April 2, 1963 R. W. HERR 3,083,926

STRIP HANDLING

Filed June 17, 1959

2 Sheets-Sheet 1

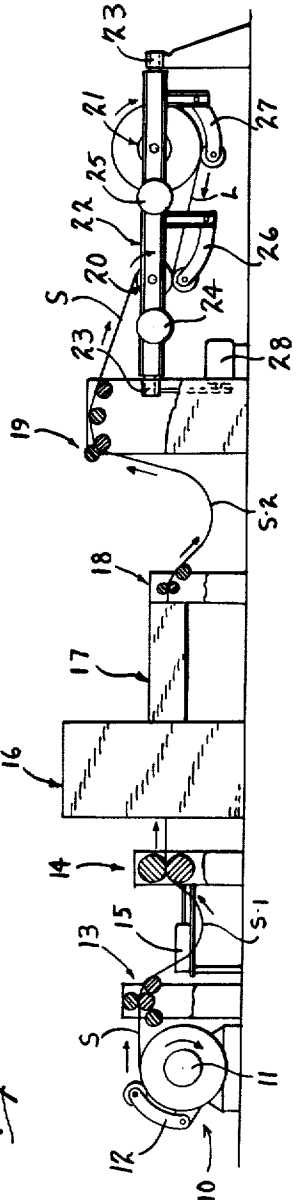

Fig. 1

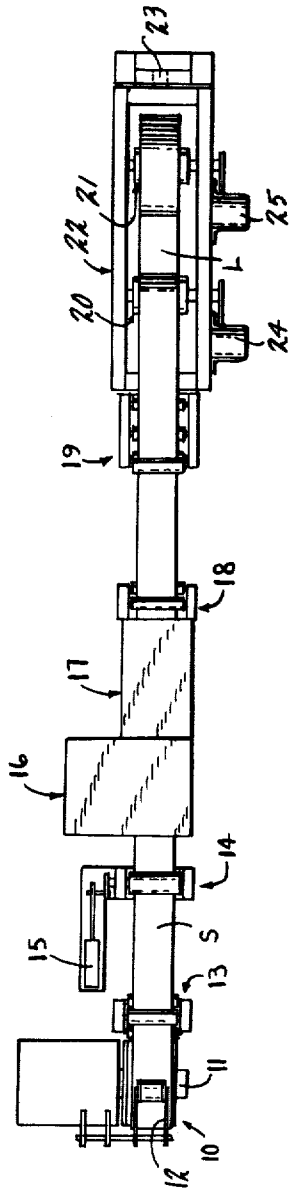

Fig. 2

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2 Sheets-Sheet 2

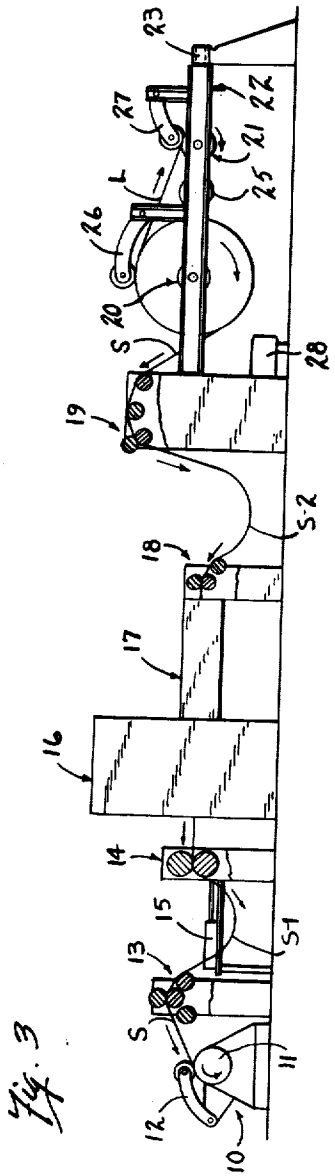

Fig. 3

Fig. 6

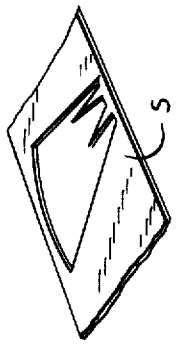

Fig. 7

Fig. 4

Fig. 5

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3,083,926

STRIP HANDLING

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4 Claims. (Cl. 242—56.8)

The present invention relates to strip handling, more particularly to methods of and apparatus for handling strip material during processing thereof, and the principal object of the invention is to provide new and improved methods and apparatus of the character described.

In certain strip processing operations, for example, operations wherein pieces are successively blanked from longitudinally spaced strip portions, it is highly desirable from the standpoint of scrap reduction that such pieces be blanked from closely spaced successive strip portions. When certain irregularly shaped pieces are being blanked. it is common practice to orient successive pieces in opposite directions to thus reduce scrap losses. This is commonly done by employing a blanking die which simultaneously blanks two closely spaced pieces from the strip, such pieces facing in opposite directions as will be apparent. The strip is then advanced so that the next two pieces are blanked from a strip portion closely spaced from that portion from which the preceeding pieces were blanked.

The foregoing prior art solution to the problem is satisfactory for many purposes; however, it has a disadvantage which at times assumes economic consequences of great importance. The prior art solution requires that two blanking dies, or a double blanking die, be employed since two pieces facing in opposite directions must be simultaneously blanked from the strip. The necessity for two dies, or a double die, substantially doubles die costs and since the price of even a simple, single die frequently amounts to several thousand dollars, it will readily be apparent that die costs are considerable.

When long production runs are contemplated, the doubled initial die costs are not of great importance since die life will be doubled over that of a single die and therefore overall die costs, per piece made, will not be increased. When, however, production runs are limited so that a die will be used for only a fraction of its potential useful life, an entirely different situation is presented. In such case, die life is not a factor and therefore doubled initial die costs spread over a limited number of pieces is an important factor.

The present invention provides methods and apparatus for the economical high-speed processing of strip material without duplication of costly components whose costs must be spread over relatively short production runs. Other advantages will readily become apparent from a study of the following description and from the drawings appended hereto.

In the drawings accompanying this specification and forming a part of this application there is shown, for purpose of illustration, an embodiment which the invention may assume, and in these drawings:

FIGURE 1 is a side elevational view of a strip processing line embodying the present invention and illustrated in one phase of operation,

FIGURE 2 is a top plane view of the line seen in FIGURE 1,

FIGURE 3 is a view similar to FIGURE 1 but showing the line in another phase of operation,

FIGURES 4 and 5 are fragmentary plan views of the material presently being processed but taken at different phases of the processing operation,

FIGURE 6 is an enlarged perspective view of an article presently being made by the instant invention, and

FIGURE 7 is a view similar to FIGURE 6 but fragmentarily showing a length of material from which the article seen in FIGURE 6 has been formed.

Referring first to FIGURES 6 and 7, this invention presently contemplates the blanking of members M from strip material S. Although not a part of the present invention, members M are subsequently adapted to be assembled into electrical components. In order to improve the electrical efficiency of the components of which members will become a part, the strip S is formed of a special metal which is quite expensive. Accordingly, the necessity of limiting scrap by obtaining as many pieces M from the strip as possible will be obvious.

Since members M are generally pie-shaped, it will be understood that scrap will be minimized if adjoining pieces are blanked from the strip oriented in opposite directions as seen in FIGURE 5. The method of and apparatus for so blanking the pieces from the strip by the use of but a single blanking die forms the subject matter of the present invention.

Referring now to FIGURE 1, there is shown a reel **10** for rotatably supporting a coil of strip S. This reel may be of conventional form wherein a rotatable, expansible-contractable drum **11** is inserted within the central aperture of the coil and then expanded to tightly grip the inner periphery of the latter. A suitable drive motor or the like (not shown) will be provided for rotating drum **11** at various speeds. A pivotally mounted arm **12** having a roller at its free end is biased to engage the periphery of the coil. This arm automatically adjusts the speed of the reel drive motor through a rheostat or the like to so control the rotational speed of drum **11** that the strip will be unwound from the coil at a constant linear speed despite the changing size of the coil supported on the drum.

From the reel **10**, the strip passes in the direction of the arrow between a set of rolls **13** whose rotational speed is controlled by a conventional motor-brake device, not shown, and to a set of feed rolls **14**. For a purpose to appear, the strip assumes a loop formation S–1 intermediate the rolls **13, 14**. Feed rolls **14** are adapted to be intermittently rotated to feed a predetermined length of strip therebetween by any suitable means; however, at the present time, such rolls are rotated by means of an adjustable stroke fluid cylinder **15** having driving connection with the rolls through a suitable arrangement of a rack, gears and clutches. The arrangement presently employed is shown and described in the application of Richard F. Herr, filed October 24, 1955, Serial Number 542,351, and entitled, Feed Apparatus, and now Patent No. 2,978,158, issued April 4, 1961; however, any other suitable construction may be employed.

From the feed rolls **14** the strip passes in the direction of the arrow through a conventional press **16** which carries the blanking die (not shown) for forming the piece M from the strip. Associated with the press is a register device **17** which need not be described in detail since it is a commercially available item. Briefly, however, device **17** utilizes a photoelectric cell or the like to sense the position of the hole blanked in the strip by the press to determine whether too much or too little strip has been fed. In accordance with a signal sent by the device **17**, the feed rolls will then be rotated a slightly greater amount or a lesser amount at their next operating cycle or at a subsequent opportune time to feed either a longer or a shorter length of strip, depending upon the correction required, to thus insure the successive pieces will be blanked from the strip at precisely the proper longitudinally spaced-apart places.

From the register device **17**, the strip passes between roll sets **18** and **19** which are similar to roll set **13** and whose rotation is also controlled by suitable motor-brake devices. For a purpose to appear, the strip assumes a loop formation S–2 intermediate the roll sets **18, 19**.

Mounted adjacent the stand which supports the roll set **19** are a pair of reels **20**, **21** in side by side, spaced-apart relation. These reels are arranged with their axes in parallel relation and are carried by a frame **22** which is supported at **23** for pivotal movement about an axis extending transversely of the axes of reels **20**, **21** and generally aligned with the direction of strip movement. The rotation of each reel **20**, **21** is presently controlled by motor-brake units **24**, **25** operably connected with respective reels. Each reel may take the form of a rotatably supported drum; however, as will appear, neither drum need be of the expansible-contractable type as is the drum **11** of reel **10**.

For a purpose to be disclosed and in the stage of operation seen in FIGURES 1 and 2, drum **21** will carry a coil of strip material L which will hereinafter be referred to as interliner strip material. The free end of the strip L may be permanently secured to reel **20** since such strip in normal operation will merely be transferred back and forth between the reels **20** and **21**.

Pivotally carried by frame **22** adjacent reels **20**, **21** are arms **26**, **27** whose free ends are biased to engagement with the outer peripheries of the coiled strip carried by respective reels **20**, **21**. Arms **26**, **27** function in a manner similar to arm **12** in that each automatically controls the speed of rotation of a respective motor-brake unit **24**, **25** in accordance with the size of the coil wound upon a respective reel so that the strip will be wound at constant linear speed despite changes in coil size. For a purpose to appear, a suitable motor unit **28** is operably connected with the frame **22** for rotating the latter about its pivots **23** from the position seen in FIGURE 1 to the position seen in FIGURE 3 and from the last mentioned position to that first mentioned.

As previously disclosed, the free end of strip L will be connected to reel **20** for winding thereon. Additionally, the strip S is also adapted to be wound upon reel **20** following its passage through roll set **19** so that upon rotation of reel **20** in the direction of the arrow, both strip S and strip L will be wound, in alternate layers, upon the reel **20**. Accordingly, the free end of strip S may either be attached to the reel **20** by any suitable means or may, if desired, merely be inserted between the reel and the strip L or between adjoining convolutions of strip L so that slight rotation of the reel will serve to clamp the strip S in position.

Assuming that strips S and L are arranged as seen in FIGURE 1, operation will be as follows: Drum **11** of reel **10** will be rotated in the direction of the arrow to continuously unwind strip S from the coil supported by reel **11**. Roll set **13** will be continuously rotated in a direction to pass strip to the loop S–**1** and at a speed to insure that the strip portion intermediate such roll set and the reel **10** will preferably be lightly tensioned.

Press **16** will then operate to blank a piece from the strip whereupon feed rolls **14** will be rotated a predetermined amount, controlled by the register device **17**, to feed a predetermined length of strip to the press. During rotation of the feed rolls, roll set **18** will rotate to draw the strip through the press and to pass it to the strip loop S–**2**. Upon cessation of rotation of the feed rolls **14** and while the strip portion adjacent the press is stationary, the press will again operate to blank a piece from the strip. The foregoing feeding and blanking operations will automatically alternate until all of the strip wound upon reel **10** has been passed through the press.

During the intermittent operation of the press and feed rolls, coiler **20** has been continuously rotated by its motor unit **24** in the direction of the arrow so as to wind both strips S and L thereon in alternate layers. Roll set **19** at this time functions as a brake to maintain a slight tension on the strip portion between such roll set and the coiler **20**. Additionally, motor-brake unit **25** of coiler **21** also functions as a brake to maintain a tension on the strip L.

Since reels **10** and **20** operate to continually pass strip while the latter moves but intermittently through the press, the strip loops S–**1** and S–**2** thus permit the strip to be momentarily fed into the loops at a faster rate than that at which the strip is withdrawn therefrom and to permit the strip to be momentarily withdrawn from the loops at a faster rate than at which it is fed thereinto. Accordingly, each strip loop will alternately increase and decrease in size during line operation.

It is to be understood that the function of strip L is to separate the windings of strip S coiled upon reel **20** so that such windings will not become entangled with each other and thus render difficult the subsequent unwinding of the strip S. It will readily be apparent that if strip blanked as seen in FIGURES 4 and 7 were wound in a coil without the strip L as a separator, the sharp edges resulting from the blanking operation aforesaid would catch upon one another and thus subsequent unwinding of the coil would likely damage the strip and render further operations thereon difficult if not impossible.

When all of the strip has been unwound from reel **10**, passed through the press **16** and wound upon reel **20**, operations will be suspended. At this time, the strip S appears as illustrated in FIGURE 4 with every other piece blanked therefrom, the punched holes remaining in the strip S after this first phase of operation being indicated at A. An operator will now actuate motor **28** to rotate frame **22** one hundred eight degrees about its pivots **23** from the position seen in FIGURE 1 to the position seen in FIGURE 3. The end of strip S projecting from the coil on reel **20** will once again be threaded through the rolls **19**, **18**, register device **17**, press **16**, feed rolls **14**, rolls **13**, and such strip end then attached to the reel drum **11**.

Reel **21** will now be rotated by its motor **25** in the direction of the arrow to wind the strip L thereon and to thus cause rotation of reel **20** in the direction of the arrow to unwind both strips S and L therefrom. At this time, motor-brake unit **24** of reel **20** functions as a brake to maintain a tension on both strips since roll set **19** is at this time being rotated in a direction to feed strip S from the reel **20** to the strip loops S—**2** and thence to the roll set **18**. The latter is, during this phase of the operation, functioning as a brake to maintain a tension on strip S as it is being intermittently pulled through the press **16** by the feed rolls **14** which are now feeding from right to left, in the position of parts shown, rather than from left to right, as was the case during the previously described phase of operation. Reel drum **11** will be rotated in the direction of the arrow to wind the strip S thereon while rolls **13** will at this time function as a brake to tension the strip portion between the reel **10** and the rolls **13**. Intermittent the feeding operations of the feed rolls **14**, press **15** will, as previously disclosed, operate to blank a piece from the strip S. These pieces will be blanked from the strip S intermediate the places where the blanks were punched from the strip during the first phase of operation. This is clearly illustrated in FIGURE 5 wherein the holes remaining in the strip after the first phase of operation are indicated at A (but oriented in the opposite direction from that seen in FIGURE 4 since the strip has been turned side for side by the rotation aforesaid of frame **22**) and wherein the holes remaining after the second phase of operation are indicated at B.

When all of the strip S has been unwound from reel **20**, passed through the press **16** and wound upon the reel **10**, operations will be suspended. The skeletal strip coil on reel **10** will now be removed and scrapped, such removal being facilitated by collapsing reel drum **11**, and a fresh coil of strip substituted therefor. Motor **28** will again be operated to rotate frame **22** from the position seen in FIGURE 3 to the position seen in FIGURE 1 whereupon another first phase of operations may begin as soon as the strip is threaded through the various parts as seen in FIGURE 1.

It is to be understood that while the present invention

has been disclosed as applied to the blanking of pieces from strip material, the invention is not limited to such operations but may be practiced whenever it is necessary to feed strip through two processing operations, intermediate which it is desired to coil the strip.

In view of the foregoing, it will be apparent to those skilled in the art that I have accomplished at least the principal object of my invention and it will also be apparent to those skilled in the art that the embodiment herein described may be variously changed and modified, without departing from the spirit of the invention, and that the invention is capable of uses and has advantages not herein specifically described; hence it will be appreciated that the herein disclosed embodiment is illustrative only, and that my invention is not limited thereto.

I claim:

1. Strip handling apparatus comprising a pair of transversely spaced drums for supporting coiled strip material extending therebetween, each drum being supported for rotation about respective first axes and one drum also being supported for rotation about a second axis extending transversely of its first, means for rotating each drum about respective first axes in a direction to wind strip material thereon, strip processing means interposed between said drums for engagement with the strip portion extending therebetween and operating intermittently on longitudinally spaced strip portions as they initially pass therethrough in one direction of movement and operating intermittently on strip portions intermediate those portions previously operated upon as they subsequently pass therethrough in the opposite direction of movement, and means for turning said one drum end-for-end about its second axis when all of the strip material has been wound thereon following initial strip movement in one direction through said processing means and prior to subsequent strip movement through said processing means in the opposite direction and winding of the strip on the other of said drums.

2. The construction of claim 1 wherein a rotatably supported third drum is spaced transversely of said one drum, wherein said third drum is mounted for simultaneous, end-for-end movement with said one drum about the latter's said second axis, and wherein second strip material extends between said third drum and said one drum for alternate winding thereon, said second strip material being wound upon said one drum simultaneously with the winding of said first mentioned strip material thereon to separate adjoining layers thereof and said second strip material being unwound from said one drum and wound upon said third drum simultaneously with the unwinding of said first mentioned strip material from said one drum.

3. The construction of claim 1 and further comprising means for rotating said third drum in a direction to wind thereon said second strip material previously wound upon said one drum.

4. Strip handling apparatus comprising a rotatably supported frame, a pair of drums supported by said frame for rotation about respective axes disposed in spaced-apart, parallel relation and each drum axis extending transversely of and intersecting the rotational axis of said frame, strip material extending between said drums and adapted to be wound alternately thereon, a first drive motor carried by said frame and connected to one of said drums to effect rotation thereof in a direction to wind thereon in alternate layers the strip material aforesaid together with another strip material, a second drive motor carried by said frame and connected to the other of said drums to effect rotation thereof in a direction to wind said first mentioned strip material thereon, and means for rotating said frame about its axis to turn said drums end for end.

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