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Costello et al.

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[54] **CONTROL SYSTEM FOR A STRIP ACCUMULATOR**

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[51] **Int. Cl.** **B65h 17/48**

[58] **Field of Search** ..... 242/55, 55.19 R, 58.1, 242/58.5, 78.1, 78.6, 78.7, 75.44, 74.54; 226/118, 119

[56] **References Cited**

UNITED STATES PATENTS

3,298,890	1/1967	Hellemans	242/58.4 X
3,506,210	4/1970	La Tour et al.	242/55.19 R X
3,669,375	6/1972	Bruton	242/58.1 X
3,785,902	1/1974	Preston et al.	242/58.1 X

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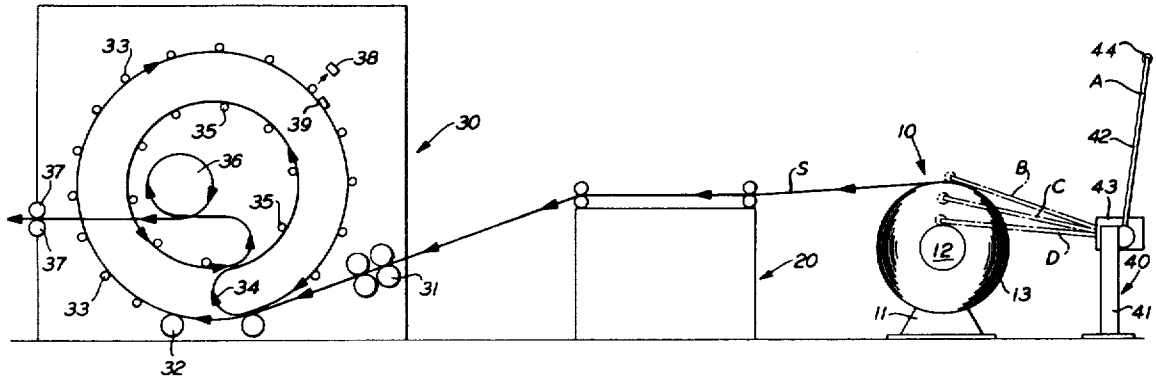
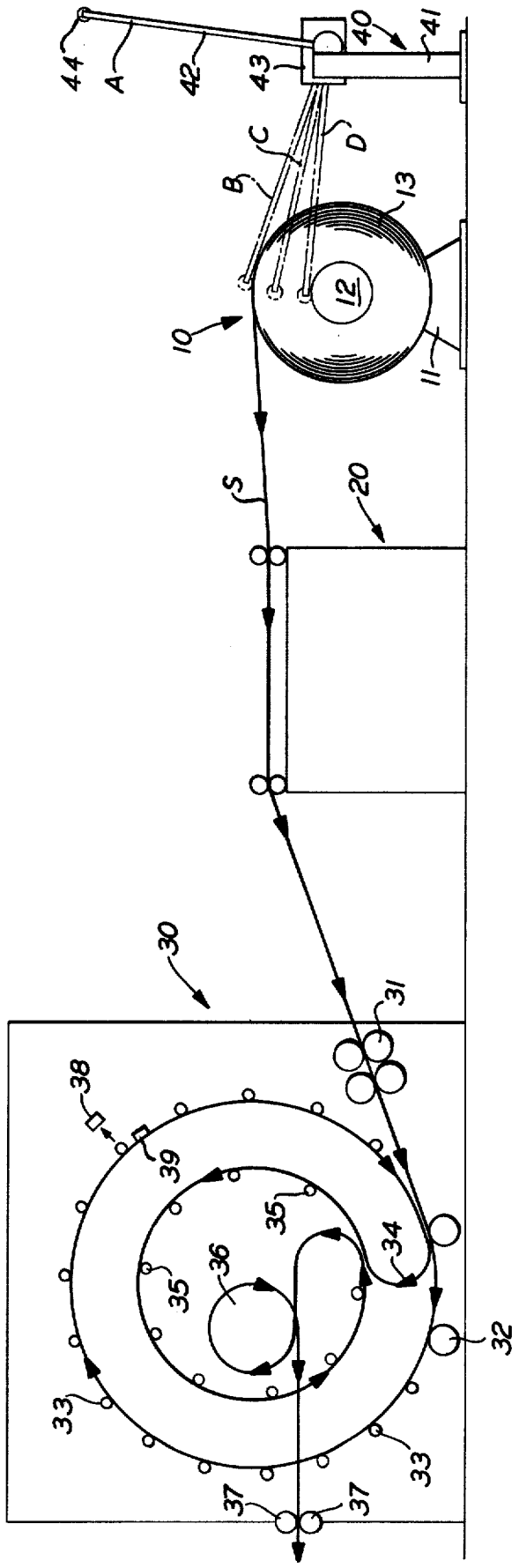
[57] **ABSTRACT**

Disclosed is a method and apparatus for assuring the optimum automatic operation of a strip accumulator which receives strip from a coil on an uncoiler and stores the same while the strip is continually fed to a process line. The method and apparatus assures that when the end of a coil is reached, the accumulator is substantially filled so that the maximum time exists for attaching a new coil to the end of the first coil to preserve the continuous operation of the process line. According to the invention, means are provided to stop the uncoiler when a predetermined amount of strip remains thereon to permit the accumulator to be emptied by the requirements of the process line. The uncoiler is then activated again to fill the accumulator at a point in time generally coincident with the depletion of the coil of strip. Then a new coil strip may be affixed to the depleted coil strip while the strip stored in the full accumulator is utilized for the process line. Normal operation of the system continues again until the next coil nears depletion when the process is repeated.

12 Claims, 1 Drawing Figure

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CONTROL SYSTEM FOR A STRIP ACCUMULATOR

BACKGROUND OF THE INVENTION

This invention relates to a method and apparatus which assures optimum automatic operation of a strip processing line which includes a strip accumulator that stores a volume of strip for use in the continuous process line. More particularly, the invention relates to a method and apparatus, as above, which assures that the accumulator is substantially filled when the end of a coil of strip is reached so as to afford a maximum amount of time to affix a new coil of strip thereto without interruption of the process line.

Many industrial processing lines utilize a strip material, such as a metallic strip material, as an input and require that the strip be continually fed thereto. As a practical matter, the strip is available from a coil which is payed out until depleted. Because it would be very undesirable to stop the processing line upon each depletion of a coil, strip accumulators, such as that shown in U.S. Pat. No. 3,506,210, have been developed which receive strip from the input coil and hold or store a certain amount thereof while at the same time paying out strip so held to the processing line. Such accumulators are thus intended to permit the processing line to remain active during the time a new input strip coil is attached, as by welding, to a coil which has just been depleted.

Unfortunately, however, no control apparatus or method of operating the same has been devised which will assure that the accumulator is filled to capacity when the welding of a new coil is to take place. For example, the accumulator disclosed is said U.S. Pat. No 3,506,210 merely provides a sensing device to detect the end of the strip before it reaches the accumulator so that the feed to the accumulator may be stopped for purposes of welding. Nothing short of an operator continually monitoring the process would approach assuring that the accumulator was filled to its maximum capacity at this time. Because the end welding process may take a few minutes to accomplish and because many process lines operate at significantly high speeds, prior art control devices of which we are aware will quite often undesirably dictate that the process line be shut down to complete the welding process.

In addition, prior art devices, although capable of sensing the end of the coil, are often running at such high speeds at the time of such sensing that the end of the coil is "lost" in the accumulator by the time it is actually stopped. Thus, the prior art devices are not totally and automatically capable of being in complete control of the strip and so that welding is readily accomplished.

SUMMARY OF THE INVENTION

It is thus a primary object of the present invention to provide a method and apparatus for automatically controlling a strip accumulator in a process line.

It is another object of the present invention to provide a method and apparatus for automatically controlling a strip accumulator, as above, which assures that the accumulator is filled to capacity when a new input coil of strip is attached to that strip in the accumulator.

It is a further object of the present invention to provide a method and apparatus for automatically controlling a strip accumulator, as above, which assures that the process line can be continually run even during periods of coil replacement.

It is an additional object of the present invention to provide a method and apparatus for automatically controlling a strip accumulator, as above, which regulates the position of the end of a depleted coil so that it can be readily affixed to the lead end of a fresh coil.

These and other objects of the present invention which will become apparent from the description to follow, are accomplished by the improvement hereinafter described and claimed.

In general, a processing line receives strip material continuously from an accumulator which, in turn, receives and stores a quantity of material from an input supply coil mounted on an uncoiling apparatus. A sensing device, associated with the uncoiler, monitors the amount of strip remaining on the input coil and when a predetermined amount of strip remains on the coil, the input to the accumulator stops and the accumulator empties to the process line. At this point in time, the amount of strip remaining on the coil is preferably an amount equal to the capacity of the accumulator or the capacity plus the amount of strip which would be used by the process line during the time in which the accumulator is subsequently filled. Then when the accumulator has emptied, the feed thereto is again initiated until the input coil is substantially depleted at which time the accumulator stops again and the last few feet of strip are slowly uncoiled until the end of the nearly depleted strip is in the proximity of a welding or other attachment device which is generally located between the uncoiler and the accumulator. Then a fresh coil is attached to the nearly depleted coil and the process continues without having to stop or slow down the process line.

BRIEF DESCRIPTION OF THE DRAWING

The sole FIG. is a schematic view of a strip accumulator, strip end joiner, uncoiler and sensor according to the concept of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The overall system which continually provides a strip material to a processing line is shown in the drawing as including an uncoiler, schematically shown and indicated generally by the numeral **10.** Uncoiler **10,** includes a base **11** and axle **12** on which a coil **13** of strip S revolves. Various types of uncoilers exist and the specific style utilized is unimportant to this invention. The strip S which may be of any material and gauge, but is generally a metallic material, is fed through the jaws of an end joiner, schematically shown and indicated generally by the numeral **20,** to an accumulating device which is also schematically shown and indicated generally by the numeral **30.** As will hereinafter be described in more detail, end joiner **20,** which can be a welding device, is used to join the end of the strips from a coil which has just become depleted from uncoiler **10** to the end of a fresh coil which has been placed on uncoiler **10.**

The accumulator **30** shown is generally of the type depicted in detail in U.S. Pat. No. 3,506,210, to which reference is made for whatever details might be necessary to fully understand the operation thereof; however, the invention described herein is capable of operation with any type of accumulating device, many of

which are well known in the art. Briefly describing the various schematically shown parts of the accumulator **30**, a plurality of drive wheels **31**, when activated, pull the strip S from the uncoiler and into the accumulator. The strip is transferred past guide and support rolls **32**, which may also be driven or which may, in fact, be driven instead of wheels **31**, to form an outer loop of strip material defined by a plurality of outer basket rolls **33**. The material travels around the outer basket rolls **33** and forms a free loop **34** as it is turned toward a series of rolls **35** which together form an inner basket loop of strip material. Upon demand from the processing line, which demand is almost always continual, the strip on the inside of the inner loop defined by rolls **35** is transferred around a take-out arbor **36** and guided by rolls **37** to the processing line.

In order to fill the accumulator **30**, strip must be fed in faster from uncoiler **10** it is going out to the process line. As this happens, the strip material builds up on the inside of the outer basket loop and simultaneously the free loop **34** orbits in a clockwise direction in the drawing to build up convolutions on the inner basket defined by rolls **35**. During the buildup process, the inner roller **35** and outer rolls **33** diverge from each other to allow for the storage of a quantity of strip therein.

The automatic operation of the accumulator **30** is primarily accomplished by the controlled activation and deactivation of the drive wheels **31** by a control device, indicated generally by the numeral **40**, which includes a stand **41** that pivotally carries a control arm **42**. Stand **41** also provides a means to mount a limit switch control box **43** which, as will hereinafter become evident, monitors the position of the arm **42**. While limit switches have been schematically shown herein as part of the controlling device, it is evident that any type of device which would send an electrical or other signal to a control panel (not shown) to operate the motor which drives wheels **31** would be satisfactory.

With arm **42** in the solid line A position in the drawing, the accumulator **30** is deactivated and receiving no strip S. This would occur primarily at times when coils are being changed. With a fresh coil **13** placed on uncoiler **10**, arm **42** is pivoted to the chain line B position in the drawing with roller **44** on the end of arm **42** riding on the strip material in the coil. In this position, the accumulator **30** can be activated to store the strip S therein. In a typical situation, the accumulator will fill at a rate of, for example, 800 feet per minute with typical process lines requiring 200 feet per minute. In such cases, after slightly over a minute of operation, if accumulator **30** has a capacity of, for example, 600 feet of material, it will be essentially filled and rolls **33** will have expanded away from rolls **35** to contact a limit switch **38** or other control device that will stop the drive wheels **31**. Then, after a preselected amount of strip discharge to the processing line, accumulator **30** will again draw strip from uncoiler **10**.

When the strip S has depleted on coil **13** to the extent that arm **42** has moved to a position such as the predetermined chain line C position, a limit switch in box **43** stops drive wheels **31** and permits the accumulator **30** to substantially empty to the process line. For reasons which will hereinafter become evident, position C should be selected so that the feed to accumulator **30** is deactivated when a volume of strip S substantially equal to the capacity of the accumulator remains on coil **13**, or preferably when a volume of strip S equal to the accumulator capacity plus an amount equal to the strip which will be used by the process line during the filling of the accumulator remains on coil **13**. Even more specifically, as a practical matter the selection of position C may be based on a full accumulation of material of the heaviest gauge contemplated for use which, of course, would be less material (in length) than that of lighter gauges which could be stored. Thus, in the example of an accumulator having a capacity of 600 feet of a certain gauge strip, a process line requirement of 200 feet per minute, and an input feed to the accumulator of 800 feet per minute, position C would be set at a point when approximately 800 feet of strip remained on coil **13**.

Then when the accumulator has emptied, limit switch **39** or other control senses the absence of strip material and starts the accumulator again which runs until arm position D occurs which trips another limit switch in box **43** to stop the accumulator momentarily. At this point in time, the accumulator is substantially filled to capacity. For example, in the example cited above, with constant process line requirements of 200 feet per minute, and accumulator capacity of 600 feet, the last 800 feet of coil have been run into the accumulator (with 200 feet having been used by the process line) between the time represented by arm positions C and D.

The position D setting of the control **40** can represent the end of the coil of strip or preferably is set such that a few wraps of strip still remain on coil **13**. As previously described, when this position is reached, the accumulator can be automatically switched from its high speed to a slow speed through an appropriate time delay. This accomplishes two things: first, it allows an uncoiler brake to be actuated to remove the inertia of the coil to prevent "clockspringing" thereof and second, by allowing the strip to come off the uncoiler at a slow rate, the end of the strip can be readily detected so that it can be positioned in the end joiner **20**. Arm **42** is then placed in the A position to reset the control system and a new coil placed on uncoiler **10** the front of which is attached to the end of the now depleted coil. In the example given, there would be approximately three minutes of coil in the accumulator which should be sufficient to attach the strip ends. Once attached, arm **42** is moved to the B position and the automatic process is begun anew.

It should thus be evident that a processing line utilizing strip and an accumulator therefor can be totally automatically operated by the method and apparatus disclosed herein, thus substantially improving the accumulator control art.

We claim:

1. A method of controlling the automatic operation of a strip accumulator which receives strip material from a coil on an uncoiler and stores the same for continuous use in a processing line comprising the steps of feeding the strip material from the uncoiler to the accumulator, stopping the feed when a predetermined amount of strip material remains on the uncoiler, permitting the accumulator to substantially empty its strip material to the processing line, then again feeding the strip material from the uncoiler to the accumulator to fill the accumulator with strip material substantially to the capacity thereof, and stopping the feed just before the strip material is depleted so that strip material from

a new coil may be attached to the end of the strip material in the accumulator to render the strip material continous for the processing line.

2. A method according to claim 1 wherein said predetermind amount of strip material is an amount equal to the capacity of the accumulator.

3. A method according to claim 1 wherein said predetermined amount of strip material is an amount equal to the capacity of the accumulator plus an amount equal to the strip material used by the processing line during the step of filling the accumulator.

4. A method according to claim 1 comprising the additional step of, after the second stoppage of the feed, moving the end of the strip material at a slow speed to position the same for attachment to the strip material from the new coil.

5. In combination, an uncoiler which carries a coil of strip material, an accumulator which receives said strip material from said uncoiler and at least temporarily stores the same while transferring said strip material to a processing line, means to feed the strip material from said uncoiler to the accumulator, and a control device, said control device comprising sensing means for monitoring the amount of strip material on said coil, first control means activated by said sensing means to interrupt the feed of said strip material from said uncoiler to said accumulator when a predetermined amount of said strip material remains on said coil, second control means actuated when said accumulator is substantially empty to reinitiate the feed of said strip material from said uncoiler to said accumulator, and third control means activated by said sensing means again stopping the feed of said strip material from said uncoiler to said accumulator when the strip material on said coil is substantially depleted.

6. The combination of claim 5 including joiner means to attach the end of a depleted coil of strip material to a fresh coil of strip material mounted on said uncoiler, said third control means moving the end of the strip of the depleted coil to said joiner means.

7. The combination of claim 5, wherein said sensing means is an arm, one end of which rests on the strip material on said coil.

8. The combination of claim 7, wherein said arm is pivotal about its other end, said first and third control means being limit switches contacted by said arm.

9. The combination of claim 5, said sensing means including means to render said accumulator inoperative.

10. The combination of claim 9, wherein said second control means is a limit switch mounted in said accumulator to detect when said accumulator is substantially empty.

11. The combination of claim 5, wherein said predetermined amount of strip material approximately equals the capacity of said accumulator.

12. The combination of claim 5, wherein said predetermined amount of strip material approximately equals the capacity of said accumulator plus an amount of strip material transferred from said accumulator to the process line during the time the feed to said accumulator is reinitiated by activation of said second control means.

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