Jan. 27, 1959 P. R. PRICE 2,871,012

DISPLAY APPARATUS TO ALLOW EXAMINATION OF A FAST-MOVING CONTINUOUS WEB

Filed Aug. 13, 1956 3 Sheets-Sheet 1

Fig. 1.

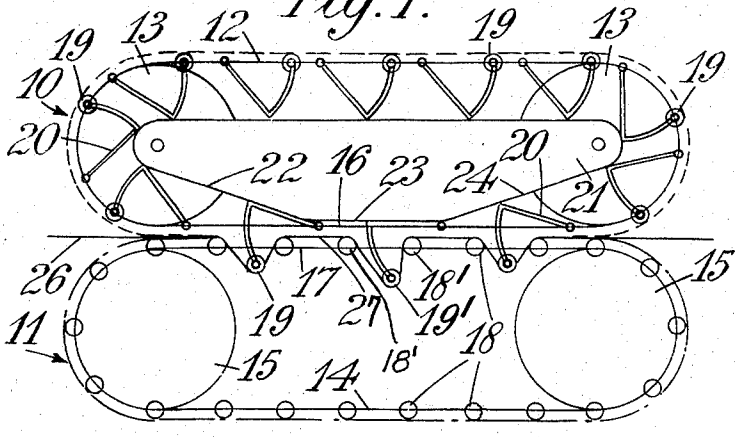
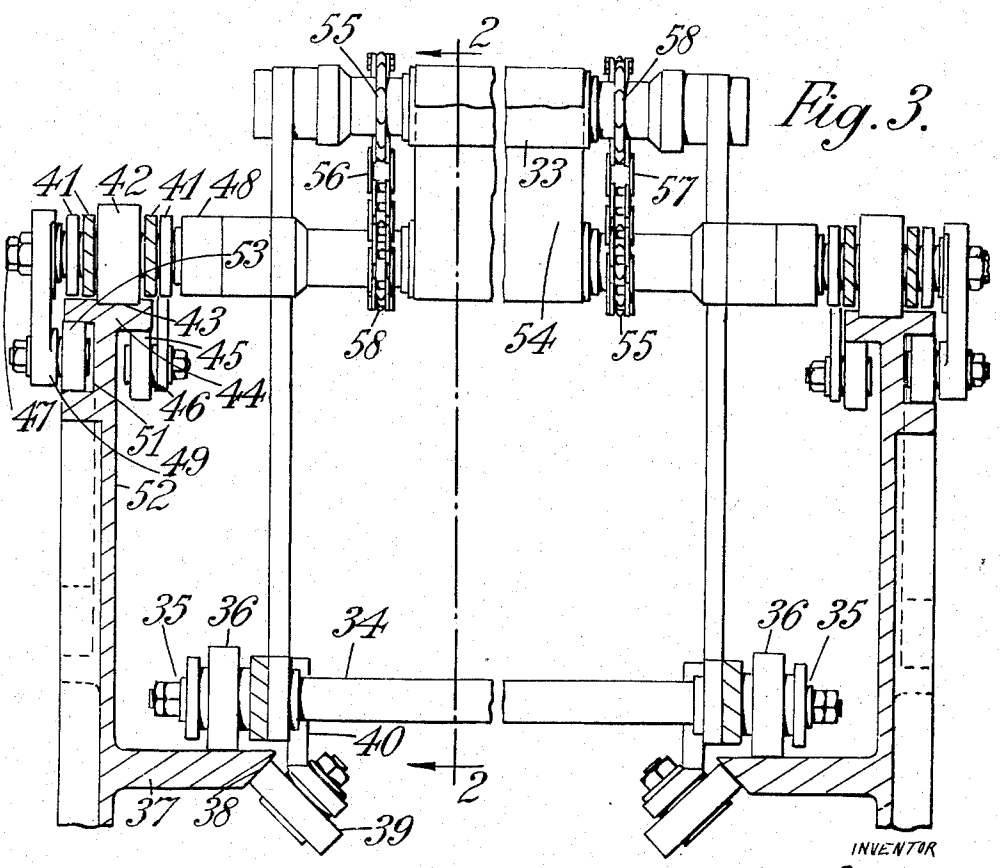


Fig. 3.



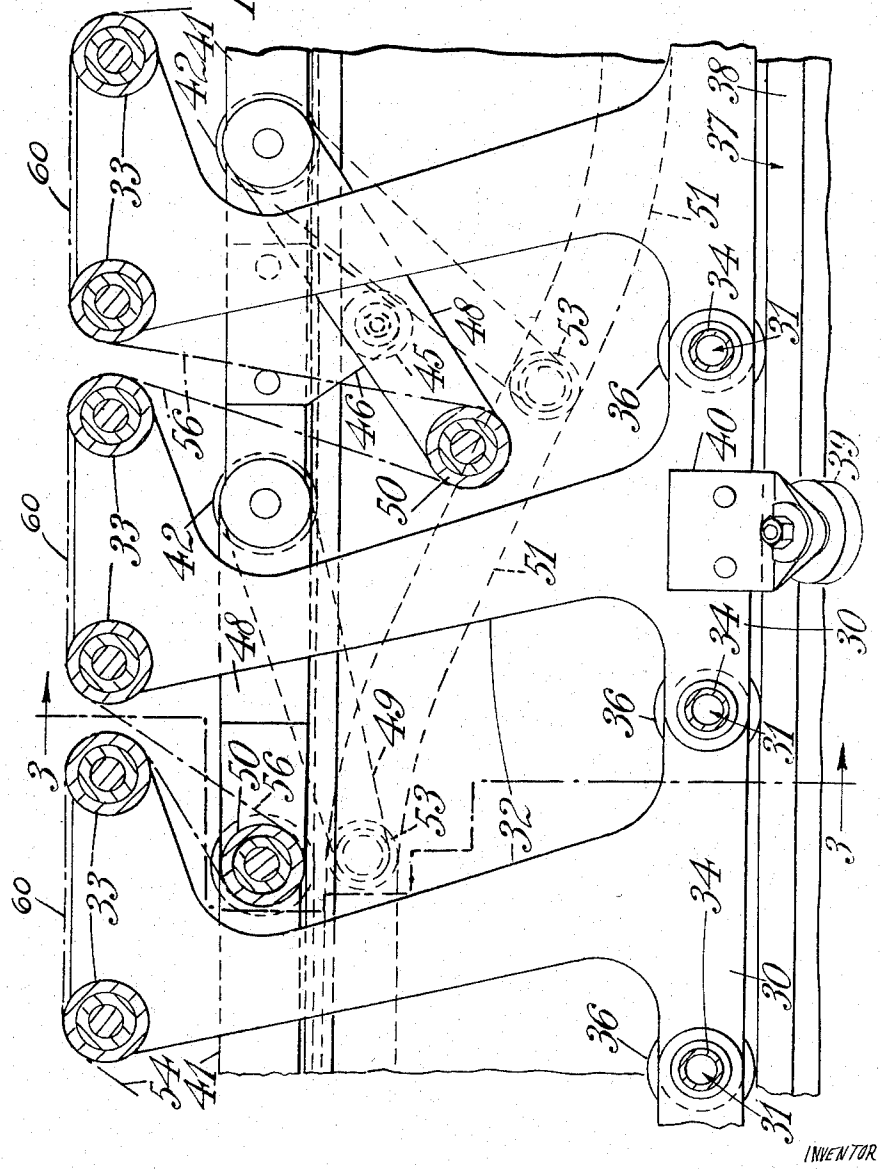
INVENTOR
P. R. PRICE
By Mawhinney & Mawhinney
ATTYS.

Jan. 27, 1959 P. R. PRICE 2,871,012

DISPLAY APPARATUS TO ALLOW EXAMINATION OF A FAST-MOVING CONTINUOUS WEB

Filed Aug. 13, 1956 3 Sheets-Sheet 2

Fig. 2.



INVENTOR

P. R. PRICE

By Mawhinney & Mawhinney

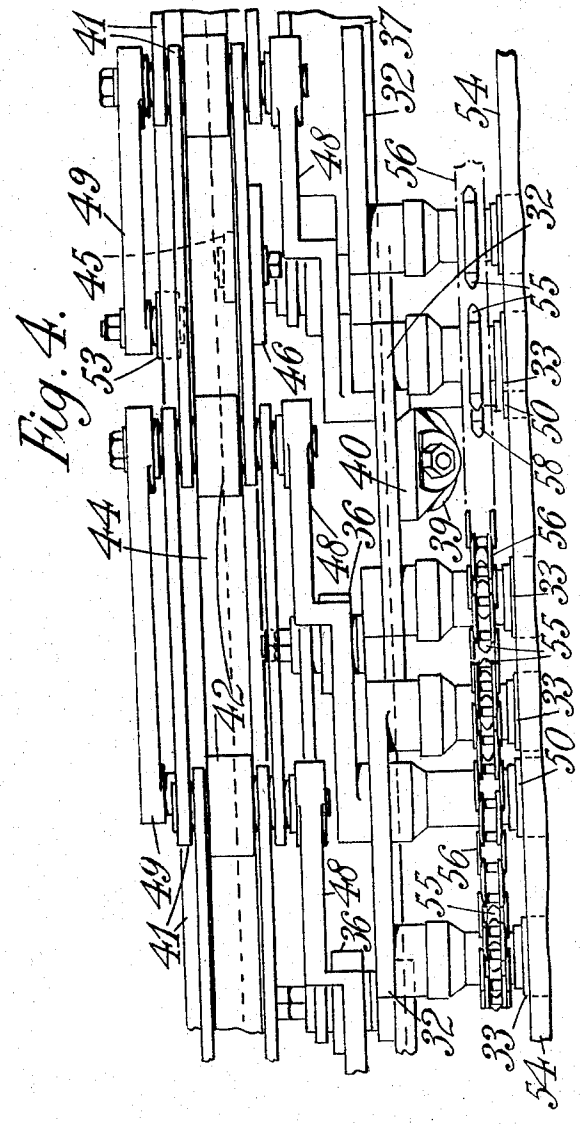
ATTYS.

Jan. 27, 1959 P. R. PRICE 2,871,012

DISPLAY APPARATUS TO ALLOW EXAMINATION OF A FAST-MOVING CONTINUOUS WEB

Filed Aug. 13, 1956 3 Sheets-Sheet 3

Fig. 4.



INVENTOR

P. R. PRICE

By Mawhinney & Mawhinney

ATTYS.

United States Patent Office 2,871,012 Patented Jan. 27, 1959

2,871,012

DISPLAY APPARATUS TO ALLOW EXAMINATION OF A FAST-MOVING CONTINUOUS WEB

Peter Ralph Price, London, England, assignor of one-third to George Edmond Brackenbury Abell, and one-third to Donald William Tilley, London, England

Application August 13, 1956, Serial No. 603,755

Claims priority, application Great Britain August 18, 1955

12 Claims. (Cl. 271—2.3)

In any process for the production or treatment of material in continuous form, such as a web, and in which visual examination of details of quality is desirable, difficulty is experienced if the web is travelling at a very high speed, and this invention relates to apparatus of the kind which provides a temporary retardation of the rate of travel of the web at the viewing zone.

The need for such a device is already felt on web-printing presses. The pressman, for example, needs to see the quality of print and make prompt adjustment to the inking systems. Generally, the web is moving too fast for him to be able to see the print clearly and he has to extract a sheet after the cutting stage. Before he can interpret the sheet and make adjustments a considerable length of web with inferior print may have been produced. In some cases of printing and textile processing, there is no cutting stage, the product being re-reeled. In all these and similar cases it would assist the control of quality if a monitoring unit is placed after each processing unit.

This invention refers to apparatus of the general type that operates to arrange a continuous web in corrugated form as it enters the apparatus and to restore it to its original form as it leaves, such as is used for the drying of material in web form.

According to this invention, in a display apparatus of the kind described, the web traverses the viewing zone at a uniform speed less than the speed at which the web passes through the apparatus. In other words, the web is not alternatively retarded and accelerated in the viewing zone.

An advantage provided by a display apparatus according to this invention is that a direct view of the printed matter is obtained without optical aids and the printed matter is in view for a sufficient length of time without recourse to stroboscopic effects.

According to another feature of this invention, means are provided to continuously effect corrugation of the web as it enters, and means to continuously restore the web to its original form as it leaves the apparatus, the viewing-zone being situated where the web is in its corrugated form. Pereferably the display apparatus comprises two continuous carrier-chain-systems so disposed and driven as to provide a lay on one system moving parallel with and at the same speed as a lay on the other, web-guiding bars or rollers carried on said chains, the rollers on at least one chain being supported thereon by arms projecting from that chain so that in the said lay, the rollers supported by the said arms enter between the bars on the other chain to define a corrugated path for the web.

According to another feature of this invention the arms, on at least one chain, carrying the web-guiding rollers are pivotally mounted on that chain.

According to yet another feature of this invention the said pivotally mounted arms engage a cam surface so shaped as to cause the rollers on that chain to enter between the rollers on the other chain and to be intersected therewith in the sections of the systems where one chain moves parallel with and at the same speed as the other.

The rates at which the web is delivered to, and withdrawn from the apparatus, are equal and constant, and the web passes through the apparatus under tension, so that essentially the length of web contained within the apparatus is constant, and the cams are so arranged as to ensure this.

The rollers in at least one system may be mounted in pairs on the said arms.

According to another feature of this invention the rollers are rotated on their own axes so that their surfaces move at substantially the same speed as that with which the web passes them. It is preferred to drive the rollers by means of continuous chains or belts, the said chains or belts travelling, over a section of their paths, along a path of substantially the same shape as that which the web follows in the apparatus.

The operation of a display apparatus and a practical construction thereof will now be described with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic view of a display apparatus showing one side of the machine;

Figure 2 is a part view in section, along the line 2—2 of Figure 3, of a display apparatus;

Figure 3 is a view in section along the line 3—3 of Figure 2;

Figure 4 is a part plan view.

Referring first to Figure 1, the display apparatus comprises two carrier-chain-systems **10**, **11**. The upper chain system **10** is constituted by a pair of continuous carrier-chains **12** spaced apart laterally on similar coaxial sprocket wheels **13**. The lower chain system **11** is similarly constituted by a pair of chains **14** on sprocket wheels **15**.

The two carrier-chain-systems **10**, **11** are disposed one directly above the other with the horizontal lays **16** of the upper chain-system **10** lying parallel with and spaced from the horizontal lays **17** of the lower system **11**. Rollers **18** are provided in the lower system **11** and each extends between and is supported at each end by the pair of chains **14**. On the upper system **10** the rollers **19** are mounted on the free ends of arms **20** pivoted on the chains **12** and the rollers **19** are each associated with a pair of rollers on the lower chain system **11**.

A pair of continuous cam-surfaces **21** are mounted alongside each of the upper chains to engage the said pivoted arms **20** and control the position of these arms. The sprockets are so rotated as to cause the chains **12** and **14** in the horizontal lays **16** and **17** respectively to move at the same speed and in the same direction. As the rollers **19** and **18** approach the horizontal lays **16** and **17** respectively the parts **22** of the cam-surfaces **21** cause the rollers **19** of the upper chain-system **10** each to descend and thus enter between the pair of rollers of the lower chain-system **11** associated with them. These groups of three rollers (for example rollers **18'** and **19'**) are maintained in this position, by the parts **23** of the cam-surfaces as they move along the horizontal lays **16** and **17**, until the parts **24** of the cam-surfaces **21** cause the rollers **19** of the upper carrier-chain-system **10** to ascend as they approach the end of the horizontal lays.

The shape of the cam-surfaces is indicated in Figure 1 but may be of any other suitable shape.

A web of material **26** issuing at constant speed from a machine, such as a printing press, enters the display apparatus between the horizontal lays of each chain system, is looped by the rollers **18** and **19** and is maintained in this form until it is restored to its original form as it emerges from between the ends of the horizontal

lays of the chain-systems. The viewing-zone is the middle part of the parallel lays of chain and in this zone the plane lengths **27** of the web supported by the said pairs of rollers on the lower chain-system, are visible.

The chains in the horizontal lays **16** and **17** move in the same direction as the web **26** and thus the plane lengths **27** of the corrugations move at a speed which is less than that at which the web enters the apparatus and these tops can therefore be examined. The displayed matter thus passes the examiner in a spaced series travelling at uniform speed and the matter which is not displayed is looped out of sight underneath.

The speed and direction of movement of the chains in the horizontal lays **16** and **17**, relative to the incoming web speed, may be so chosen that the displayed parts of the plane lengths of the web, either move backwards, are stationary or even move forwards relatively to the examiner; the displayed portions of the web may be stationary relative to the examiner by making the web move backwards relatively to the rollers.

The cam surfaces are so shaped as to cause the sum of the lengths of all the lengthening loops to increase at a constant rate, and the sum of the lengths of all the shortening loops to decrease at a constant rate and so that the rates of increase and decrease are equal.

In a practical construction of displaying apparatus (see Figures 2, 3 and 4) according to this invention the lower carrier-chain-system comprises a pair of chains each constituted by links **30** pivotally connected at **31** to adjacent links. Each link has an upstanding extension **32** and a pair of rollers **33** is carried between the free ends of each pair of extensions **32**, one extension being on each chain. Rods **34** are provided which extend between the chains and each end thereof provides the pivotal connection between the links **30**. The ends **35** of the rods **34** extend beyond the links **30** and each carry a roller wheel **36**. These roller wheels **36** each engage, in the horizontal lays of the chains (of which a part is shown in Figure 2), with the upper plane surfaces of a track **37** secured to the frame of the apparatus and thus support the horizontal lays of the chain. A second plane surface **38** lying below and at an acute angle to the said upper plane surface is provided on each track **37**. Further roller wheels **39** are secured by means of brackets **40** to some of the links **30**. These roller wheels **39** each engage with a surface **38** of a track **37** thereby maintaining the wheels **36** in contact with their respective tracks. The wheels **39** also serve to limit transverse movement of the chains.

The upper carrier-chain-system comprises a pair of chains each constituted by links **41** pivotally connected to adjacent links. Spindles **47** pivotally connecting each link, each carry a freely rotatable roller wheel **42** which engages with a shallow groove **43** in the upper surface of a guide-track **44** formed integrally with the frame **52** of the apparatus. Further roller wheels **45** are secured by means of brackets **46** to some of the links **41**. These roller wheels **45** each engage with the lower surface of a guide **44**.

Each spindle **47** has secured thereto a roller-arm **48** and a cam-follower-arm **49**; the roller-arm **48** and the cam-follower-arm **49** together constitute a two-armed lever. The roller-arm **48** is disposed on the inner end of the spindle **47** and the cam-follower-arm **49** on the outer end. A roller **50** is carried between the free ends of the two roller-arms **48**, one on each chain, the two chains being so disposed relative to one another that the roller-arms **48** on one chain are directly opposite the roller-arms on the other chain.

Two identical pairs of cam surfaces, each pair constituted by a groove **51** in the side frames **52** of the display apparatus, are provided along the length of the apparatus. Each cam-follower **53**, rotatably mounted on the free end of a cam-follower-arm **49**, engages with the two side walls of a groove **51**. Thus as the upper

carrier-chain moves along on the track **44** the cam-followers **53** are constrained to follow the path of the grooves **51**. A web **54** is entrained between and looped by the rollers as hereinbefore described, and plane lengths **60** are traversed past a viewing zone.

The spacing between two adjacent rollers **33** each mounted on an adjacent link **30** is made as small as practicable. Where the lower carrier-chain passes round sprocket wheels (not shown) the spacing between these rollers is increased and thus the increase is sufficient to allow the roller **50** of the chain-system to enter between the said adjacent rollers **33**. The cam surfaces **51** are so shaped as to cause the rollers **50** to enter between rollers **33** and to return therefrom whilst the chain-links **30**, carrying these rollers, are following an arcuate path.

The cam surfaces **51** are parallel with the tracks **37** and **44** along most of the length of the parallel lays of chain and at each end thereof are curved away from the tracks **37** towards the tracks **44**. The curved parts of the cam surfaces **51** are so shaped as to cause the sum of the length of all the lengthening loops to increase at a constant rate, and the sum of the lengths of all the shortening loops to decrease at a constant rate such that the rates of increase and decrease are equal. A second consideration in the shaping of the cam surfaces **51** is that the accelerations and decelerations of the rollers **33** and **50** should be as low as practicable.

The shape of the cam surfaces **51** is merely indicated in Figure 2 and the precise shape thereof is determined by the requirements hereinbefore set forth.

It is desirable to drive the web-guiding-rollers **33** and **50** about their axes so that their surfaces each move with the same speed as that of the web **54** passing over them. The web may then be maintained at substantially constant tension as it passes through the apparatus and it is not subjected to extra stress due to it passing over a roller that is not rotating at the correct speed. Each roller **33** and **50** is provided with a sprocket **55** of the same pitch circle diameter as the roller; these sprockets **55** on the rollers **33** of the lower carrier-chain-system are staggered axially with respect to those on the upper carrier-chain-system and in this example are disposed at opposite ends of the respective rollers **33** and **50**. One continuous driving-chain **56** meshes with the sprockets **55** of the rollers **33** of the lower carrier-chain-system and a second continuous driving-chain **57** meshes with those of the upper system. In addition an identical sprocket **58** is mounted on each roller **33** and **50**. The sprockets **58** on one chain-system are arranged to be aligned with the sprockets **55** on the other chain-system so that while the rollers are travelling along the horizontal lays the sprockets on their axes mesh with both the continuous driving-chains. The driving-chains are thus constrained to follow the path of the web and may each be driven, by a further chain meshing with the sprockets **55** or **58** in a section of the carrier-chains outside the said horizontal lays, so that the surface speed of each roller is equal to the speed of the web passing that roller.

Alternatively double chains may be used in place of the single chains **56** and **57** which permit a driving sprocket to engage with the second half of the chain.

The form of presentation of the web obtained with the display apparatus hereinbefore described has the advantage, over known kinds of display apparatus, that the eye can follow and dwell on doubtful parts of the web, or scan each part as it comes into view. Also, since the displays travel at constant speed, flicker and other effects tiring to the eyes are obviated.

A further advantage of this form of display apparatus is that sub-standard sections of the web may be easily marked by the examiner in any convenient manner, and these sections may be automatically rejected after leaving the display apparatus, by using suitable devices operated by the marking.

In another arrangement the rollers of the upper sys-

tem are mounted in pairs on the said pivoted arms. These rollers are thus mounted closely adjacent each other in pairs, and the rollers of the lower system are mounted in groups of three to co-oeprate with the pairs of rollers in the upper chain-system. The section of the web which may be examined lies between the end rollers of each group of three.

To obtain a low speed of travel of the displayed web, it is desirable to make the space between the displayed plane lengths of web as small as possible. To attain this it is necessary to make the diameter of all the rollers **33** and **50** as small as possible. Alternate arms, supporting the rollers on the lower system may be pivoted to allow, temporarily, an increase of space between the said rollers, whilst the rollers of the upper system are entering or being withdrawn through these spaces. Thus the displayed sections may nearly join each other. This effect is accomplished in the preferred construction by entering the rollers of the upper system between those of the lower system whilst the lower carrier chain is passing round the sprocket as hereinbefore described.

Shields may be provided on the roller-supporting-arms to mask the sections of the web which lie between the tops of the corrugations to be examined.

Although the apparatus has been described having the displayed plane lengths of the web passing therethrough horizontally, the apparatus may be turned so that the displayed plane lengths pass through in a vertical plane.

I claim:

1. Display apparatus for traversing a web of material past a viewing zone comprising a first means for revealing at the viewing zone in succession plane lengths of the web comprising a first continuous sprocket-driven carrier-chain, guide-rollers journalled at the ends of arms extending from the links of said chain, the rollers being arranged in pairs to support and reveal at the viewing zone successive plane lengths of web and a second means operative during the period of time between the appearance at and disappearance from the viewing zone of any part of a plane length of web for moving said plane length past the viewing zone at a substantially constant speed which is less than the speed at which the web enters the apparatus, for maintaining a substantially constant tension in the web and for delivering the web from the apparatus at substantially the same speed at which it enters the apparatus, said second means comprising a second continuous sprocket-driven carrier-chain, second guide-rollers journalled at the ends of first arms of two-armed levers which are pivotally mounted on said second chain, said second chain having a lay adjacent and parallel to a lay of the said first carrier-chain, means, operable when the carrier-chains are driven to cause the said second guide-rollers to enter between the said pairs of first guide-rollers to loop the web.

2. Display apparatus according to claim 1 wherein each of the guide-rollers has co-axially mounted on it two sprockets, one at each end of the guide-rollers.

3. Display apparatus according to claim 2 wherein the guide-rollers are rotated by continuous drive-chains meshing with the said sprockets, which drive-chains travel over a section of their paths parallel to the path of the web and rotate each roller so that its surface speed is the same as the speed of the web passing over it.

4. Display apparatus for traversing a web of printed material past a viewing zone comprising in combination, a first sprocket-driven continuous carrier-chain comprising links pivotally connected end to end, an arm extending outwardly from each of the said links, a pair of guide-rollers carried on each of the said arms, extending transversely to the path of movement of the said carrier-chain and spaced apart along the said path, a second sprocket-driven continuous carrier-chain having a lay parallel with and adjacent to a lay of the first carrier-chain, a bell-crank lever on each link of said second carrier chain having a roller-arm and a cam-follower arm,

a guide-roller carried on the roller-arm of each of the said bell-crank levers, a cam-follower carried on the cam-follower arm of each of the said bell-crank levers, a cam-groove whereof the two side-walls engage the said cam-follower, and move it to rock the bell-crank and carry its said guide-roller into and out from the space between the adjacent arms on the said first carrier-chain when moving along the said parallel lays of the two carrier-chains, and means for feeding a web of paper between said parallel lays of the carrier chains, supported by the pairs of guide-rollers on the said first carrier-chain and in position for pushing between those rollers by the bell-crank-carried rollers thereby to form speed reducing loops in the web.

5. Display apparatus according to claim 4 wherein each of the said guide-rollers has co-axially mounted on it two sprockets, one at each end of the guide-roller and wherein the sprockets on like ends of the guide-rollers carried by the said first carrier-chain mesh continuously with a first continuous drive-chain and the sprockets on the opposite ends of the guide-rollers carried by the said first carrier-chain mesh intermittently with a second continuous drive-chain, which second drive-chain meshes continuously with the sprockets on like ends of the guide-rollers carried by the said second carrier-chain and the sprockets on the opposite ends of the guide-rollers carried by the said second carrier-chain mesh intermittently with the said first drive-chain, which intermittent meshing occurs in the region of the said adjacent lays where the said drive chains follow a path substantially the same as that followed by the web of printed material, and wherein means are provided for driving at least one of the said drive-chains.

6. Display apparatus according to claim 4 wherein each of the said guide-rollers has co-axially mounted on it two sprockets, one at each end of the guide-roller and wherein the sprockets on like ends of the guide-rollers carried by the said first carrier-chain mesh continuously with a first continuous drive-chain and the sprockets on the opposite ends of the guide-rollers carried by the said first carrier-chain mesh intermittently with a second continuous drive-chain, which second drive-chain meshes continuously with the sprockets on like ends of the guide-rollers carried by the said second carrier-chain and the sprockets on the opposite ends of the guide-rollers carried by the said second carrier-chain mesh intermittently with the said first drive-chain, which intermittent meshing occurs in the region of the said adjacent lays where the said drive chains follow a path substantially the same as that followed by the web of printed material, and wherein means are provided for driving at least one of the said drive-chains.

7. In a web manipulating machine of the kind in which a web is caused to travel under tension at a uniform high overall speed, means for locally reducing the web speed at a viewing station to enable successive planar sections of the web to be examined visually, comprising an endless succession of spaced web-support devices each embodying two such supports spaced apart along the length of the succession to support between them a planar section of the web, means for moving the succession past the viewing station in the direction of web movement and adjacent one face of the web, an endless succession of web diverting members, means for moving the diverting members in the direction of web movement adjacent the other face of the web and in staggered relation with the web-support devices and means for moving the diverting members into the spaces between the support devices as they approach the viewing station, thereby to push the web between the support devices to form a succession of loops in the web alternating with a succession of plane surfaces and means for withdrawing the diverting members from the spaces after leaving the viewing station.

8. In a web manipulating machine, web-speed reducing means as claimed in claim 7 in which the means for

moving the diverting members into the spaces are operative progressively and at a loop producing speed such that the section of the web on the immediately preceding support device remains substantially stationary.

9. In a web manipulating machine, web-speed reducing means as claimed in claim 7 in which the web supports are rollers transverse to the web.

10. In a web manipulating machine, web-speed reducing means as claimed in claim 9 and including means for driving the rollers at a surface speed equal to the speed of the web travelling around the rollers.

11. In a web manipulating machine, web-speed reducing means as claimed in claim 7 in which the means for moving the diverting means into the spaces and for withdrawing them therefrom are operative at substantially the same effective overall loop forming and loop releasing

speed whereby the overall tension in the web remains constant.

12. In a web-manipulating machine, web speed reducing means as claimed in claim 7 in which the means for moving the diverting members into the spaces are operated progressively and at loop producing speeds such that the sections of the web travel past the viewing station on the support devices at substantially the rate of travel of the succcession of support devices.

References Cited in the file of this patent

UNITED STATES PATENTS

1,755,006	Hurxthal	Apr. 15, 1930
2,513,777	Andre	July 4, 1950