March 19, 1957 R. F. HERR 2,785,891

ACCUMULATOR APPARATUS IN STRIP FEEDING MACHINES

Filed Feb. 13, 1953 6 Sheets-Sheet 1

Fig. 1

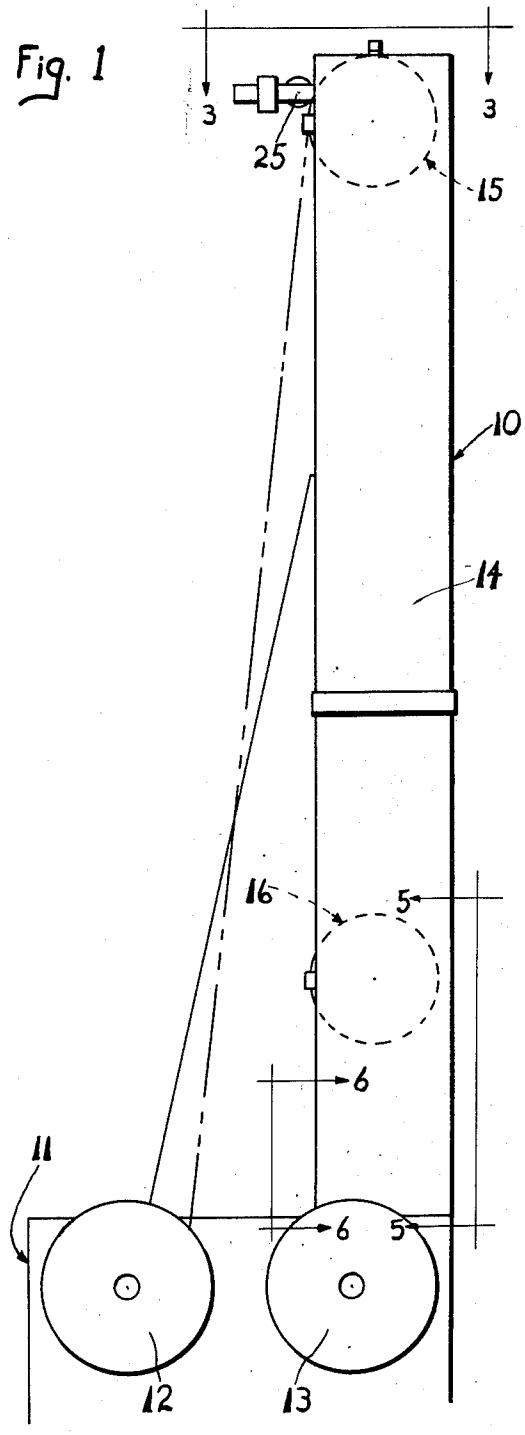
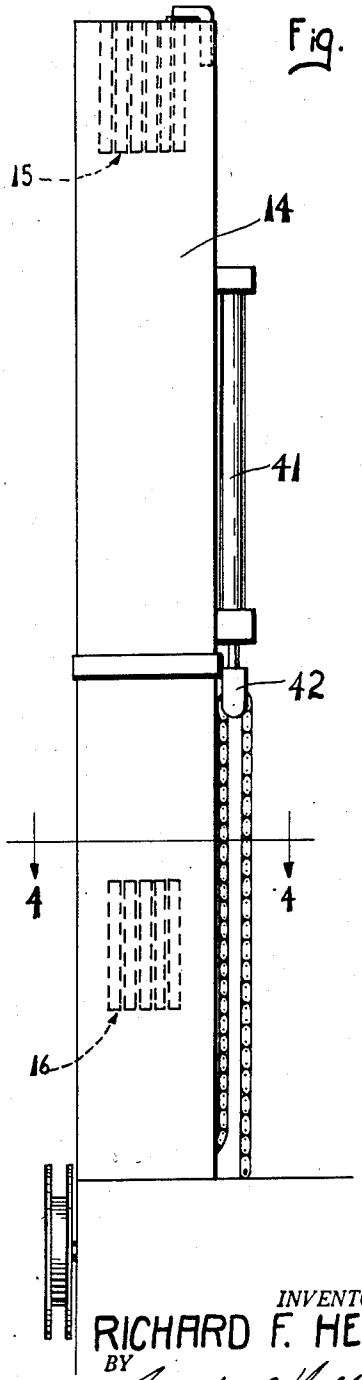


Fig. 2



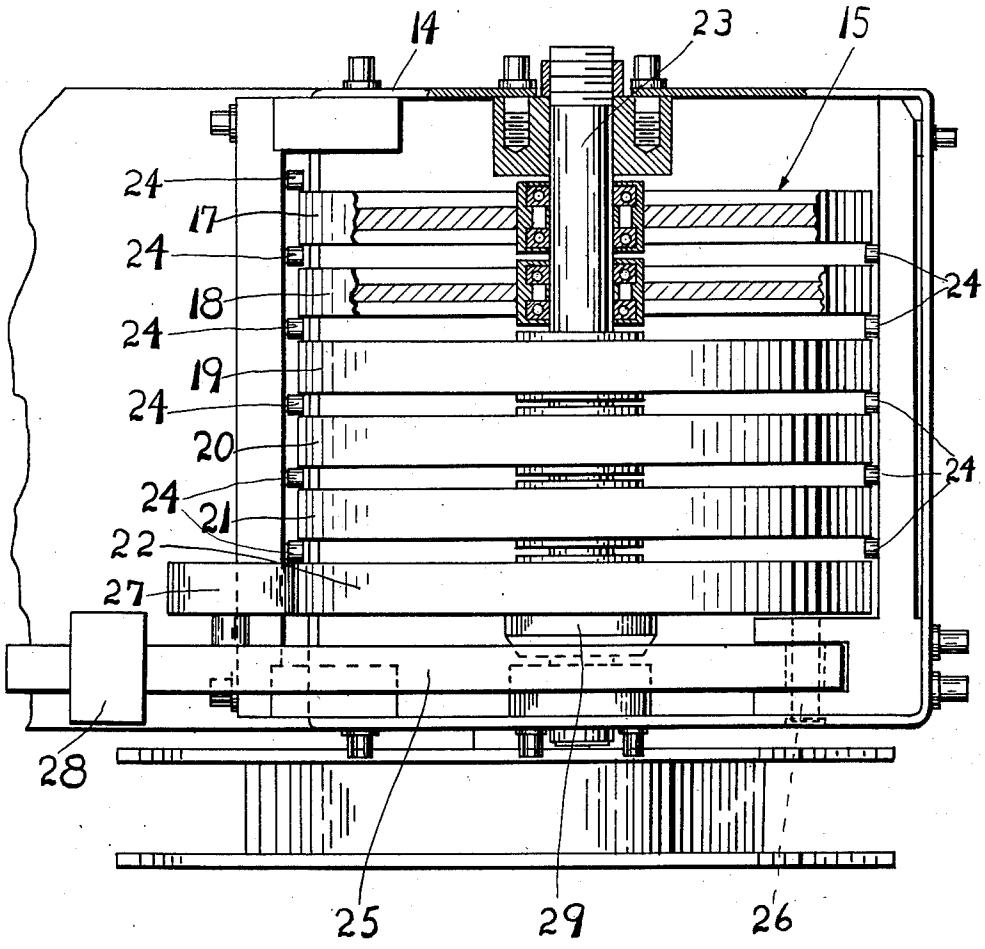
INVENTOR.
RICHARD F. HERR
BY
Richard Williams
ATTORNEY

March 19, 1957 R. F. HERR 2,785,891

ACCUMULATOR APPARATUS IN STRIP FEEDING MACHINES

Filed Feb. 13, 1953 6 Sheets-Sheet 2

Fig. 3



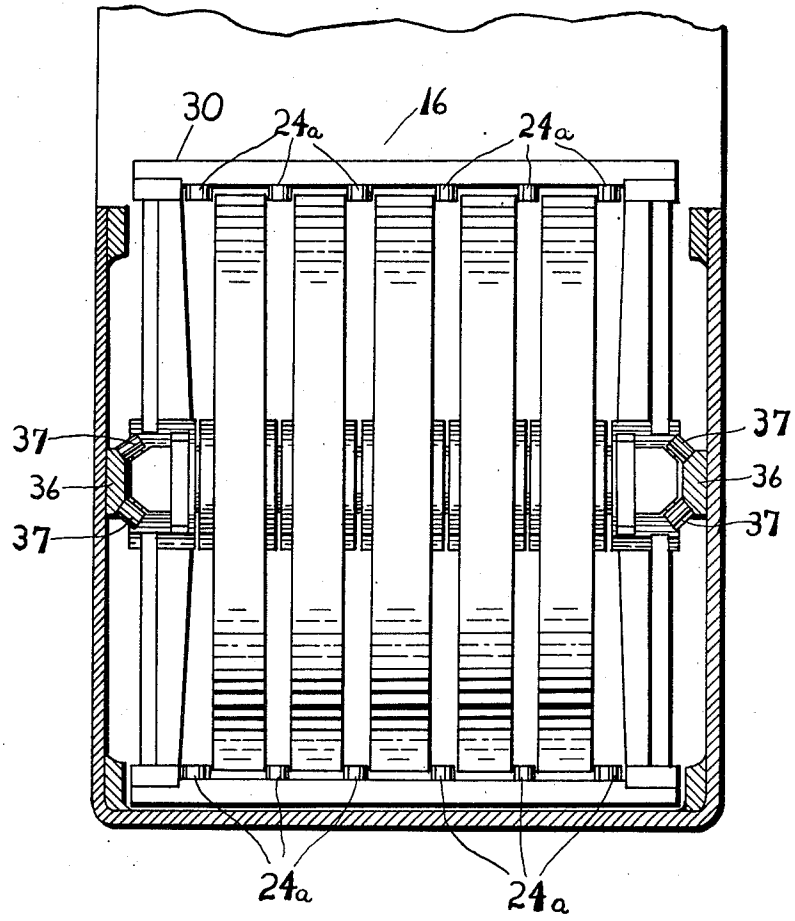
INVENTOR.
RICHARD F. HERR
BY
Marshall Williams
ATTORNEY

March 19, 1957 R. F. HERR 2,785,891

ACCUMULATOR APPARATUS IN STRIP FEEDING MACHINES

Filed Feb. 13, 1953 6 Sheets-Sheet 3

Fig. 4



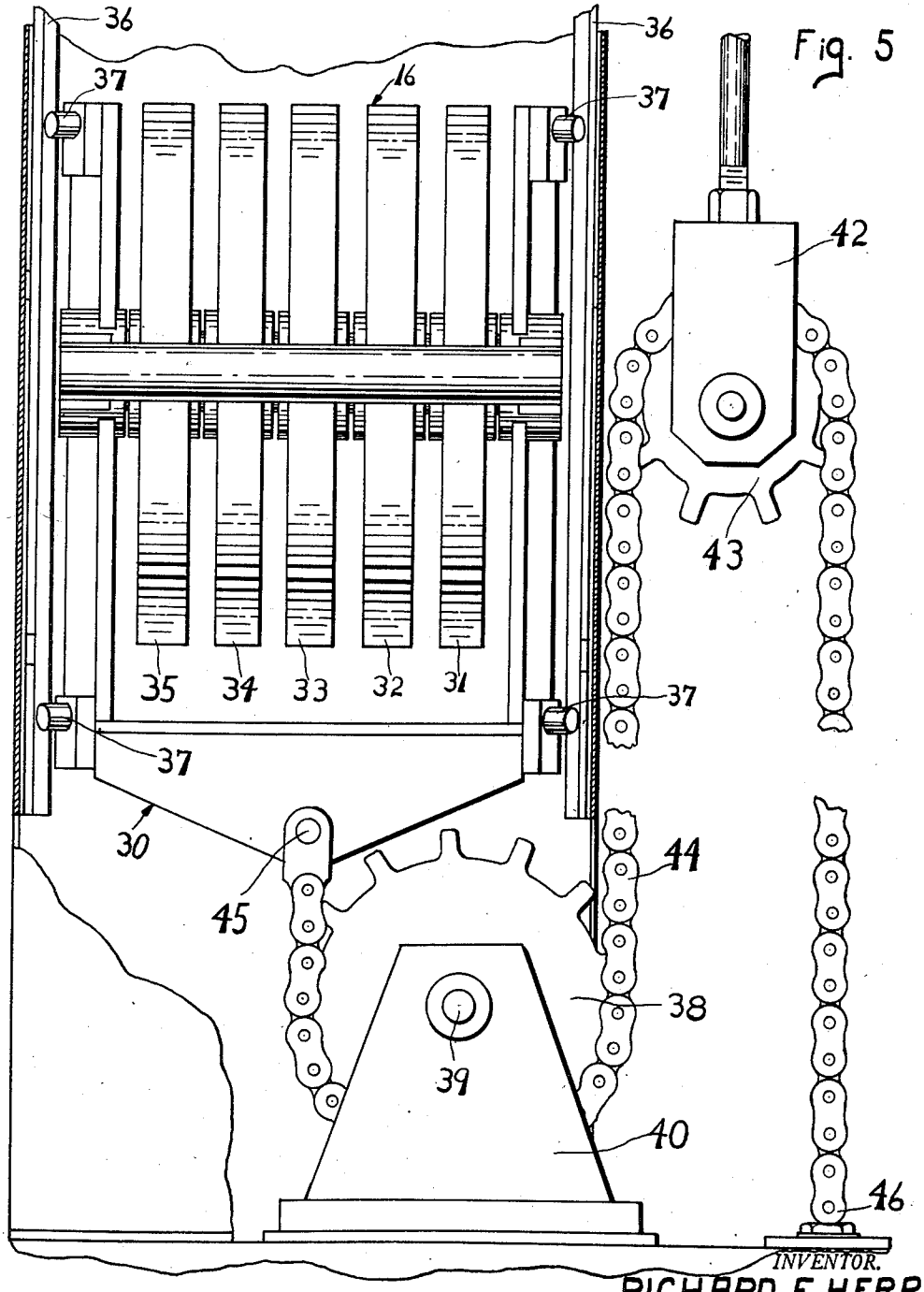
INVENTOR.
RICHARD F. HERR
BY
Richard Williams
ATTORNEY

March 19, 1957 R. F. HERR 2,785,891

ACCUMULATOR APPARATUS IN STRIP FEEDING MACHINES

Filed Feb. 13, 1953 6 Sheets-Sheet 4

Fig. 5



INVENTOR.
RICHARD F. HERR
BY
Richard Williams
ATTORNEY

March 19, 1957 R. F. HERR 2,785,891

ACCUMULATOR APPARATUS IN STRIP FEEDING MACHINES

Filed Feb. 13, 1953 6 Sheets-Sheet 5

Fig. 6

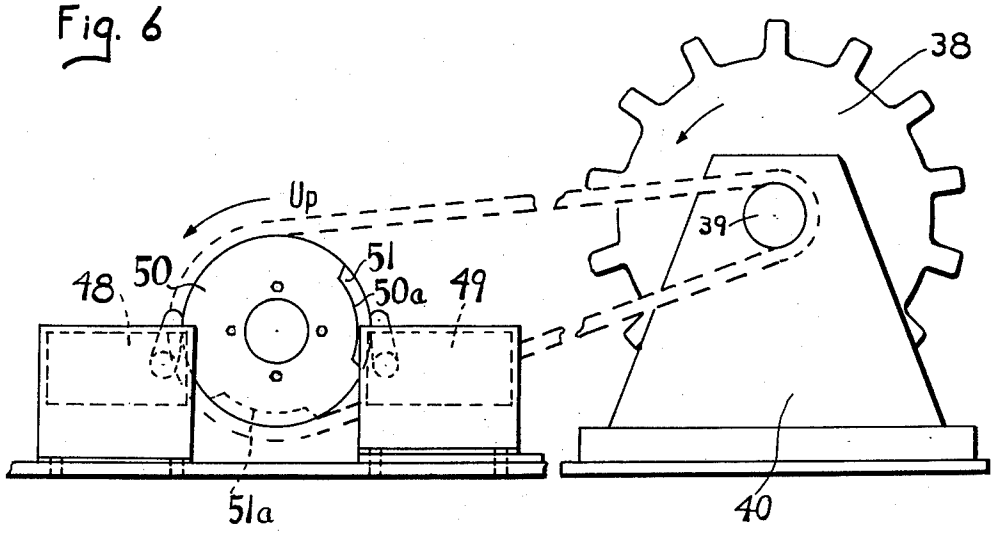
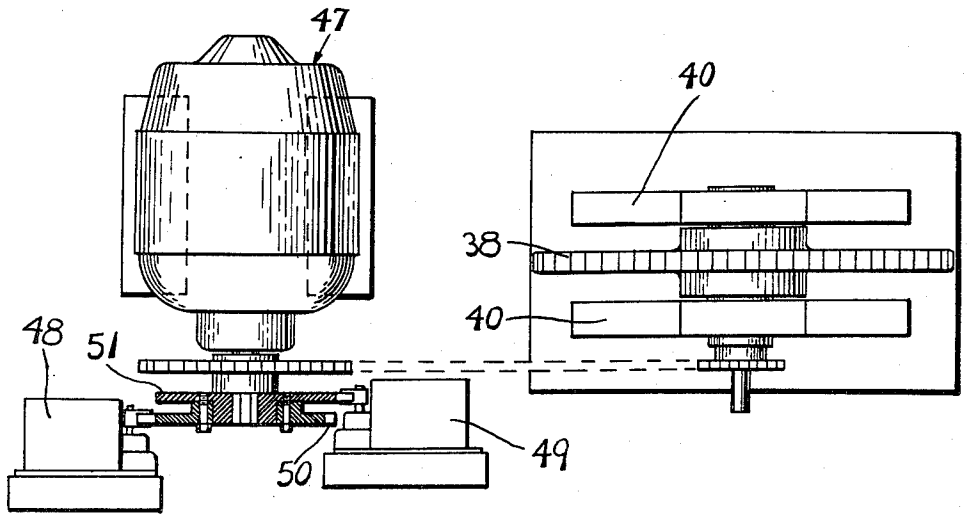


Fig. 7



INVENTOR.
RICHARD F. HERR
BY
Marshall Williams
ATTORNEY

March 19, 1957 R. F. HERR 2,785,891

ACCUMULATOR APPARATUS IN STRIP FEEDING MACHINES

Filed Feb. 13, 1953 6 Sheets-Sheet 6

Fig. 8

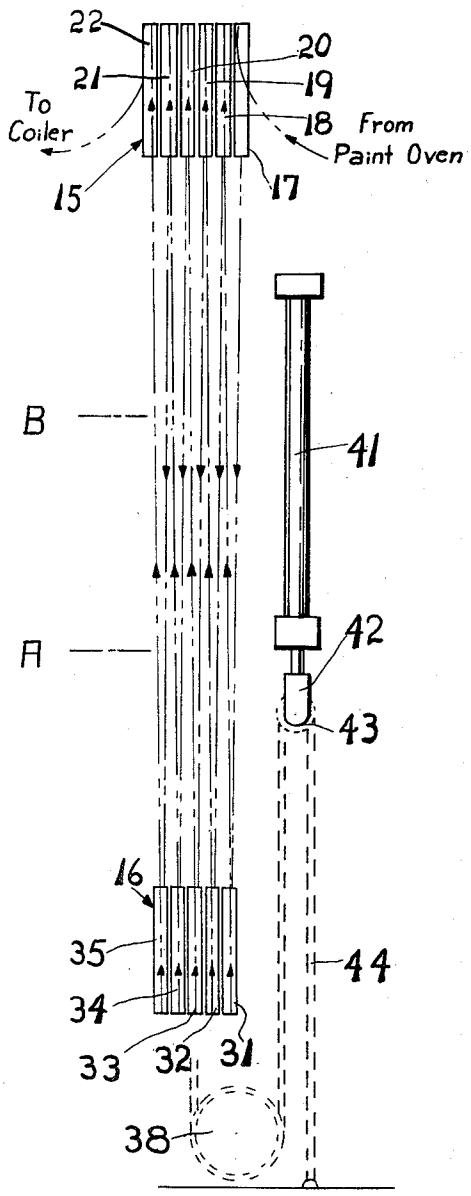
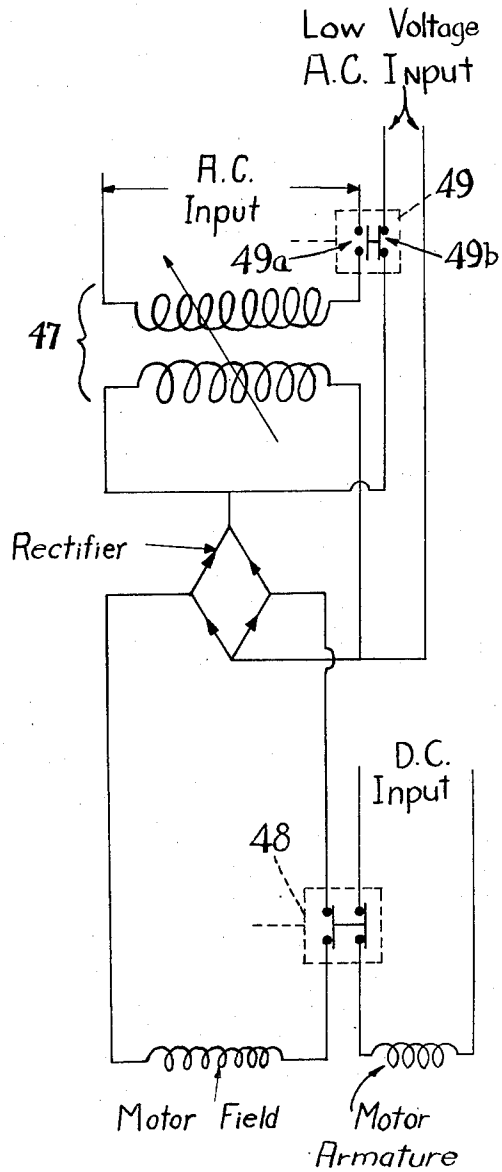


Fig. 9



INVENTOR.
RICHARD F. HERR
BY
Richard Williams
ATTORNEY

United States Patent Office

2,785,891

Patented Mar. 19, 1957

2,785,891

ACCUMULATOR APPARATUS IN STRIP FEEDING MACHINES

Richard F. Herr, Warren, Ohio, assignor, by mesne assignments, to The Herr Equipment Corporation, Warren, Ohio, a corporation of Ohio

Application February 13, 1953, Serial No. 336,839

7 Claims. (Cl. 271—2.3)

My invention relates to an accumulator for maintaining operating conditions between a strip dispensing apparatus and a strip receiving apparatus, and particularly to an accumulator for absorbing the relatively constant rate output of strip and the like from continuous process apparatus such as, for example, a paint oven, and for dispensing such strip to intermittently operated apparatus such as a coiler, and the principal object of my invention is to provide new and improved accumulators of the character described.

A need has long existed for apparatus which would permit tenuous material such as strip and the like to be passed through continuous process apparatus at its optimum constant speed and which would then coil the finished strip without periodically shutting down the continuous process apparatus when the coiling device becomes filled to its capacity in order to shift the strip from a full coiling reel to an empty coiling reel.

My invention fulfills the above mentioned need by providing efficient, compact apparatus that is automatic in operation. These and other advantages will become apparent from a study of the following description and of the drawings appended thereto.

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

Figure 1 is a front elevational view of apparatus embodying my invention,

Figure 2 is a side elevational view of the apparatus shown in Figure 1,

Figure 3 is a fragmentary enlarged plan view generally corresponding to the line 3—3 of Figure 1, certain parts being broken away to illustrate interior construction,

Figure 4 is a fragmentary enlarged sectional view generally corresponding to the line 4—4 of Figure 2,

Figure 5 is a fragmentary enlarged view generally corresponding to the line 5—5 of Figure 1, the outer casing of my apparatus being removed to show the interior construction,

Figure 6 is a fragmentary enlarged view generally corresponding to the line 6—6 of Figure 1,

Figure 7 is a top plan view of the details illustrated in Figure 6, certain parts being shown in section,

Figure 8 is a diagrammatic view illustrating operation of my accumulator apparatus, and

Figure 9 is a portion of the electrical control circuit employed by the present embodiment of my invention.

My accumulator is particularly well adapted for use with coiling apparatus such as shown and described in my co-pending application for Letters Patent, Serial Number 311,491. I have therefore shown the present invention in use with the above identified coiling apparatus;

however, it will be evident that the present invention may also be used with any conventional coiling apparatus.

As illustrated in Figures 1 and 2, my accumulator **10** may conveniently be secured to coiling apparatus **11** so that strip S may be easily fed to either of two reel heads **12**, **13** rotatably supported by the apparatus **11**. Strip is adapted to be fed to my accumulator **10** from any desirable source (not shown) such as, for example, a continuous process device such as a paint oven or the like.

In brief, the coiling apparatus **11** comprises the two coiling reels **12**, **13** that may be selectively driven by means of a variable speed electric motor. However, as previously mentioned, the coiling apparatus **11** herein disclosed is illustrative only and any suitable commercially available coiling apparatus may advantageously be employed.

As illustrated, my accumulator comprises an upright casing **14** supporting a pair of spaced-apart reel units **15**, **16** about which the strip S is adapted to be wound. As shown in Figures 1, 2 and 3, the reel unit **15** comprises a plurality of reels **17**, **18**, **19**, **20**, **21**, and **22** that are disposed in side-by-side relation upon a shaft **23**. The shaft **23** is fixedly secured to the casing **14** and the reels **17** through **22** are independently rotatable about the stationary shaft. Rollers **24** are disposed between the reels **17** through **22** for insuring that the strip will not become disengaged from the respective reels.

Referring particularly to Figures 1 and 3, an arm **25** is pivotally secured to the casing **16** at **26** and a roller **27** is rotatably secured to the arm **25** in position wherein the periphery of the roller **27** engages the periphery of the reel **22**. A weight **28** is positioned on the free end of the arm **25** to urge the roller **27** toward reel **22**.

As mentioned, reel **22** is rotatable about the shaft **23**; however, one-way clutch means **29** of any suitable design is interposed between the reel **22** and the shaft **23** to limit rotation of the reel **22** to the direction shown by the arrow.

As best seen in Figures 4 and 5, reel means **16** comprises a frame structure **30** that supports a plurality of reels **31**, **32**, **33**, **34**, and **35**. These reels are similar in all respects to previously described reels **17** through **21**, and the reels **31** through **35** are independently rotatable about a shaft carried by the frame **30**. Rollers **24***a* are rotatably supported by the frame **30**, these rollers being similar to rollers **24** and being disposed between each of the reels **31** through **35** for the same purpose as rollers **24**.

Vertically extending, oppositely disposed tracks **36** are secured to the inside of the accumulator casing **14** by any suitable means and rollers **37** are rotatably carried by the frame **30** and are engageable with respective tracks **36** as shown. It will be clear that the frame **30** and the reels carried thereby are thus guided for bodily shiftable movement along the tracks **36** toward and away from the stationary reel means **15**.

Referring particularly to Figure 8, the strip S is adapted to be wound upon the reels **17** through **22** and **31** through **35** in the following manner: The strip leading from the paint oven or the like is adapted to first engage reel **17** and to then pass down to reel **31**; around reel **31** and back up to reel **18**; around reel **18** and down to reel **32**; around reel **32** and up to reel **19**; around reel **19** and down to reel **33**; around reel **33** and up to reel **20**; around reel **20** and down to reel **34**; around reel **34** and up to reel **21**; around reel **21** and down to reel **35**; around reel **35**

and up to reel 22; around reel 22 passing between the reel and roller 27 and thence to the coiler 11.

It will be clear that, in operation, the reel unit 16 will be moved toward reel unit 15 whenever the winding speed of the coiler 11 is greater than the speed at which strip is being fed to the accumulator by the paint oven.

Means are provided to resist upward movement of the reel unit 16 by maintaining a constant downward pull thereon. As herein illustrated, a sprocket 38 is rotatably supported by the base of the accumulator apparatus. This sprocket is adapted to be secured to a shaft 39 that is rotatable in bearings provided by spaced-apart supports 40.

A fluid-operated cylinder 41 is secured to the casing 14 of the accumulator 10 and the piston rod of the cylinder is secured to a bifurcated member 42 that rotatably supports a sprocket 43 between its furcations. As best seen in Figure 5, a chain 44 is adapted to engage with each of the sprockets 38, 43 in the manner shown, one end of the chain 44 being secured to the lower portion of the frame 30 at 45 and the other end of the chain being secured to the base of the accumulator at 46. Thus, any desired amount of downward force may be exerted on the reel unit 16 with consequent tension on the strip wound upon the accumulator reels by pulling upwardly on the sprocket 43 with the fluid cylinder 41.

Means are provided for controlling the speed of the coiler 11 in accordance with the amount of strip stored in the accumulator, and as best shown in Figures 6 and 7, comprises a voltage regulator 47 that is chain-connected with the sprocket 38 for unitary rotation therewith. Limit switches 48, 49 are engageable with respective cams 50, 51 that are secured to the rotating portion of the regulator 47 and are rotatable therewith.

In the present embodiment, the regulator 47 comprises an ordinary electric motor whose armature and field have been re-wound to form a transformer whose input and output windings are relatively shiftable. This transformer or regulator operates on alternating current in the conventional manner; however, since the input and output windings are shiftable relative to one another, the output of the transformer may be varied.

As shown in Figure 9, the output of the regulator leads to a rectifier where the current is changed from A. C. to D. C. and is then fed to the field of a D. C. motor that drives the coiler 11. It will be clear that shifting the armature of the regulator will vary the latter's output and this will vary the voltage in the field of the coiler drive motor and thus effectively regulate the speed thereof.

The purpose of the previously mentioned limit switch 49 is to by-pass the regulator 47 so as to feed full voltage to the coiler drive motor at certain times and the purpose of the switch 48 is to stop the coiler motor entirely under conditions to be described.

Operation is as follows, assuming the strip S has been wound about the reels contained within the casing 14 of the accumulator in the manner previously described: As shown in the various drawings and with particular reference to Figure 8, the reel unit 16 of the accumulator has been shown in its maximum down position wherein the accumulator is filled to capacity. It is to be understood, however, that the reel unit 16 will be in the position shown only when the strip is first threaded through the accumulator and that during normal operation this reel unit will not come down to this point.

The end of the strip S may be secured to one of the coiler reels 12, 13 of the coiler unit 11 and the drive motor of the coiler together with the drive mechanism which feeds strip from the paint oven to the accumulator may then be energized. Since the switch 49 is on the lobe, or high point, of its cam (see Figure 6), contacts 49*a* carried by this switch (see Figure 9) interrupt current flow through the input windings of the regulator and thereby render the latter inoperative. Other contacts 49*b* carried by this switch close a low voltage circuit and cause full voltage to be fed to the field of the coiler motor so that it rotates at maximum speed.

The winding speed of the coiler 11, under these conditions, is faster than the generally constant speed at which strip is being fed to the accumulator from the paint oven; consequently, the reel unit 16 will be drawn upwardly toward reel unit 15 against the resistance provided by the cylinder 41. It is to be understood that fluid pressure in the cylinder 41 has previously been adjusted to provide the required amount of tension on the strip.

When the reel unit 16 has moved up to point "A" (see Figure 8) the regulator 47 and cams 50, 51 will have been rotated sufficiently to cause the follower arm of the switch 49 to fall off the lobe of cam 51 and into depression 51*a*. This movement of the switch 49 will close contacts 49*a* thereof and permit the regulator 47 to control the field circuit of the coiler motor. Substantially simultaneously with the closing of switch contacts 49*a*, contacts 49*b* will open to break the low voltage circuit previously passing current to the field circuit of the motor. As the reel unit 16 moves upwardly from point "A," the regulator 47 will continually reduce the speed of the coiler drive motor until the winding speed of the coiler 11 is the same as the speed at which strip is being fed to the accumulator from the paint oven. At this point, reel unit 16 will become stabilized and will remain substantially in one position without moving either up or down.

In the event the voltage regulator 47 cannot reduce the speed of the coiler 11 to a point where the reel unit 16 becomes stabilized, the reel unit 16 will move upwardly until it reaches point "B." The follower arm of the switch 48 will then fall off the lobe of cam 50 and into depression 50*a*. This will break the circuit to both the field windings of the coiler drive motor and to the armature windings thereof to thus cause the motor to stop. As soon as the coiler 11 stops, the reel unit 16 will start to move downwardly since strip is still being fed to the accumulator by the paint oven and since the cylinder 41 is constantly pulling on the reel unit. However, in order to prevent needless cycling of the coiling unit 11, the drive motor of the coiling unit will not be re-energized until the reel unit 16 has moved down to point "A." This control circuit has not been shown since it is provided by a plurality of conventional contactors and holding circuits.

Returning once again to the situation wherein the reel unit has become stabilized by action of the voltage regulator and assuming that a sufficient quantity of strip has been wound upon the coiling reel of the coiling unit 11, the operator will stop the coiling unit 11. He will then sever the strip from the completed reel and secure the severed end leading from the accumulator to an empty reel of the coiling apparatus.

During the discontinuance of the coiling operation, the reel unit 16 has been moving steadily downward under the pressure exerted by the cylinder 41 to absorb the strip being fed from the paint oven. It will be noted that the end of the strip leading from the accumulator will not run back into the accumulator even though it has been severed from the coiling unit 11 because of the one-way clutch 29 which prevents reverse rotation of reel 22 of reel unit 15 and roller 27 which tightly presses the strip against this reel.

As soon as the free end of the strip S has been secured to the empty reel of the coiling unit 11, the operator will energize the coiling unit to once again start the coiling operation. This will then cause the reel unit 16 to start moving upwardly again to repeat the cycle.

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. For use with strip dispensing apparatus operating at a relatively constant rate and strip receiving apparatus operating intermittently and at variable speeds, an accumulator for receiving strip from said dispensing apparatus and for passing strip to said receiving apparatus, comprising spaced-apart reel means upon which the strip is adapted to be wound, said reel means being relatively movable toward and away from each other to vary the storage capacity of said accumulator, means yieldably urging said reel means away from each other with predetermined force, means for effecting operation of said receiving means at relatively high speed when said reel means are relatively widely spaced, means for reducing the speed of said receiving means as said reel means move together, and means for stopping said receiving means when said reel means are relatively closely spaced.

2. An accumulator for passing strip to receiving means, comprising a plurality of reels upon which strip is adapted to be wound and including a first set of reels coaxially disposed in side-by-side relation and a second set of reels also coaxially disposed in side-by-side relation, the axes of said reels being disposed in spaced-apart parallel relation and the axis of said first set of reels being fixed in position and the axis of said second set of reels being movable transversely of its axis toward and away from the axis of said first set of reels to thereby vary the storage capacity of said accumulator, a fluid motor connected with said second set of reels to effect movement thereof in a direction away from said first set of reels, means for effecting operation of said receiving means at relatively high speed when said reel means are relatively widely spaced, means for reducing the speed of said receiving means as said reel means move together, and means for stopping said receiving means when said reel means are relatively closely spaced.

3. An accumulator for receiving strip from dispensing apparatus operating at a relatively constant rate and for storing said strip under tension and for passing said strip to engagement with coiling apparatus operating intermittently and at variable speeds, comprising spaced-apart reel means upon which said strip is adapted to be wound, said reel means being relatively movable toward and away from each other to vary the storage capacity of said accumulator, means for effecting operation of said coiling apparatus at relatively high speed when said reel means are relatively widely spaced and for effecting operation of said coiling apparatus at relatively low speed when said reel means are relatively closely spaced, and means to prevent movement toward said accumulator of the strip portion extending between said accumulator and said coiling apparatus upon disengagement of said strip portion from said coiling apparatus.

4. In strip handling apparatus, the combination of accumulating apparatus for storing varying amounts of strip and having an entrance portion for receiving the strip and an exit portion for exit of the strip and of withdrawing apparatus engaged with the exiting strip portion and operable at variable speeds to withdraw strip from said accumulating apparatus at variable rates, said accumulating apparatus holding the stored strip under a longitudinal tension which exerts a force tending to pull the strip in a reverse direction from said withdrawing apparatus to said accumulating apparatus, means interposed between said accumulating apparatus and said withdrawing apparatus and operable to engage the exiting strip portion to prevent movement thereof in said reverse direction when the longitudinal tension exerted by said accumulating apparatus is predominant, and means for effecting operation of said withdrawing apparatus at relatively high speed when a relatively large amount of strip is stored in said accumulating apparatus and for reducing the speed of said withdrawing means as the amount of strip stored within said accumulating apparatus decreases.

5. In strip handling apparatus, the combination of an accumulator for storing varying amounts of strip and of withdrawing apparatus engaged with a strip portion exiting from said accumulator for withdrawing strip from the latter, said accumulator having a plurality of rotatably mounted reels about which the strip is adapted to be wound to provide a plurality of longitudinally extending reaches and said accumulator having an exit reel about which the exiting strip passes to said withdrawing apparatus, said reels being relatively movable toward and away from each other to vary the length of said strip reaches to thus vary the amount of strip stored in said accumulator, means for holding the strip stored in said accumulator under a longitudinal tension which exerts a force tending to pull said strip portion in a reverse direction from said withdrawing apparatus to said accumulator, and means preventing movement of said strip portion in said reverse direction when said longitudinal tension is predominant comprising means for preventing rotation of said exit reel in a direction to pass strip in said reverse direction and means for maintaining said strip in frictional engagement with said exit reel.

6. In strip handling apparatus, the combination of an accumulator for storing varying amounts of strip and of withdrawing apparatus engaged with a strip portion exiting from said accumulator and operable at variable speeds for withdrawing strip from the latter at variable rates, said accumulator having a plurality of rotatably mounted reels about which the strip is adapted to be wound to provide a plurality of longitudinally extending reaches and said accumulator having an exit reel about which the exiting strip passes to said withdrawing apparatus, said reels being relatively movable toward and away from each other to vary the length of said strip reaches to thus vary the amount of strip stored in said accumulator, means for holding the strip stored in said accumulator under a longitudinal tension which exerts a force tending to pull said strip portion in a reverse direction from said withdrawing apparatus to said accumulator, means preventing movement of said strip portion in said reverse direction when said longitudinal tension is predominant comprising means for preventing rotation of said exit reel in a direction to pass strip in said reverse direction and means for maintaining said strip in frictional engagement with said exit reel, and means for effecting operation of said withdrawing apparatus at relatively high speed when a relatively large amount of strip is stored in said accumulator and for reducing the speed of said withdrawing means as the amount of strip stored within said accumulator decreases.

7. In strip handling apparatus, the combination of accumulating apparatus for storing varying amounts of strip under longitudinal tension and having an entrance portion for receiving the strip and an exit portion for exit of the strip, and of withdrawing apparatus engaged with the exiting strip portion to overcome the tension exerted by said accumulating apparatus and withdraw strip therefrom, the longitudinal tension exerted on the strip by said accumulating apparatus tending to pull the strip in a reverse direction from said withdrawing apparatus to said accumulating apparatus, and means providing a pass for the strip through which the latter is drawn by said withdrawing apparatus and comprising a pair of members relatively movable toward and away from each other and engaged with transversely opposed strip portions, said means being interposed between the stored strip and said withdrawing apparatus and clamping the engaged strip portion therebetween to prevent strip movement in said reverse direction when the longi-

tudinal tension exerted by said accumulating apparatus is predominant.

References Cited in the file of this patent

UNITED STATES PATENTS

1,587,639	Fleischer	June 8, 1926
1,637,892	Benner et al.	Aug. 2, 1927
1,740,844	Strout	Dec. 24, 1929
2,007,614	Prentice	July 9, 1935
2,048,182	Ybarrondo	July 21, 1936
2,050,053	Graf et al.	Aug. 4, 1936
2,248,333	Burbank	July 8, 1941
2,292,511	Ferm	Aug. 11, 1942
2,348,456	Dickerman	May 9, 1944
2,494,402	Mursch	Jan. 10, 1950
2,584,293	Sachs et al.	Feb. 5, 1952
2,605,101	Lessmann	July 29, 1952