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Costello et al.

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[45] May 27, 1975

[54] TAKE-OUT ARBOR FOR A STRIP ACCUMULATOR

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[51] **Int. Cl.** **B65h 75/02;** B65h 17/48
[58] **Field of Search** .... 242/55, 55.18, 55.19 R, 242/55.19 A, 55.21, 78.1

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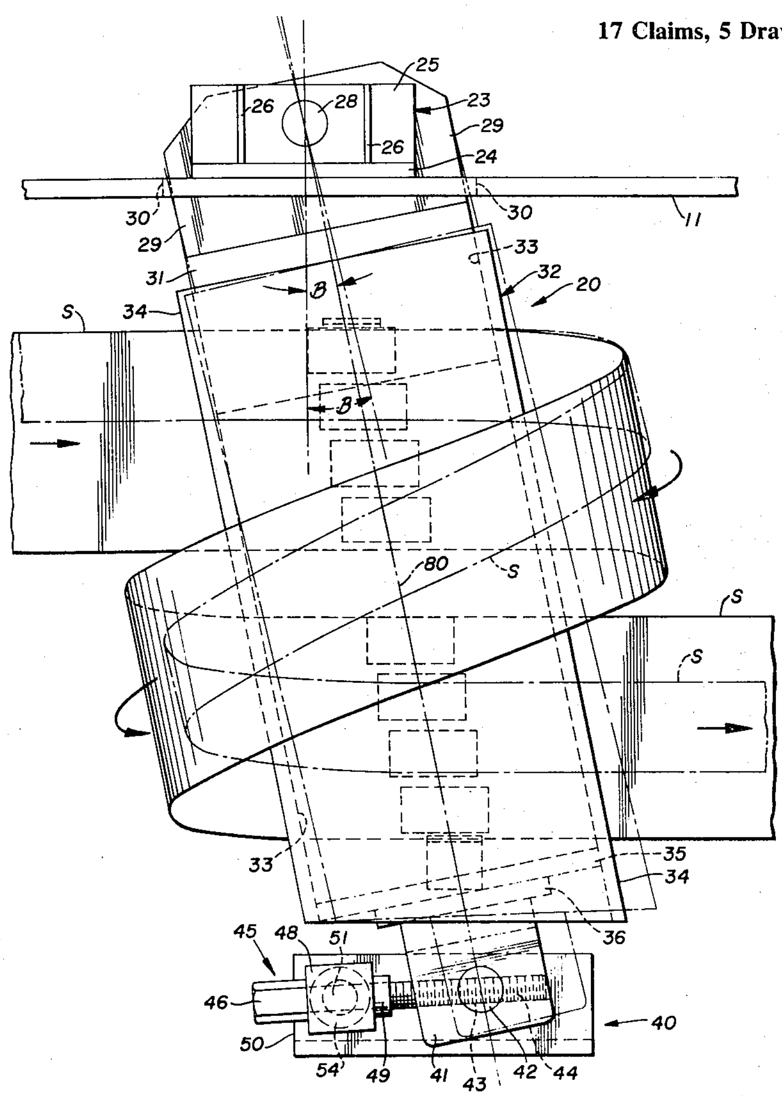
Attorney, Agent, or Firm—Hamilton, Renner & Kenner

[57] **ABSTRACT**

Disclosed is a strip accumulator for use in a continuous process line. According to the method and apparatus disclosed, no matter what the width of the strip of material, it can be fed into the accumulator with one edge thereof against a guide and yet all strip will exit the accumulator with the center line thereof maintained in line with the processing equipment, thereby obviating the need for either adjusting the position of the feed to the accumulator or the position of the processing line equipment. The material is fed into an outer basket or coil of strip, loops around to an inner basket or coil of strip, and then spirals around a take-out arbor before exiting to the process line. The angle of the mounting of the take-out arbor can be adjusted to maintain the center line of the strip in line with the processing equipment. In addition, the arbor is provided with a series of guide rollers which assure a smooth movement in a helical path over the arbor and then out of the accumulator.

17 Claims, 5 Drawing Figures



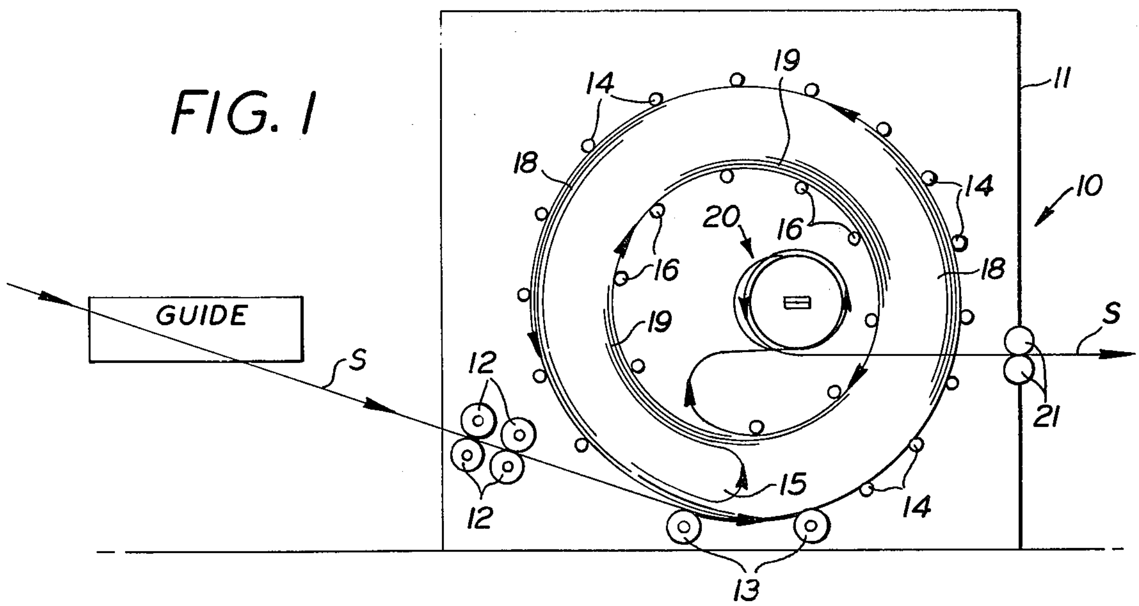

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FIG. 1

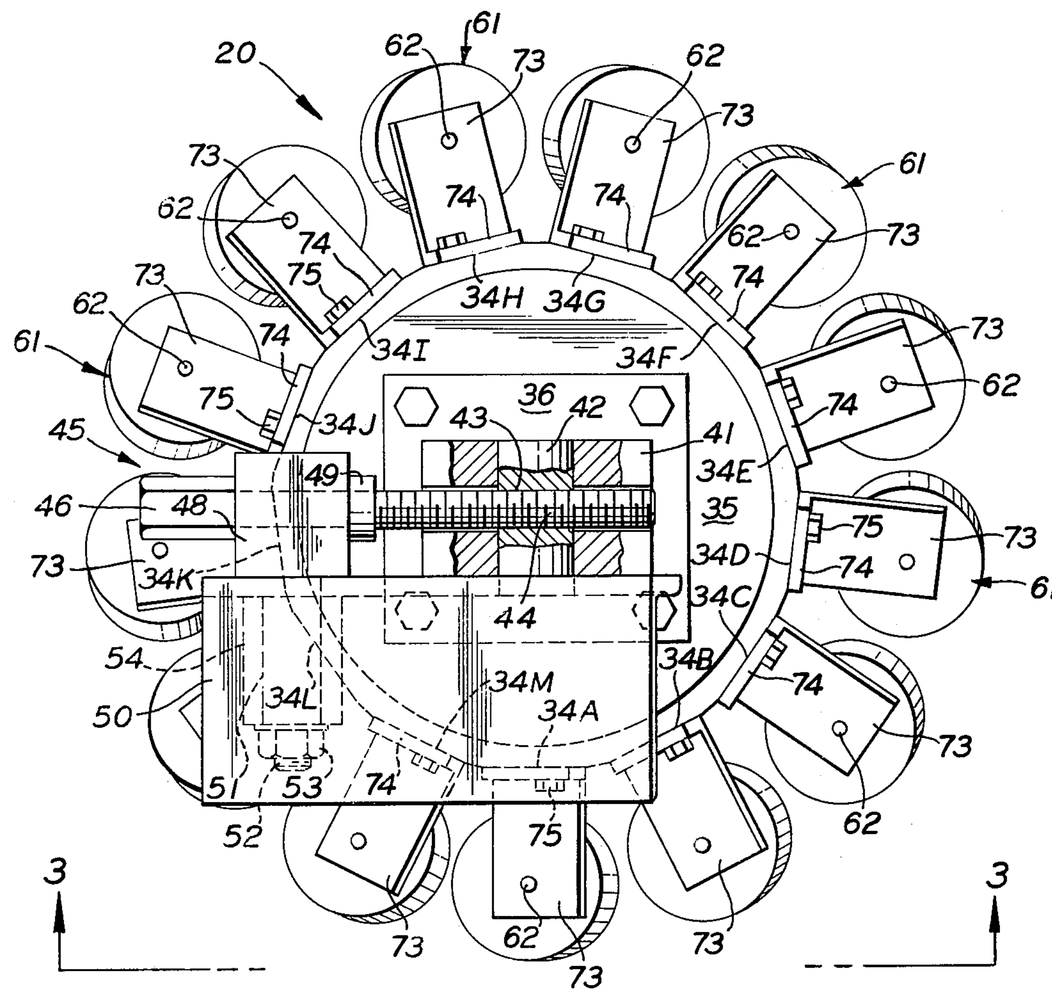
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FIG. 2

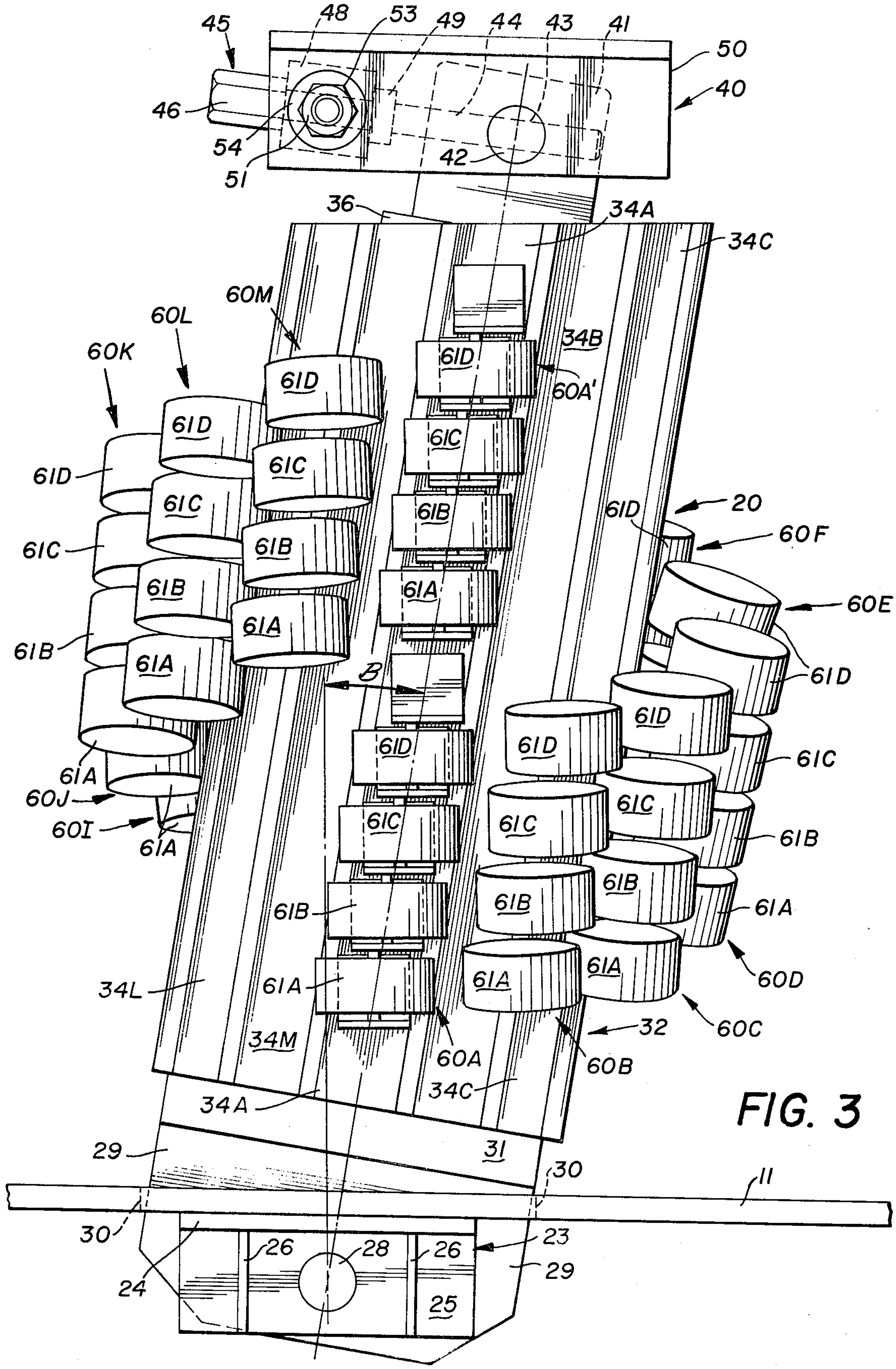
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FIG. 3

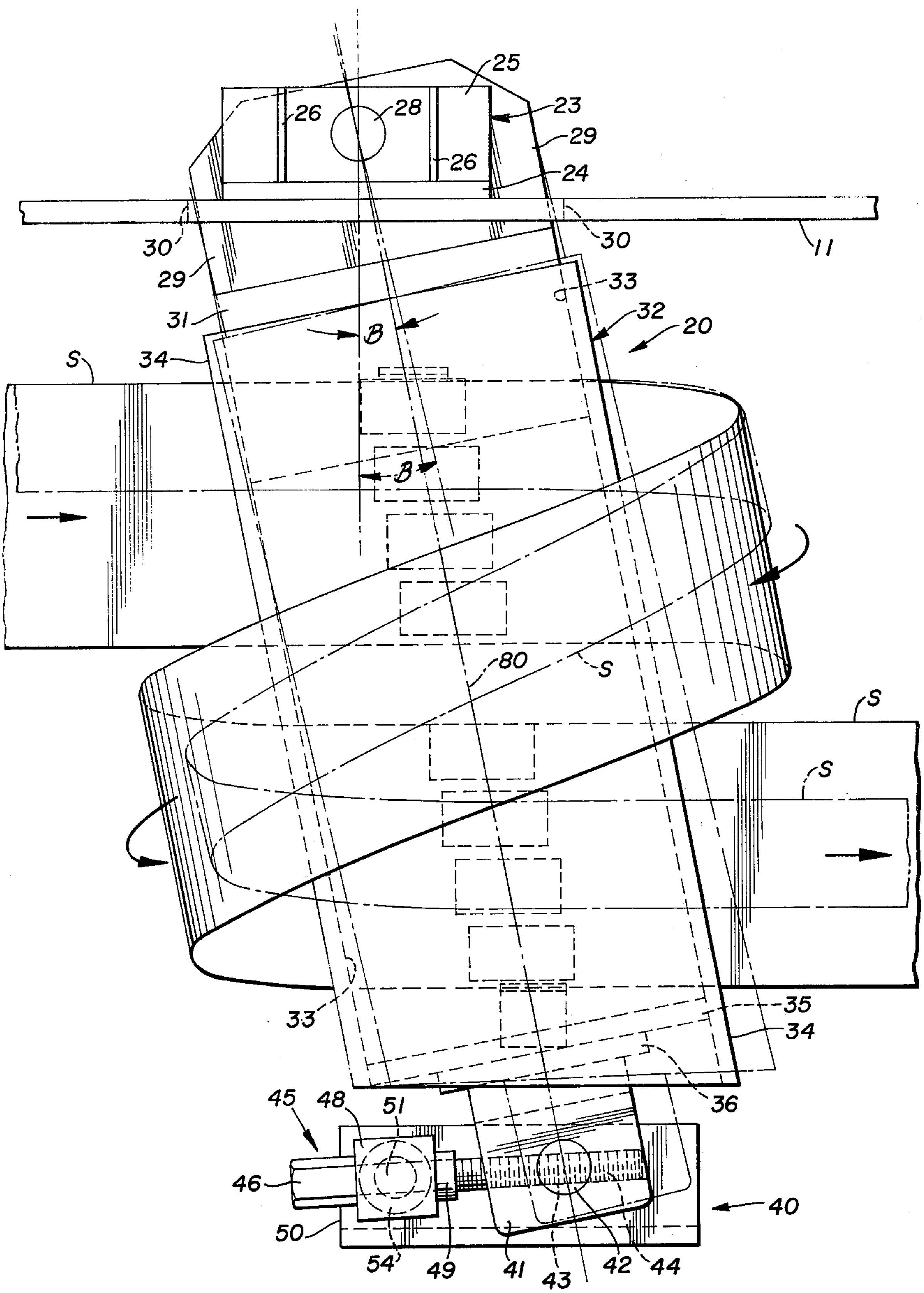
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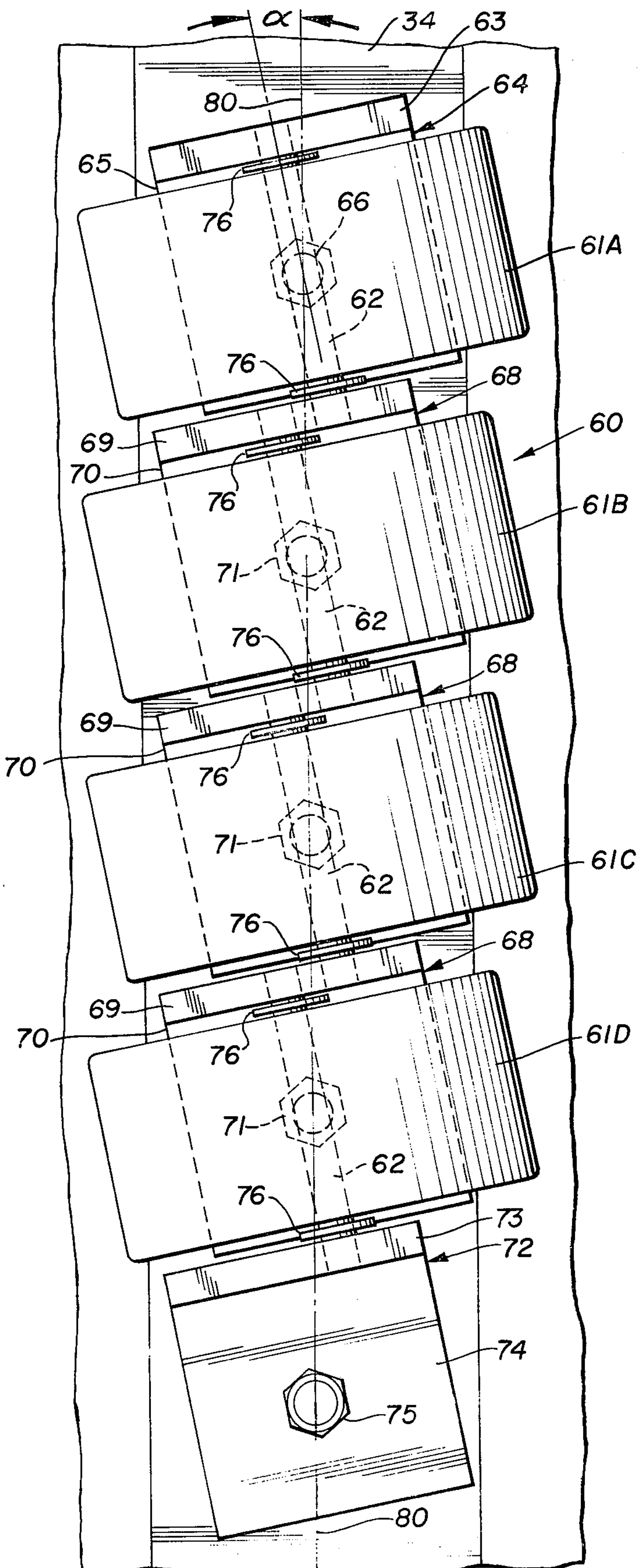
FIG. 4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61C
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61D
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FIG. 5

TAKE-OUT ARBOR FOR A STRIP ACCUMULATOR

BACKGROUND OF THE INVENTION

This invention relates to a strip accumulator for use in a continuous processing line wherein minimal adjustments are necessary to use the accumulator for strip materials of varying widths. More particularly, this invention relates to an accumulator having an angularly mounted take-out arbor, the angularity of which is adjustable to perform the method of maintaining the center line of all sizes of strip at the same position as it exits the accumulator to the processing 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 payed out from a coil until depleted. Because it would be highly 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 to receive strip from the input coil and hold or store a quantity of the same 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 coil is attached, as by welding, to the end of a coil which has just been depleted.

Often times it is possible that the processing line will utilize strips of varying widths throughout the normal working day or week. When a change of strip width is desired, using prior art accumulators of which we are aware, a major alignment problem exists. Essentially all strip processing lines are designed to receive strip material along the center line of the width thereof. Thus, the strip which exits the accumulator must exit at a point such that the center line of the width of the strip is in line with the processing equipment. In order to accomplish this requirement, prior art accumulators dictate that the strip be fed thereto from the coil with the center line of the width of the coil at the proper position so that the strip will exit aligned with the processing equipment. This requires complex adjustments of the position of the coil each and every time the coil width is changed to assure that the coil is properly centered with respect to the accumulator. While adjustable uncoilers are available for this purpose, they are quite expensive and often prove difficult and time consuming to properly adjust.

Many processing lines utilize an uncoiler with a strip guide against which an edge of the strip is placed to guide the strip into the accumulator. In these instances, utilizing presently existing accumulators, the strip is not properly centered as it leaves the accumulator and certain centering adjustments must be made. Machines especially designed to center the strip are available, at some cost, or the processing line can be separated some distance from the accumulator and uncoiler and the strip is permitted to twist and form a sag loop prior to entering the line to properly center the same. These alternative methods of centering the strip are undesirable for a number of reasons. First, additional valuable floor space is always necessary in that the line is spread significantly. Next, additional centering and guiding equipment is required. And finally, these alternate systems of centering do not always perform efficiently, particularly where high speed or incremental hitch feeding is involved, as is most often the case.

Still other problems exist in the manner in which strip is removed from presently existing accumulators such as that shown in U.S. Pat. No. 3,506,210. In these types of machines, strip is accumulated with outer and inner convolutions which are separated by a loop which orbits between the two sets of convolutions. Strip is transferred from the inner loop, around an arbor or pay-off roll, and on to the processing line. However, because the strip is moving at quite high speeds, it rarely tracks properly around the pay-off roll causing adverse twisting or other deformation of the strip and also hingering the precise placement of the strip upon exiting the accumulator.

SUMMARY OF THE INVENTION

It is thus a primary object of the present invention to provide an accumulator capable of feeding strip to processing equipment, the center of the strip being aligned with the processing equipment without requiring that the strip being fed to the accumulator be centered accordingly.

It is a related object of the present invention to provide an accumulator, as above, which may receive strip of varying widths from coils without requiring adjustment of the position of a coil when a change in strip width is desired.

It is another object of the present invention to provide an accumulator, as above, with a take-off arbor which is angularly mounted with respect to the path of the strip, the angularity of the mounting being adjustable to place the center of the strip properly in line with the processing equipment.

It is yet another object of the present invention to provide an accumulator, as above, with a take-off arbor over and around which the strip will properly track during its route out of the accumulator.

It is still another object of the present invention to provide an accumulator, as above, which can be used in a high speed strip processing line without requiring extraneous strip centering equipment and utilizing a minimal amount of floor space.

It is an additional object of the present invention to provide a method of accumulating strip material whereby strip of any width may be fed to the accumulator aligned at a single reference point, yet will exit the accumulator aligned with the processing line.

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

In general, a strip accumulator for use in a processing line includes a plurality of outer rolls which receive strip material and form outer convolutions thereof and a plurality of inner rolls which receive strip from the outer convolutions to form inner convolutions of strip. The strip is then transferred from the inner rolls to and around a take-out arbor which is angularly mounted with respect to the path of the strip material. The strip can be guided into the accumulator by means of an edge alignment device establishing a reference point but due to the angularity of the mounting of the arbor, it leaves the accumulator with the center line of the width of the strip properly in line with the processing equipment. When a different width strip is to be used by the processing line, it too is guided into the accumulator at the same reference point by means of the same edge aligning device but because the angularity of the arbor may be adjusted, it too leaves the accumulator properly centered. In addition, so that the strip of whatever width properly tracks over and around the arbor, it is provided with a series of discontinuous roll clusters mounted in a generally helical path around the arbor to guide the strip thereover.

Thus, according to the method of the present invention, strip is fed to the accumulator aligned with a reference point regardless of the width thereof. Two sets of convolutions of the strip are formed and the strip is transferred from these convolutions, around a take-out arbor in a helical path, and to the processing line at another reference point, this being in the preferred form, a point aligned with the center line of the processing line.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic elevational view of a strip accumulator according to the concept of the present invention.

FIG. 2 is a detailed view of the end of the take-out arbor shown schematically in FIG. 1 and taken perpendicular to the axis of the take-out arbor.

FIG. 3 is a bottom plan view of the take-out arbor taken substantially along line 3—3 of FIG. 2.

FIG. 4 is a schematic top plan view of the take-out arbor depicting its use with two strips of differing widths.

FIG. 5 is a detailed plan view of one roll cluster shown on the arbor in FIGS. 2 and 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An accumulator having the novel features according to the present invention is depicted schematically in FIG. 1 and indicated generally by the numeral **10.** In its preferred form, accumulator **10** is 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 environment of the present invention; however, the invention described herein is capable of utilization in many types of accumulating devices, all of which are well known in the art.

Accumulator **10** receives strip S, which may be of any material and gauge, but which is generally a metallic material, from an uncoiler (not shown) which carries a coil of the strip S. Usually the uncoiler or other device includes an alignment device, such as an edge guide shown schematically in FIG. **1**, for presenting the strip S to the accumulator at a particular position or reference point. While the accumulator **10** of the present invention can advantageously receive strip of any width with only one edge thereof aligned against the guide, it is to be understood that the strip S may also be fed to the accumulator centered, if that is desired.

Accumulator **10** includes a base or face member **11** which in its preferred form is generally vertically upstanding, but which could be tilted or even horizontally oriented, to carry the remaining structures of the accumulator. A plurality of drive wheels **12**, when activated, pull the strip S from the uncoiler and into the accumulator. The strip is transferred past guide and support rollers **13**, which may also be driven or which may be driven instead of wheels **12**, to form an outer loop of strip material, the outer edge of which is defined by a plurality of outer basket rollers **14**. The material travels around the outer basket rollers **14** and forms a free loop **15** as it is turned toward a series of rollers **16** which together form an inner basket or loop of strip material. In order to perform its storing function, the speed of the strip S into the accumulator **10** is generally faster than the speed of the strip out of the accumulator to the processing line. Thus, outer convolutions **18** of strip S are accumulated with strip being continually fed to the outside thereof, and inner convolutions **19** of strip S are accumulated by receiving strip from the inside of the outer convolutions **18** by means of the orbiting of loop **15.** Upon demand from the processing line, which demand is almost always continual, the strip on the inside of the inner convolution **19** is transferred around a take-out arbor assembly, generally directed by the numeral **20,** and guided by rollers **21** to the processing line. Regardless of the manner in which the strip is fed to the accumulator **10,** that is, regardless of whether it is centered or placed against the edge guide, because of the construction of the arbor **20,** to be described below, the strip will exit accumulator **10** at a reference point different than the reference point established by the edge guide, preferably centered to be received directly by the processing line.

The details of the take-out arbor assembly **20** are best shown in FIGS. **2** and **3.** A support bracket **23** has an upstanding flange **24** fixed to face member **11** and a rearwardly extending flange **25** with angular support braces **26** therebetween. Flange **25** has an aperture therein which receives a pivot pin **28.** An arbor support member **29** is carried by and is rotatable on pivot pin **28** and extends through a slot or other suitable aperture **30** in face member **11.** Arbor support member **29** terminates at its inner end as a tongue **31** over which is fitted and welded the arbor body indicated generally by the numeral **32.** Arbor body **32** is a generally hollow member having a cylindrical inner surface **33** (FIG. **4**) which forms a socket for and engages and is welded to tongue **31.** The outer surface **34** of arbor **32** is generally polygonal in nature having, in the form shown, thirteen generally flat surfaces lettered A through M, inclusive, best shown in FIG. **2.**

The front of arbor body **32** is provided with a circular support plate **35** which is fitted within and fixed to cylindrical surface **33** of body **32.** An adjustment support plate **36** is bolted or otherwise affixed to plate **35** and carries the adjustment assembly indicated generally by the numeral **40.** A yoke **41** carries a pin **42** which has a threaded radial bore **43** therethrough. Bore **43** receives the threaded portion **44** of an adjusting bolt **45** having a head **46** which rests against a block **48.** Bolt **45** extends slidably through block **48** with the relative position of the block **48** and bolt **45** being maintained by a lock collar **49.**

Block **48** is rotatably carried on an angle iron **50** which is supported by structural framework (not shown) of accumulator **30.** A pin **51** which is welded or otherwise affixed to block **48** extends through angle iron **50** and has, at its lower end, a threaded nipple **52** to receive nut **53** which is tightened against collar **54** that forms a bearing surface for nut **53.**

As will hereinafter be described in more detail, rotation of bolt **45** will pull or push pin **42** along the bolt's threaded portion **44** to pivot the arbor body **32** on pin **28.** Of course, at the same time block **48** and pin **51** will rotate accordingly to prevent adverse binding of the bolt **45.**

In order to guide the strip material spirally around arbor assembly **20,** a series of roll clusters, each indicated generally by the numeral **60,** are provided and mounted on arbor surfaces **34**A through **34**L, inclusive, in a spiral or helical fashion as shown in FIG. **3.** Each roll cluster **60** can be identical, with the construction thereof being best shown in FIG. **5** as including a series of idler rolls **61**A, **61**B, **61**C and **61**D. While the number and size of the rolls **61** in each cluster is not critical to this invention, a plurality of rolls is necessary for wider strips, at least over two inches in width and it has been found that three or four rolls of approximately 4 inches in diameter and two inches wide will adequately serve to guide medium gauged strip material of widths at least up to 12 inches. Each roll **61** has an axle **62** with the axle or roll **61**A being received by the upstanding branch **63** of an angular end bracket **64,** the second branch **65** of which is attached as by bolt **66** to an arbor surface **34.** Between rolls **61**A and **61**B, rolls **61**B and **61**C and rolls **61**C and **61**D there is provided an intermediate angular bracket **68.** Each bracket **68** includes an upstanding branch **69** and a second angular branch **70** which is attached to arbor surface **34** as by bolts **71.** Each upstanding branch **69** is adapted to receive two axles **62** for the rolls **61** adjacent thereto. An angular end bracket **72** includes an upstanding branch **73** which receives the axle **62** of roll **61**D and a second branch **74** which is attached to arbor surface **34,** as by bolt **75.** Thrust washers **76** can be provided between each bracket **64, 68** and **72** and their adjacent rolls **61**A through **61**D, inclusive to permit facile rotation of the rolls on axles **62.**

The manner in which the roll clusters **60** are mounted on arbor surfaces **34** is important to the guidance of the strip material around arbor **32.** As shown in FIG. **5,** bolts **66, 71** and **75** lie in a line **80** which is parallel to the axis of arbor **32.** A plane, going through the axis of arbor **32** and the line defined by bolts **66, 71** and **75** would be perpendicular to the plane of the surface **34** to which the roll cluster **60** is mounted. The axis of the rolls **61** is, however, angular to the line defined by bolts **66, 71** and **75** an angular to the axis of the arbor **32.** This angle, α in FIG. **5,** is, in the form shown, 11°, 15 minutes, which is designed as such so as to accommodate a wide range of widths of strip material, as will hereinafter be explained.

As best shown in FIG. **3,** roll clusters **60** are mounted on surfaces **34** of arbor **32** in a manner such that the generally helical path of the strip material is approximated. Although there are thirteen surfaces **34**A through **34**M, fourteen roll clusters **60** are necessary with surface **34**A receiving two clusters **60** as shown in the bottom plan view, FIG. **3,** and the remaining surfaces **34**B through **34**M each carrying one cluster **60.** For expediency, the details of the clusters **60,** such as the brackets and the like, are shown only for the clusters on surface **34**A, it being understood that all clusters would be identical to that shown in FIG. **5.** Thus, as strip S approaches arbor **32** (from the left in FIG. **3**), it first contacts cluster **60**A on surface **34**A then cluster **60**B on surface **34**B and on over clusters **60**C through **60**M, inclusive, and exits accumulator **10** after passing over cluster **60**A', the second cluster on surface **34**A.

As previously described, the arbor **32** is normally angularly mounted with respect to the face **11** of accumulator **10.** This permits the strip to move in the generally helical path thereover. The amount of this angle, β in FIGS. **3** and **4,** determines the pitch of the helix such that if a larger angle β is provided, the pitch of the helix will be larger and the strip S will move axially further along arbor **32.**

If the strip is provided to the accumulator **10** and therefore arbor **32** with a fixed edge regardless of the width of the strip, by adjusting the angle β, the strip can be made to leave the arbor **32** with the center line thereof fixed regardless of the width. It has been found, for example, that with an angle β of about 10°, (9°, 55 minutes and 43 seconds to be precise) strip of a width of 10 inches, as shown in the solid lines of FIG. **4,** will be centered as it exits an arbor having an effective diameter, that is, the diameter of the arbor body **32** and roll clusters **60,** of 24 inches, which diameter is a function of strip gauge. If the same arbor were to be used for 4 inch strip, as shown in the chain lines in FIG. **4,** the angle β would be increased to about 12¼° or, more precisely, 12°, 15 minutes and 6 seconds. This will center the strip by enlarging the pitch of the helix to enable the center of the 4 inch strip to move 3 inches farther down the arbor than the center of the 10 inch strip, which is necessary to maintain coincidence of the center lines out.

Because it is desirable that the axis of the rollers **61** be generally perpendicular to the path of the strip, that is, that the rollers **61** be generally aligned with the strip, the angle α should be designed and selected according to the range of strip which might be used in a particular accumulator and therefore within the range of the β angles. Thus, in the situation presented herein, angle α was selected to be 11°, 15 minutes which would be acceptable for the four to ten inch strip widths shown in FIG. **4.** While it is understood that only when the angle α equals the angle β, such as is shown in FIG. **3,** will the strip be perfectly aligned with the rollers **61,** a permissible range of a few degrees of tilt of rollers **61** can be tolerated, as long as the rollers are approximately aligned with the incoming strip.

As shown in FIG. **4,** as the strip S approaches any of the roll clusters **60** it will first contact roller **61**A then sequentially rollers **61**B, **61**C and **61**D of each cluster and because of the angle β of the arbor **32** and the sequence of precisely positioned roll clusters, it will follow the helical path to move out to the processing equipment. Although the arbor assembly **20** described herein is particularly useful in situations where the strip is edge guided thereto and centered by arbor **32** because of the adjustment of angle β, it should be apparent that the apparatus described herein will also operate satisfactorily if the strip were centered as it approached arbor **32** or even fixed in location by means other than an edge guide.

It should thus be evident that an accumulator constructed according to the invention herein will substantially improve the art by permitting its use with wide varieties of strip widths with only minimal adjustments thereby meeting the objects of the invention.

We claim:

1. Apparatus for accumulating strip material in a processing line comprising means receiving the strip and forming an outer set of convolutions of the strip, means receiving strip from the outer set of convolutions and forming an inner set of convolutions of the strip, and arbor means receiving strip from the inner set of convolutions before the strip is transferred to the processing line, said arbor means having an axis which is angular to the path of the strip as received from the inner set of convolutions, and means to adjust the angularity of the axis of said arbor means with respect to the path of the strip to maintain the strip in line with the processing line.

2. Apparatus according to claim **1** wherein said arbor means is pivotally mounted on one end thereof and said means to adjust the angularity of the axis of said arbor means includes a bolt, the rotation of which pivots said arbor means.

3. Apparatus according to claim **2** wherein said means to adjust the angularity of the axis of said arbor means is located at the other end of said arbor means and further includes a threaded pin, and means for carrying said pin, said bolt threadably engaging said pin to pivot said arbor means.

4. Apparatus according to claim **1** further comprising means to guide one edge of the strip material prior to the formation of said outer set of convolutions.

5. Apparatus according to claim **1** wherein the processing line is adapted to receive strip at the center of the width thereof, and said means to adjust the angularity of the axis to the arbor means positions the strip with the center of the width thereof in line with the processing line.

6. Apparatus according to claim **1** wherein said arbor means has a generally polygonal outer surface and further comprising roll cluster means on said polygonal outer surface to guide the strip around said outer surface of said arbor means.

7. Apparatus according to claim **6** wherein said generally polygonal outer surface includes a plurality of flat planar surfaces, at least one said roll cluster means being mounted on each said planar surface to form a helical path for the strip.

8. Apparatus according to claim **6** wherein said generally polygonal outer surface includes at least thirteen planar surfaces, a first of said planar surfaces receiving two of said roll cluster means and the remaining of said planar surfaces receiving one said roll cluster means, said roll cluster means being mounted on said planar surfaces to define a helix starting with one of said roll cluster means on said first of said planar surfaces and ending with the other of said roll cluster means on said first of said planar surfaces.

9. Apparatus according to claim **6** wherein said roll cluster means includes a plurality of rollers having an axis which is angular to the axis of said arbor means.

10. Apparatus according to claim **9** wherein the angle of the axis of said arbor means with respect to the path of the strip material is such that the path of the strip material is substantially perpendicular to the axis of said rollers.

11. Apparatus according to claim **10** wherein said means to adjust the angularity of the axis of the arbor means is capable of moving said axis from a first angle to a second angle and the axis of said rollers with respect to the axis of said arbor means is at a third angle lying between said first and second angles.

12. A take-out arbor for receiving strip material in a strip accumulator, comprising a body member, means to mount said body member on a pivot point, and means to pivot said body member on said pivot point.

13. A take-out arbor according to claim **12** further comprising roll cluster means mounted on said arbor body in a generally helical path to guide the strip material around said arbor body.

14. A take-out arbor according to claim **13** wherein said body member is generally cylindrical having an axis and a generally polygonal outer surface, and said roll cluster means includes a plurality of rollers each having an axis which is angular to the axis of said body member.

15. A method of accumulating strip material in an accumulator for use by a processing line which receives the strip material at a first reference point comprising the steps of, feeding the strip material to the accumulator at a second reference point which is the same regardless of the width of the strip material, forming inner and outer convolutions of the strip material, and transferring the strip material from the convolutions to the processing line at the first reference point.

16. A method according to claim **15** wherein the first reference point is the center line of the width of the strip material and the second reference point is one edge of the strip material,

17. A method according to claim **15** wherein the accumulator includes a take-out arbor and the step of transferring includes the step of moving the strip material around the arbor in a generally helical path to move the strip from the second reference point to the first reference point.

* * * * *