip is pulled through pin hole detector 43 and into roller leveler 44 where it is flexed backwardly and forwardly over a multiplicity of rollers. The flexing is progressively decreased so that an absolutely flat strip is delivered from the roller leveler. The second pin hole detector 45 then inspects the strip before it is fed into shear 46. Gate 48 is operated through appropriate means by pin hole detectors 43 and 45. When perforations are detected in the strip by the pin hole detectors they will, by appropriate means, cause gate 48 to be raised, deflecting the resultant perforate sheet to perforate sheet piling station 49. By use of our invention we are able to classify sheets quickly and accurately according to the further use which must be made of them. The several piles of sheets in the classifier may be removed from time to time and further and further processed as necessary.

While we have shown and described a present preferred embodiment of our invention and of a preferred modification thereof it is to be understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims.

We claim:

1. A strip classification line comprising means to flex the strip sharply and repeatedly along a sinuous path to a degree sufficient to enlarge and open pin holes in the strip, means receiving the strip from the flexing means and cutting it into sheets after passage through said sinuous path, classifying means placed on the delivery side of the cutting means in position to receive sheets from the cutting means, pin hole inspecting means placed to inspect the strip between the flexing means and the cutting means, said inspecting means being in controlling relationship to the classifying means.

2. A strip classification line comprising means to flex the strip sharply and repeatedly along a sinuous path to a degree sufficient to enlarge and open pin holes in the strip, shearing means receiving the strip from the flexing means and cutting it into sheets after passage through said sinuous path, classifying means placed on the delivery side of the shearing means in position to receive sheets from the shearing means, photoelectric perforation inspecting means placed to inspect the strip between the flexing means and the shearing means, said inspecting

means being in controlling relationship to the classifying means.

3. A strip classification line comprising means to flex the strip sharply and repeatedly along a sinuous path to a degree sufficient to enlarge and open pin holes in the strip, said means being a roller leveler, shearing means receiving the strip from the flexing means and cutting it into sheets after passage through said roller leveler, classifying means placed on the delivery side of the shearing means in position to receive sheets from the shearing means, photoelectric perforation inspecting means placed to inspect the strip between the flexing means and the shearing means, said inspecting means being in controlling relationship to the classifying means.

4. A strip classification line comprising means to flex the strip sharply and repeatedly along a sinuous path to a degree sufficient to enlarge and open pin holes in the strip, shearing means receiving the strip from the flexing means and cutting it into sheets after said sharp and repeated flexing, classifying means placed on the delivery side of the shearing means in position to receive sheets from the shearing means and to separate sheets having pin holes from prime sheets, and photoelectric perforation inspecting means placed to inspect the strip between the flexing means and the shearing means, said inspecting means being in controlling relationship to said classifying means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,229,638	Chamberlin et al.	Jan. 28, 1941
2,291,027	Cole	July 28, 1942
2,387,952	Smith	Oct. 30, 1945
2,466,615	Rusca	Apr. 5, 1949
2,469,608	Phillimore	May 10, 1949
2,612,677	Boley	Oct. 7, 1952