Nov. 25, 1958 N. J. RANNEY 2,861,802

LOOPING TOWER

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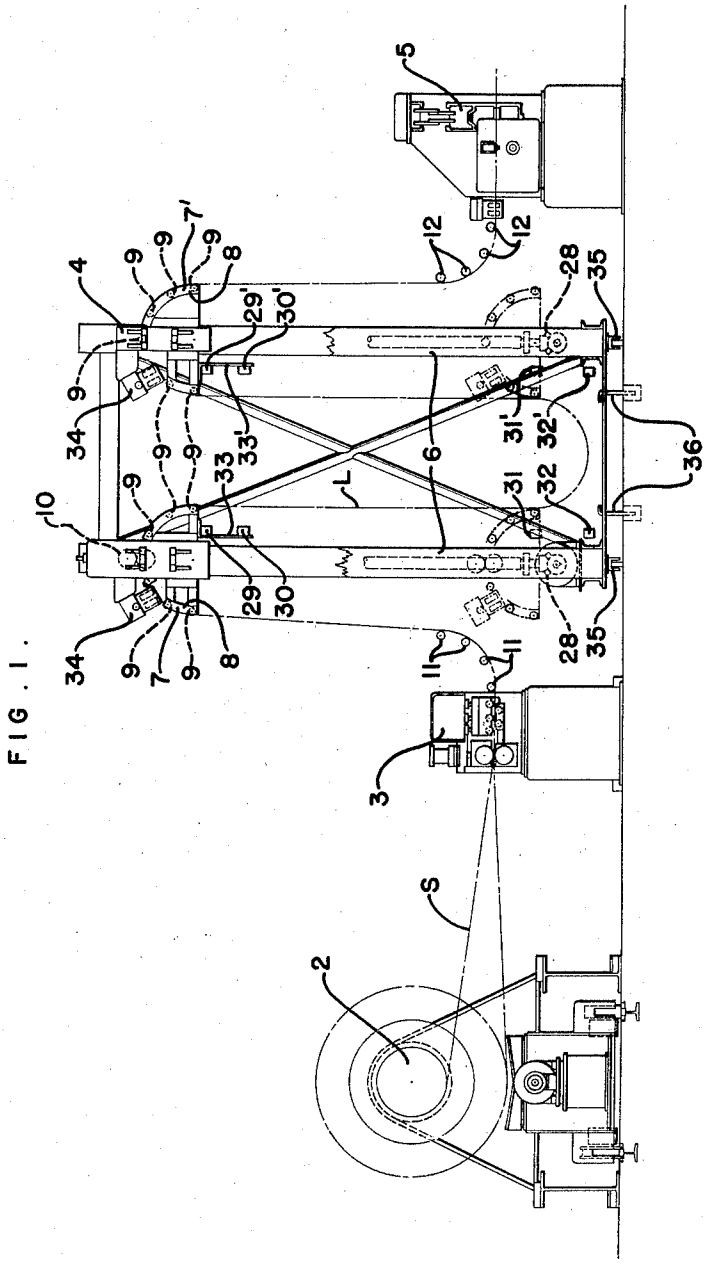

FIG. 1.

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FIG. 2.

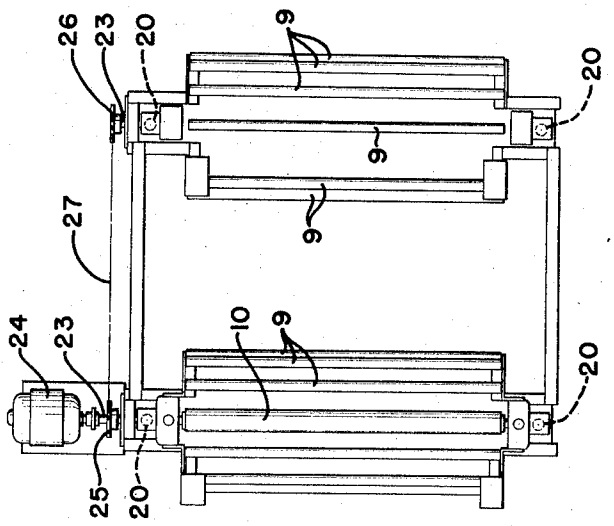

FIG. 4.

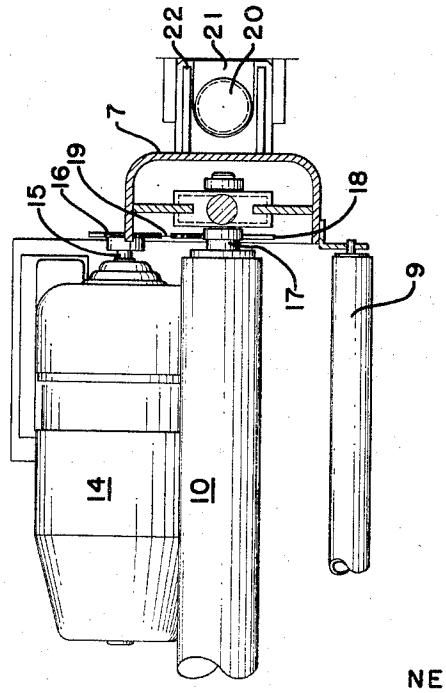

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FIG. 5.

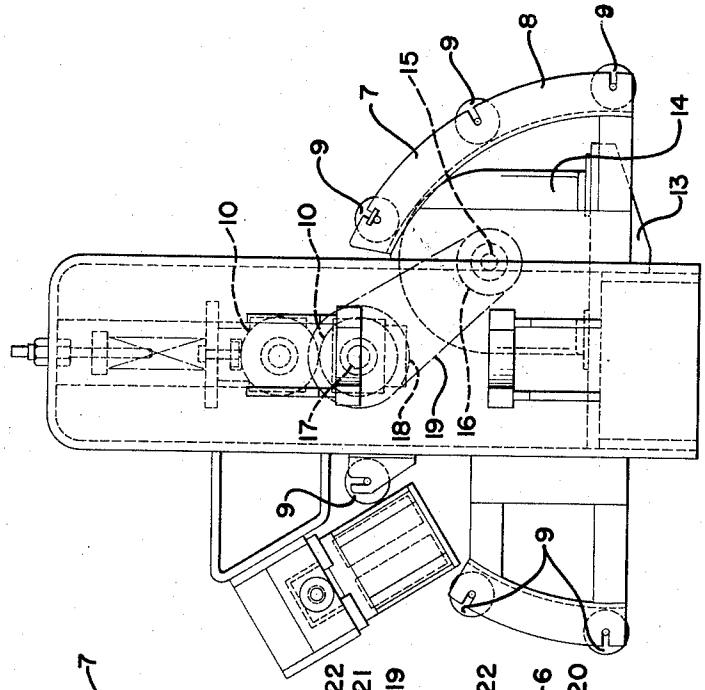
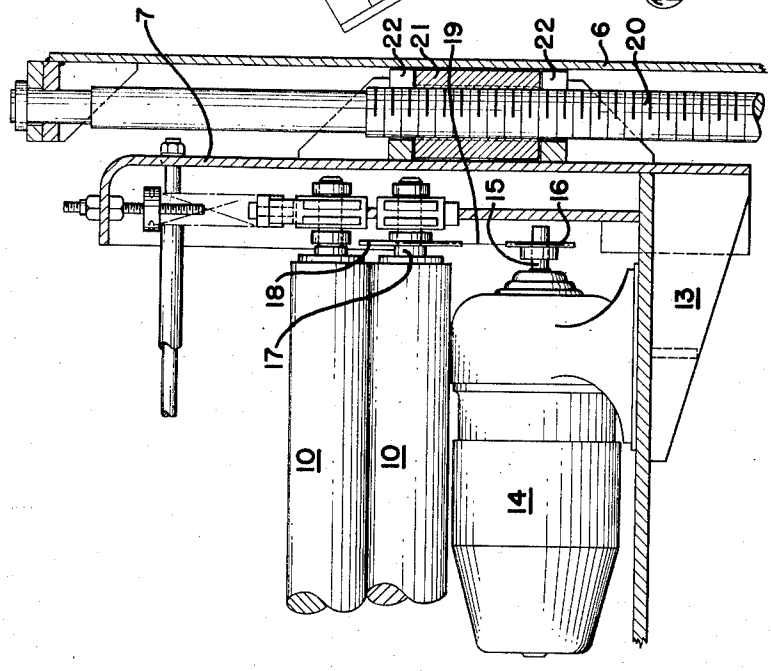


FIG. 3.



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United States Patent Office 2,861,802
Patented Nov. 25, 1958

2,861,802

LOOPING TOWER

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Application August 11, 1955, Serial No. 527,793

15 Claims. (Cl. 271—2.2)

This invention relates to a looping tower which may be utilized for providing a loop of strip in a feed line for an intermittently operating press or other instrumentality acting on the strip.

When strip is acted on intermittently by a press, shear or other instrumentality which requires that the strip be stationary while it is being acted on means must be provided for intermittently feeding the strip. The strip may come from a coil held in an uncoiler and may be fed continuously from the coil to a looping station where a loop of the strip is maintained to compensate for the intermittent feed of the strip to the press or other instrumentality. During the time while the strip is being acted on the length of the loop increases and between operations of the press the strip is fed through the press at a speed greater than the mean speed of the feeding of the strip to the loop, the object being to withdraw from the loop upon each cycle of operation of the press the amount of strip introduced into the loop during a cycle so that the mean length of the loop remains approximately constant although its length of necessity varies somewhat during each cycle.

Control means are provided to take care of situations in which due to temporary or unusual conditions the loop may tend to become too long or too short. For example, light sensitive devices which are actuated upon movement of the bottom of the loop therepast are commonly used for loop control. When the loop becomes shorter than a predetermined length control means actuated by a light sensitive device may increase the speed of feed of the strip to the loop. When the loop becomes still shorter similar control means may stop the entire line. When the loop lengthens to a predetermined point control means may reduce the speed of feed to the loop. When the loop lengthens further control means may either further decrease the speed of feed to the loop or stop the feed entirely or stop the entire line.

In past years, with feed units operating at slow feed rates, and especially when running short feed lengths from relatively light coils, a small loop ahead of the press (ranging to a maximum height equal to the distance from the floor line to the pass line) has been satisfactory. The uncoiler and the means for feeding the strip to the loop, which may be a roller leveler, could be jogged intermittently to maintain the loop, using some such means as a dancer roll for the feed signal. However, with present high speeds of feed and press operation a small loop such as above referred to is no longer adequate. When feeding lengths up to fifteen feet or more from coils weighing forty thousand pounds or more it is impractical to jog the coil and accelerate and decelerate the strip fed from the coil upon each cycle of operation of the press. Unless provision is made for accelerating and decelerating the coil a short loop becomes inadequate as it does not provide for sufficient storage to insure an operation of the press at optimum speed while maintaining the length of the loop within proper operating limits with a constantly fed strip.

In order to take advantage of the high rate of feed potential of modern press feed equipment it is necessary that a free hanging loop of adequate length be provided ahead of the press. Unless sufficient loop storage is provided the number of cycles or feeds per unit of time which can be accomplished with high speed press equipment may be reduced by one-half or more.

It has heretofore been proposed to provide the required loop storage by forming a deep pit below the pass line and extending many feet below the floor. Such a pit has not, however, proved to be the solution to the problem since it has a number of serious disadvantages. A pit cannot be used in many plants because it would interfere with operations being performed in the basement or the floor below the floor on which the strip line is installed. Many strip processing plants are built alongside rivers because of the availability of water transportation; deep pits cannot be used in many such plants because the bottom of the pit would be below water level, at least at times of high water. Moreover, a pit is expensive to build and maintain and presents a difficult drainage problem. Also, a pit represents a safety hazard and may be the cause of increased insurance rates. Many operators are opposed to any type of excavation in the floor because it impairs the flexibility of a plant and the ability to shift equipment around into various arrangements.

I have devised a looping tower which solves the problem of providing a free hanging loop of adequate length without the use of a pit. My looping tower incorporates a number of features whereby important advantages over prior arrangements are realized.

My looping tower comprises upstanding supporting means and a plurality of spaced apart loop supporting heads carried by the upstanding supporting means. Each of the loop supporting heads preferably has loop supporting members, as, for example, rollers, disposed in generally upwardly convex semi-cylindrical arrangement. Thus when viewed from the end each of the loop supporting heads has generally umbrella shape but when viewed from the side or the direction of feed it is straight and substantially horizontal. The axes of the loop supporting heads are substantially horizontal and parallel. When the loop supporting heads are operative they are disposed at the upper portion of the upstanding supporting means.

Means are preferably provided for moving the loop supporting heads up and down in the upstanding supporting means. While the loop supporting heads are disposed at the upper portion of the upstanding supporting means during normal operation of the looping tower, it is convenient to move them down to a position relatively close to floor level and preferably at about the level of the pass line when strip is to be threaded through the looping tower.

The space within my looping tower between and below the level of the loop supporting heads is preferably entirely clear providing for a freely hanging vertical loop of varying length.

One of the loop supporting heads preferably includes strip advancing means for positively advancing strip into a loop formed between the loop supporting heads. The strip advancing means may comprise driven pinch rolls, and a motive unit for driving the pinch rolls is preferably carried by the loop supporting head which includes the pinch rolls. Strip feeding means are preferably provided ahead of the looping tower, such means commonly comprising a roller leveler for removing coil set from the strip. The pinch rolls in the looping tower preferably operate at the same speed as the leveler which may be provided for by driving the pinch rolls with a constant torque motor.

The means for advancing strip into a loop formed between the loop supporting heads may include control means sensitive to the length of the loop. The control means when operative may be at least partially in the path of movement of at least one of the loop supporting heads and mounted for movement to non-interfering position to permit movement of the loop supporting head. The control means may have a light sensitive device actuated upon movement of the bottom of the loop therepast, the light sensitive device when operative being at least partially in the path of movement of at least one of the loop supporting heads and mounted for movement to non-interfering position to permit movement of the loop supporting head. The control means or the light sensitive device may be carried by at least one of the loop supporting heads. Alternatively, the control means or the light sensitive device may be hinge-mounted with cam means to automatically swing it out of the way when the loop supporting heads are lowered and swing it back into place when the loop supporting heads are raised. In either case the control means or light sensitive device is mounted for movement to non-interfering position to permit movement of the loop supporting head.

I preferably employ screw means for moving the loop supporting heads up and down in the upstanding supporting means. Upstanding screws may be provided cooperating with both ends of each of the loop supporting heads. Means may be provided for rotating the screws in unison to move the loop supporting heads up and down in the upstanding supporting means.

In a preferred form of my looping tower one of the loop supporting heads may include driven pinch rolls for positively advancing strip into a loop formed between the loop supporting heads and a motive unit for driving the pinch rolls may be carried by the loop supporting head which includes the pinch rolls. Means are provided for feeding strip to the pinch rolls. Control means for the feeding means are provided which are sensitive to the length of the loop and may, for example, include a light sensitive device. The control means when operative are at least partially in the path of movement of at least one of the loop supporting heads and as above explained are mounted for movement to non-interfering position to permit movement of the loop supporting head.

Other details, objects and advantages of the invention will become apparent as the following description of a present preferred embodiment thereof proceeds.

In the accompanying drawings I have shown a present preferred embodiment of the invention in which

Figure 1 is a somewhat diagrammatic side elevational view of a press line incorporating my looping tower;

Figure 2 is a top plan view of the looping tower;

Figure 3 is a detail fragmentary vertical cross-sectional view to enlarged scale showing the drive for the pinch rolls and a portion of the machanism for raising and lowering one of the loop supporting heads;

Figure 4 is a plan view of the mechanism shown in Figure 3; and

Figure 5 is an elevational view of a portion of the mechanism shown in Figure 3.

Referring first more particularly to Figure 1, the strip line comprises an uncoiler designated generally by reference numeral **2** and which may be of conventional construction, a roller leveler designated generally by reference numeral **3** and which may also be of conventional construction, a looping tower designated generally by reference numeral **4** made in accordance with my invention and a press designated generally by reference numeral **5** which may be of conventional construction. Thus all of the elements of the line except the looping tower may be conventional. The leveler is driven in the conventional way and acts to feed strip S continuously from a coil in the uncoiler **2** to the looping tower **4**. The leveler also has the function of removing coil set from the strip. The leveler normally operates at a speed

calculated to adequately maintain the loop in the looping tower but the speed of the leveler may be increased or decreased or the leveler or the entire line may be stopped by control mechanism presently to be described. The press **5** is of the intermittent type. It contains its own feed rolls which advance strip from the looping tower **4** step by step. The strip is operated on in the press when it is standing still in between advancing movements. Thus while the leveler **3** feeds strip continuously to the looping tower the press **5** draws strip intermittently from the looping tower. The mean speed of feeding strip to the looping tower is less than the speed at which the strip advances in the press in between press operations so that the result is the maintenance in the looping tower of a free hanging loop of adequate length. The loop is shortened as the press advances the strip and is lengthened while the strip is standing still in the press to be operated upon.

The looping tower **4** comprises upstanding supporting means **6** and a plurality (two are shown) of spaced apart loop supporting heads carried by the upstanding supporting means **6**. The loop supporting head at the entry end of the looping tower is designated **7** while the loop supporting head at the exit end of the looping tower is designated **7'**. Each of the loop supporting heads **7** and **7'** comprises a frame **8** in which are mounted for free rotation six rollers **9**. The loop supporting head **7** does not have a topmost roll **9** corresponding to the topmost roll **9** of the loop supporting head **7'** but instead has at its top a pair of pinch rolls **10**. The strip as shown in Figure 1 passes over all twelve of the rollers **9** and between the pinch rolls **10** and a loop L of the strip hangs down in the looping tower between the loop supporting heads. The loop L is a free hanging loop of adequate length to provide for variations in feed of the strip to the loop by the leveler and withdrawal of the loop by the press. In each of the loop supporting heads the rolls are disposed in generally upwardly convex semi-cylindrical arrangement (like a cross section through an umbrella) with the axes of the loop supporting heads substantially horizontal and parallel as shown in Figure 1. Normally the loop supporting heads are at the same elevation although that is not an essential characteristic of my looping tower.

Rollers **11** are provided for guiding the strip from generally horizontal orientation as delivered from the leveler to generally vertical orientation as it moves toward the loop supporting head **7** and rollers **12** are provided for guiding the strip from generally vertical orientation as delivered from the loop supporting head **7'** to generally horizontal orientation as it moves into the press **5**. The rollers **9**, **11** and **12** and the pinch rolls **10** are arranged relatively to one another so that the strip turns gradually about radii large enough so that the strip will not acquire set after leaving the leveler.

The loop supporting head **7** in which the pinch rolls **10** are journaled also comprises a bracket **13** on which is mounted a constant torque electric motor **14** whose shaft **15** has a sprocket **16** fixed thereto. The lower pinch roll **10** has a shaft **17** to which is fixed a sprocket **18**. A sprocket chain **19** is trained about the sprockets **16** and **18** so that the motor drives the lower pinch roll **10**. Since the pinch rolls tightly engage the strip passing between them it is not necessary that the upper pinch roll be driven but if desired the two pinch rolls may be geared or otherwise connected together so that the upper pinch roll is driven from the lower pinch roll. The constant torque motor **14** will maintain the strip taut between the leveler and the looping tower and feed it into the looping tower, the speed of feed of the strip to the looping tower being determined by the speed of the leveler drive.

The upstanding supporting means **6** has a vertical screw **20** at each of the four corners thereof as shown in Figure 2. The screws **20** are journaled for rotation and are of identical pitch and of proper hand to raise and

lower both of the loop supporting heads together. A nut 21 is in mesh with each of the four screws 20. Each nut 21 is bracketed in the vertical direction by portions 22 of one of the loop supporting heads respectively above and below the nut as shown in Figure 3. At the bottom of the upstanding supporting means 6 are two shafts 23 extending parallel to the respective loop supporting heads above them. One of the shafts 23 is coupled to a reversing type electric motor 24 and has fixed thereto a sprocket 25. The other shaft 23 has fixed thereto a sprocket 26. A sprocket chain 27 is trained about the sprockets 25 and 26 so that the motor 24 drives the two shafts 23 in synchronism in either direction depending upon the direction in which the motor is driven. The shafts 23 pass beneath the screws 20 and drive the screws 20 through bevel gears 28. When the motor 24 operates in one direction the screws 20 are driven so that the loop supporting heads 7 and 7' move upwardly together and when the motor 24 operates in the other direction the screws 20 are driven so that the loop supporting heads 7 and 7' move downwardly together.

Provision should be made for preventing the loop L from becoming either too long or too short. Four light sources 29, 30, 31 and 32 are provided to the left of the loop L viewing Figure 1 and four light sensitive devices 29', 30', 31' and 32' are provided to the right of the loop L. The light source 29 is horizontally opposite the light sensitive device 29', the light source 30 is horizontally opposite the light sensitive device 30', the light source 31 is horizontally opposite the light sensitive device 31' and the light source 32 is horizontally opposite the light sensitive device 32'. The horizontal line extending from each light source to the corresponding light sensitive device passes through the loop when the loop is long enough to intercept the line. The bottom of the loop is normally between the level 30—30' and the level 31—31'. When the bottom of the loop moves downwardly to intercept the light beam passing from the light source 31 to the light sensitive device 31' means are operated to slow down the leveler drive. When the bottom of the loop reaches the level 32—32' the leveler is stopped. When the loop shortens so that its bottom rises above the level 30—30' the speed of the leveler is increased until the bottom of the loop again passes below that line. If the bottom of the loop rises above the level 29—29' the entire line is stopped. The controls are conventional in their operation and are such as may be found in looping pits.

The upper light sources 29 and 90 and the upper light sensitive devices 29' and 30' are disposed in the paths of movement of the loop supporting heads 7 and 7', respectively, and provision must be made for mounting those light sources and light sensitive devices for movement to non-interfering position to permit downward movement of the loop supporting heads. One way of accomplishing the result is to mount the light sources 29 and 30 on the loop supporting head 7 and mount the light sensitive devices 29' and 30' on the loop supporting head 7'. This is done through brackets 33 and 33', respectively, shown in Figure 1. Thus when the loop supporting heads move downwardly the light sources 29 and 30 and the light sensitive devices 29' and 30' move downwardly along with them and hence do not interfere with downward movement of the loop supporting heads.

All of the light sources and light sensitive devices are positioned at or near the longitudinal center line of the strip so that even for relatively narrow strips the loop L intercepts all of the beams from the respective light sources to the corresponding light sensitive devices when the loop is of adequate length. However, the upper light sources 29 and 30 and the upper light sensitive devices 29' and 30' are offset laterally from the lower light sources 31 and 32 and the lower light sensitive devices 31' and 32', respectively, so that when the loop supporting heads 7 and 7' move downwardly to

the chain line positions shown in Figure 1 for threading of the looping tower the upper light sources and light sensitive devices do not strike the lower light sources and light sensitive devices but pass to the side thereof.

Suitable side guides 34 are provided at the sides of the strip in the respective loop supporting heads 7 and 7' to maintain the strip in proper centered position in the looping tower.

The looping tower is mounted on casters or rollers 35 so that it is readily portable and may be rolled on the mill floor from one place to another. It is maintained in position in any one location by clamps 36.

My looping tower provides a free hanging loop of sufficient length to provide for high speed operation without use of a pit. The free hanging loop affords a minimum of back tension ahead of the press. Substantial back tension in the loop such as might be produced by a weighted roll in the loop will tend to produce slippage of the feed rolls in the press and thus result in an inaccurate length of feed.

In some press feed lines the uncoiler is driven to feed the strip into the loop and the leveler is included as an integral part of the press unit and feeds the strip directly into the press. With such an arrangement the looping problem is the same as with the arrangement shown and described in the present application and is equally well solved by my looping tower.

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

I claim:

1. A looping tower comprising upstanding supporting means, a plurality of spaced apart loop supporting heads, each of the loop supporting heads having loop supporting members disposed in generally upwardly convex semicylindrical arrangement with the axes of the loop supporting heads substantially horizontal and parallel, the loop supporting heads being carried by the upstanding supporting means and the loop supporting heads when operative being disposed at the upper portion of the upstanding supporting means, and means for moving the loop supporting heads up and down.

2. A looping tower comprising upstanding supporting means, a plurality of spaced apart loop supporting heads, each of the loop supporting heads having loop supporting members disposed in generally upwardly convex semicylindrical arrangement with the axes of the loop supporting heads substantially horizontal and parallel, the loop supporting heads being carried by the upstanding supporting means, and means for moving the loop supporting heads up and down in the upstanding supporting means.

3. A looping tower comprising upstanding supporting means, a plurality of spaced apart loop supporting heads having their axes substantially horizontal and parallel, the loop supporting heads being carried by the upstanding supporting means and the loop supporting heads when operative being disposed at the upper portion of the upstanding supporting means, the space within the tower between and below the level of the loop supporting heads being entirely clear providing for a freely hanging vertical loop of varying length, and means for moving the loop supporting heads up and down.

4. A looping tower comprising upstanding supporting means, means cooperatively engaging and guiding a flexible elongated member passing therealong, said engaging and guiding means including a plurality of spaced apart loop supporting heads having their axes substantially horizontal and parallel, the loop supporting heads being carried by the upstanding supporting means, the space within the tower between and below the level of the loop supporting heads being entirely clear providing for a freely hanging vertical loop of varying length, and

means for moving the loop supporting heads up and down in the upstanding supporting means.

5. A looping tower comprising upstanding supporting means, a pluraity of spaced apart loop supporting heads having their axes substantially horizontal and parallel, the loop supporting heads being carried by the upstanding supporting means and the loop supporting heads when operative being disposed at the upper portion of the upstanding supporting means, one of the loop supporting heads including strip advancing means for positively advancing strip into a loop formed between the loop supporting heads, and means for moving the loop supporting heads up and down.

6. A looping tower comprising upstanding supporting means, a plurality of spaced apart loop supporting heads having their axes substantially horizontal and parallel, the loop supporting heads being carried by the upstanding supporting means, one of the loop supporting heads including strip advancing means for positively advancing strip into a loop formed between the loop supporting heads, and means for moving the loop supporting heads up and down in the upstanding supporting means.

7. A looping tower comprising upstanding supporting means, a plurality of spaced apart loop supporting heads having their axes substantially horizontal and parallel, the loop supporting heads being carried by the upstanding supporting means, means for moving the loop supporting heads up and down in the upstanding supporting means and means for advancing strip into a loop formed between the loop supporting heads, the last mentioned means including control means sensitive to the length of the loop.

8. A looping tower comprising upstanding supporting means, a plurality of spaced apart loop supporting heads having their axes substantially horizontal and parallel, the loop supporting heads being carried by the upstanding supporting means, means for moving the loop supporting heads up and down in the upstanding supporting means and means for advancing strip into a loop formed between the loop supporting heads, the last mentioned means including control means sensitive to the length of the loop, the control means when operative being at least partially in the path of movement of at least one of the loop supporting heads and mounted for movement to non-interfering position to permit movement of the loop supporting head.

9. A looping tower comprising upstanding supporting means, a plurality of spaced apart loop supporting heads having their axes substantially horizontal and parallel, the loop supporting heads being carried by the upstanding supporting means, means for moving the loop supporting heads up and down in the upstanding supporting means and means for advancing strip into a loop formed between the loop supporting heads, the last mentioned means including control means having a light sensitive device actuated upon movement of the bottom of the loop therepast, the light sensitive device when operative being at least partially in the path of movement of at least one of the loop supporting heads and mounted for movement to non-interfering position to permit movement of the loop supporting head.

10. A looping tower comprising upstanding supporting means, a plurality of spaced apart loop supporting heads having their axes substantially horizontal and parallel, the loop supporting heads being carried by the upstanding supporting means, means for moving the loop supporting heads up and down in the upstanding supporting means and means for advancing strip into a loop formed between the loop supporting heads, the last mentioned means including control means sensitive to the length of the loop carried by at least one of the loop supporting heads.

11. A looping tower comprising upstanding supporting means, a plurality of spaced apart loop supporting heads, each of the loop supporting heads having loop supporting members disposed in generally upwardly convex semi-cylindrical arrangement with the axes of the loop supporting heads substantially horizontal and parallel, the loop supporting heads being carried by the upstanding supporting means, means for moving the loop supporting heads up and down in the upstanding supporting means and means for advancing strip into a loop formed between the loop supporting heads, the last mentioned means including control means sensitive to the length of the loop, the control means when operative being at least partially in the path of movement of at least one of the loop supporting heads and mounted for movement to non-interfering position to permit movement of the loop supporting head.

12. A looping tower comprising upstanding supporting means, means cooperatively engaging and guiding a flexible elongated member passing therealong, said engaging and guiding means including a plurality of spaced apart loop supporting heads having their axes substantially horizontal and parallel, the loop supporting heads being carried by the upstanding supporting means, and screw means for moving the loop supporting heads up and down in the upstanding supporting means.

13. A looping tower comprising upstanding supporting means, a plurality of spaced apart loop supporting heads having their axes substantially horizontal and parallel, the loop supporting heads being carried by the upstanding supporting means, upstanding screws cooperating with both ends of each of the loop supporting heads and means for rotating the screws in unison to move the loop supporting heads up and down in the upstanding supporting means.

14. A looping tower comprising upstanding supporting means, a plurality of spaced apart loop supporting heads having their axes substantially horizontal and parallel, the loop supporting heads being carried by the upstanding supporting means, one of the loop supporting heads including driven pinch rolls for positively advancing strip into a loop formed between the loop supporting heads, a motive unit for driving the pinch rolls carried by the loop supporting head which includes the pinch rolls and means for moving the loop supporting heads up and down in the upstanding supporting means.

15. A looping tower comprising upstanding supporting means, a plurality of spaced apart loop supporting heads having their axes substantially horizontal and parallel, the loop supporting heads being carried by the upstanding supporting means, one of the loop supporting heads including driven pinch rolls for positively advancing strip into a loop formed between the loop supporting heads, a motive unit for driving the pinch rolls carried by the loop supporting head which includes the pinch rolls, means for feeding strip to the pinch rolls, means for moving the loop supporting heads up and down in the upstanding supporting means and control means for the feeding means sensitive to the length of the loop, the control means when operative being at least partially in the path of movement of at least one of the loop supporting heads and mounted for movement to non-interfering position to permit movement of the loop supporting head.

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