July 7, 1970 O. S. SMITH 3,519,117

FEED ROLLER CONSTRUCTION AND DRIVE

Original Filed Oct. 2, 1967 2 Sheets-Sheet 1

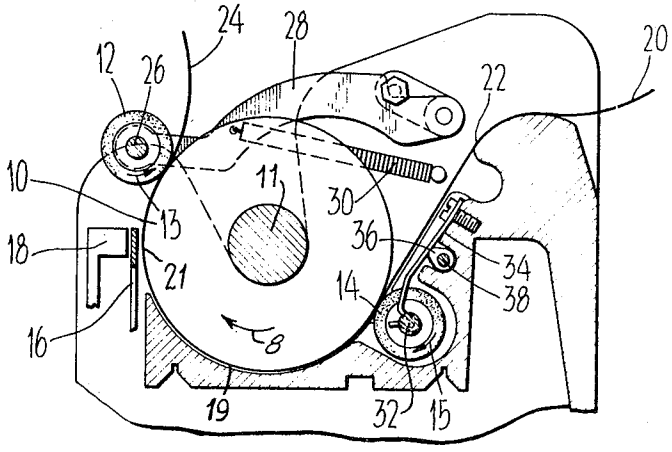


Fig_1

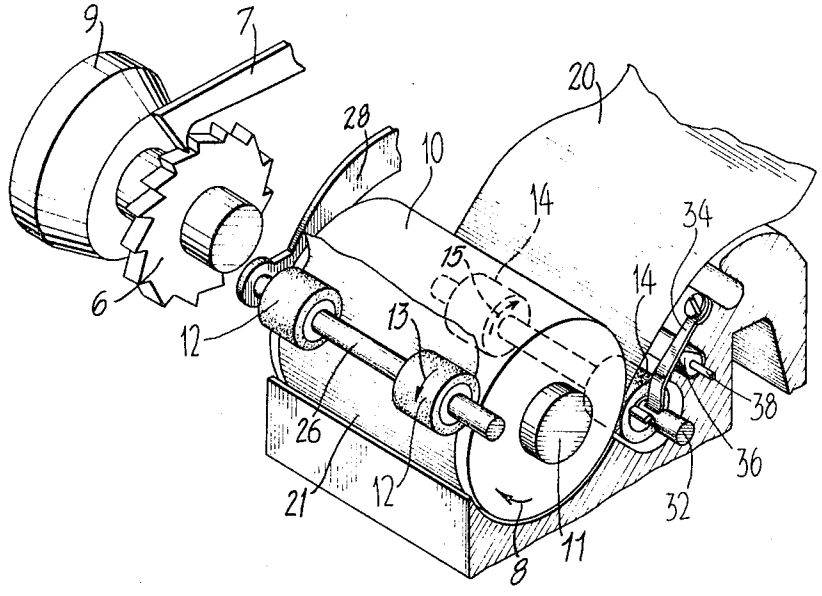


Fig_2

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FEED ROLLER CONSTRUCTION AND DRIVE

Original Filed Oct. 2, 1967 2 Sheets-Sheet 2

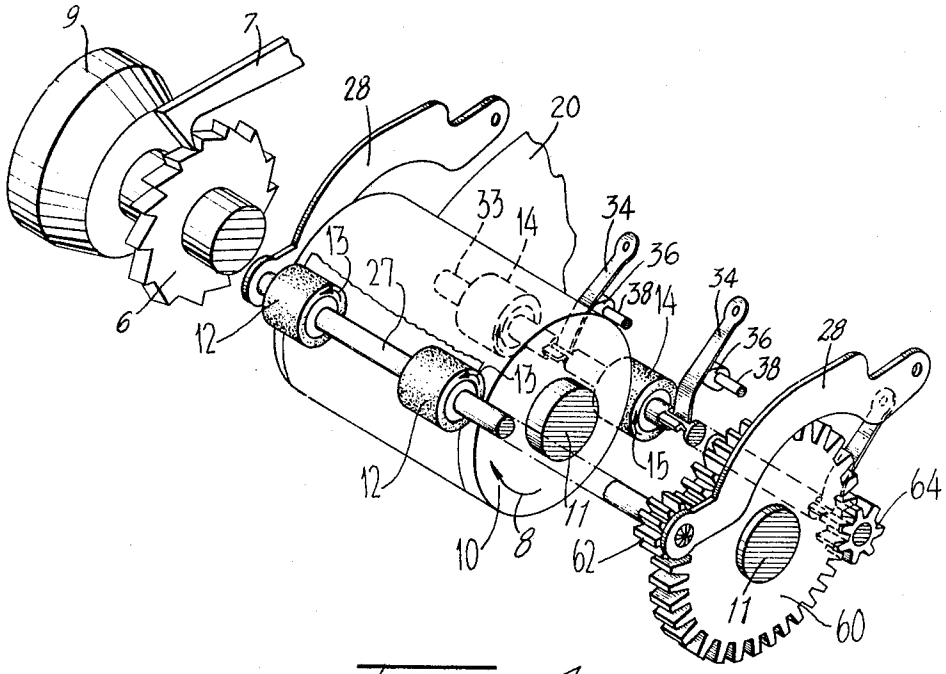


Fig. 4

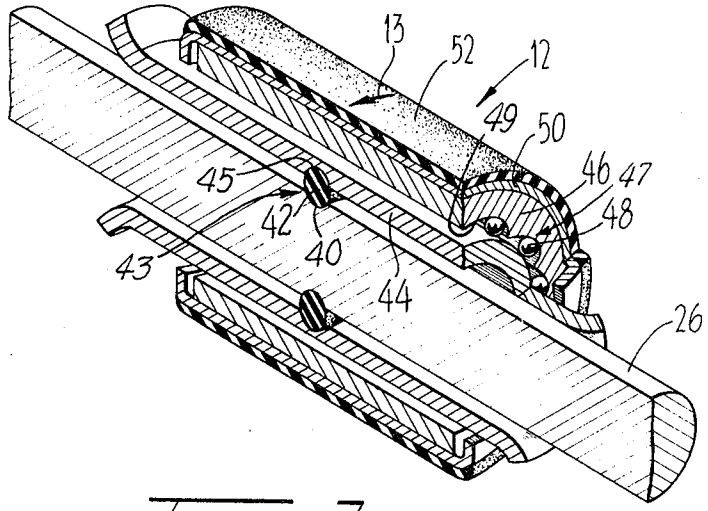


Fig. 3

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3,519,117

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3,519,117

FEED ROLLER CONSTRUCTION AND DRIVE

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Continuation of application Ser. No. 672,132, Oct. 2, 1967. This application May 23, 1969, Ser. No. 828,109

Int. Cl. B41j *13/02*

U.S. Cl. 197—138 9 Claims

ABSTRACT OF THE DISCLOSURE

The rear feed roll for the paper of a typewriter or adding machine is restrained in one direction by a one-way clutch for imposing a drag on the paper as it moves toward the printing area. Alternatively, the front feed roll is overdriven through a one-way clutch for drawing the paper ahead of the platen as it moves out of the work area. Preferably both the front and rear feed rolls are similarly equipped, but oppositely oriented for pulling the paper taut for both directions of rotation of the cylindrical platen. The slippage may occur between the rollers and the paper, or slip clutches may be included.

This application is a continuation of patent application Ser. No. 672,132 filed Oct. 2, 1967, now abandoned.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to feed rolls for the paper, or work sheet, on a typewriter, adding machine, or the like.

Description of the prior art

Feed rolls have usually turned free on their supports, as for example, in U.S. Pat. No. 2,163,944, but since any slight friction restraint acted equally in both directions, it often caused wrinkling of the paper, if the work consisted of several sheets, or if the platen was turned backward. Feed rolls have been overdriven from the platen, as in U.S. Pat. No. 2,274,834, where the upper, or output, feed rolls tend to draw the paper faster than the platen does, but when the platen is reversed, the overdriven rolls produce slack in the paper.

Summary of the invention

The feed rolls have one-way clutches, each oriented to lock on its support when turned thereon in the direction that carries the paper from it toward the print area. The support may be nonrotative so that for both forward and backward rotation of the platen, the clutch and roller imposes a drag on the paper as it moves toward the work space, or the support may be driven at a greater speed than the platen for overdriving the paper as it leaves the work area. Either action reduces slack and holds the paper taut for every rotation of the platen, either backward or forward. A slip clutch may be included.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the invention will be apparent from the following description of specific embodiments, taken in connection with the accompanying drawing, wherein:

FIG. 1 is a fragmentary left elevation of a typewriter, partly in section, showing the platen, feed rollers and associated parts embodying my invention;

FIG. 2 is a perspective view of part of the apparatus of FIG. 1;

FIG. 3 is an enlarged, perspective, cut-away view of a feed roller; and

FIG. 4 is a perspective view of a second embodiment of my invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The machine of the specific embodiment of FIGS. 1 and 2 includes a rotatable platen **10**, front feed, or pressure, rollers **12**, rear feed, or pressure, rollers **14**, a type wheel **16** and a type hammer **18**. Means for driving and rotating the platen **10** include a ratchet **6** and pawl **7** of known construction for driving it in the forward direction indicated by arrow **8**, and include also a manual knob **9** for rotation in both directions. A strip of paper **20**, or work sheet, enters the machine at **22**, passes down between the platen **10** and rear feed rollers **14**, forward under the platen **10** at **19**, up at the front of the platen **10** through a printing area, or work area **21**, behind the type wheel **16**, up between the platen **10** and the front feed rollers **12**, and out of the machine at **24**. The front feed rollers **12** are carried on a shaft, support, or bail rod **26**, which is fixed and nonrotatable in bail arms **28**, and are urged by a spring **30** into a firm pressure engagement with the platen **10**.

The rear feed rollers **14** are supported on a shaft, or support **32** which is nonrotatably carried by leaf springs **34**. Cams **36** carried on a common shaft **38**, are shown in a position in which they hold the rollers **14** firmly against the platen **10**, but are rotatable for releasing the rollers **14**. Thus, each of the feed rollers **12** and **14** is spaced from the work area **21** along the direction of motion of the work sheet **20** between such roller and the work area **21**.

Each of the rollers **12** and **14** is equipped with both a one-way clutch **47**, FIG. 3, and slip clutch **43**. The one-way clutches **47** are oriented to roll free on the nonrotatable shafts **26** and **32** when the paper **20** exits at the particular roller **12** or **14**, and to oppose the rotation of the roller **12** or **14** and thereby impose a drag on the paper **20** when the paper **20** enters at that roller **12** or **14**. These directions, in which the feed rollers **12** and **14** roll free on their support shafts **26** and **32**, are indicated by arrows **13** and **15**.

One of the feed rollers **12** and its cltuches **43** and **47** is shown in an enlarged, perspective, cutaway view in FIG. 3. The shaft **26** has a circumferential groove **40** which receives a friction element **42**, such as a rubber O-ring **42** as shown, or a metal spring. A bushing **44** has a groove **45** which fits over the O-ring **42** with a slight pressure so that the bushing **44** is rotatable about the shaft **26**, but is frictionally restrained. These parts **26**, **42** and **44**, together constitute the slip clutch **43**. It slips at a torque less than that required for sliding the roller **12** on the paper **20**.

The bushing **44** is the central part of the one-way clutch **47** which also includes a camming race **46** having tapered recesses **49** containing rollers **48**. A light metal cover **50** encloses the one-way clutch **47** and retains the rollers **48** in place. An outer rubber tire **52**, for providing a good traction on the paper completes the feed roller **12**.

Referring to FIG. 3, when the tire **52** and camming race **46** rotate in the direction of the arrow **13**, counterclockwise in FIG. 3, the rollers **48** lag behind the motion of the race **46**, move to the wide parts of the tapered recesses **49**, and let race **46** and tire **52** turn free on the bushing **44**. When the race **46** is rotated in the opposite direction, that is, against the arrow **13** and clockwise in FIG. 3, the rollers **48** again lag behind the motion of the race **46**, and this time they move to the narrow portions of the tapered recesses **49** where they jam between the race **46** and bushing **44**. This action locks the race **46** and bushing **44** together so that the roller **12** can rotate only by slippage between the O-ring **42** and one or the other of the bushing **44** and shaft **26**.

The apparatus of FIGS. 1 and 2 removes slack from the paper or work sheet **20** by imposing a drag at the entrance feed rollers **12** or **14**. When the platen **10** is rotated in its forward direction indicated by arrow **8**, that is, in the direction in which the paper **20** progresses through the machine in the normal operation of typing on it, clockwise in FIG. 1, the roller **14** is the entrance roller and roller **12** is the exit roller. When the platen **10** is turned in the opposite direction, that is, backward, counter-clockwise in FIG. 1, roller **12** becomes the entrance roller and roller **14** the exit roller. As indicated by the arrows **13** and **15**, each of the rollers **12** and **14** in FIG. 1 rolls free only in the direction in which it serves as the exit roller, that is, when the side of the roller **12** or **14** toward the platen **10** moves away from the work area **21**. In each of these rollers **12** and **14**, when it serves as an entrance roller, so that its side toward the platen **10** moves toward the work area **21**, its one-way clutch **47** engages so that its friction clutch **43** imposes a drag on the paper **20**. This drag causes the paper **20** to slip on the platen **10** at that entrance roller **12** or **14** and to progress more slowly than the rotation of the platen **10**, so that slack is rapidly removed from the paper **20**, and so that the paper **20** is continually held taut between the two rollers **12** and **14**, and particularly at the work space **21** opposite the type wheel **16** and printing hammer **18**.

As seen in FIG. 2, I employ several front feed rollers **12** on the bail shaft **26**, and similarly, several rear feed rollers **14** on shaft **32**. Each of these rollers **12**, **14** slips, locks and runs free, independently of the others. This independent action of the roller **12**, **14** is particularly useful for reducing conditions of uneven slack as when the paper **20** is skewed so that more slack appears at one edge than at the other.

It is feasible to eliminate the slip clutch **43** as by mounting the bushing **44** nonrotatably on the bail shaft **26**, and letting the slippage occur between the roller **12** and the paper **20**. However, such slippage against the paper **20** tends to smear the printing, provides an unpredictable and variable frictional force, and lets slippage also occur in an axial direction. Accordingly, I prefer to provide individual slip clutches **43** for the rollers **12** and **14** as described, each arranged to slip before its roller **12** or **14** slides on the paper **20**.

The modification of FIG. 4 differs from that of FIGS. 1 and 2 in that the shafts **27** and **33** which support the feed, or pressure, rollers **12** and **14** are driven from the platen **10** and are geared up for making the rollers **12** and **14** overdrive. In FIG. 4, a gear **60** is fixed to the shaft **11** of the platen **10**, and pinions **62** and **64**, driven by the gear **60**, are fixed to the shafts **27** and **33** which support the rollers **12** and **14**. The numbers of teeth on the gear **60** and on pinions **62** and **64** are such that they drive the surface of the rollers **12** and **14** faster than the surface movement of the platen **10**. Because of the action of the one-way clutches **47**, this overdrive occurs only at the exit roller, i.e., the roller **12** or **14** at which the paper **20** is leaving the platen **10**.

The one-way clutches **47** are oriented the same in FIG. 4 as in FIGS. 1 and 2. The fact that in FIG. 4 they exert a pull at the exit rollers rather than a drag at the input rollers, results from overdriving the supporting shafts **27** and **33** in FIG. 4, for reversing the relative motion between the inner parts **44** and outer parts **46** of the one-way clutches **47**. This result can be seen from an examination of the action of rollers **48** in FIG. 3.

Arrow **13** indicates the exit direction of roller **12**, that is, the direction in which feed roller **12** rolls free on bushing **44**, when bushing **44** is stationary as in FIG. 1. But, since it is the relative motion between race **46** and bushing **44** that controls rollers **48**, the clutch **47** is free also when bushing **44** turns clockwise (against arrow **13**) inside of race **46**, and also when both race **46** and bushing **44** turn clockwise (entrance direction), but bushing **44** turns faster as in FIG. 4.

Similarly, with bushing **44** stationary, as in FIGS. 1 and 2, if race **46** turns clockwise, against arrow **13**, that being the entrance direction, the rollers **48** lag behind and jam in the narrow ends of the tapered recesses **49** to engage the clutch **47**. Also, if the bushing **44** is driven faster than race **46** as in FIG. 4, and driven counter-clockwise, with the arrow **13**, that being the exit direction, the bushing **44** runs counter-clockwise ahead of race **46** and carries the rollers **48** into the narrow end of the recesses **49** for engaging the clutch **47**.

So, in FIG. 4, when platen **10** turns forward, or clockwise, the gears **60** and **62** overdrive bail shaft **27** and rollers **12**, counter-clockwise, to pull the paper **20** ahead of the motion of the platen **10**. This is the direction of rotation when the paper **20** exits at the roller **12**. At the same time in FIG. 4, the gear **64** drives the shaft **33** counter-clockwise faster than the platen **10** tends to turn the roller **14**, and consequently it causes the one-way clutch **47** in roller **14** to disengage. When the platen **10** is rotated backward, counter-clockwise, front rollers **12** in FIG. 4 run free and rear rollers **14** pull the paper **20** ahead of the platen **10**. Thus, in FIG. 4, the entrance rollers run free, but the exit rollers are overdriven for pulling the paper **20** ahead of the platen motion for reducing slack in the paper **20** and for holding it taut.

As in the construction of FIGS. 1 and 2, I prefer in the construction of FIG. 4, to use several rollers **12** and **14** on each shaft **27** and **33**, and to provide them with independent one-way clutches **47** and slip clutches **43**.

In FIG. 4, when the bail shaft **27** is lifted for the insertion of a new sheet of paper **20**, the pinion **62** will be lifted from the gear **60**, but will easily slip into mesh when it is again put in operating position. The gear **64** may or may not be disengaged from the gear **60** when the rollers **14** are withdrawn from the platen **10**.

The one-way clutches **47** of the construction of the present invention are symmetrical with respect to the printing area **21**. In FIGS. 1 and 2, for each direction of rotation of the platen **10**, the entrance roller **12** or **14** engages its one-way clutch **47** and imposes a drag on the paper **20** for holding it taut. Similarly, in FIG. 4, for each direction of rotation of the platen **10**, the exit roller **12** or **14** is immediately overdriven for pulling the paper **20** taut. Thus, the operator may freely rotate the platen **10** backward for making corrections, or forward for making the work easier to read, and every such backward or forward motion tends to reduce slack and pull the paper **20** taut. The taut condition of the paper **20** provides clear readable printing and neat alignment of the work, eliminates any tendency to press wrinkles and folds into the paper, and reduces the noise of operation.

In FIG. 3, tire **52**, cover **50** and the main body of race **46** constitute a feed, or pressure, roller **12**. The cam surfaces, or tapered recesses **49**, of race **46**, the rollers **48**, and the main body of bushing **44** constitute a one-way clutch **47**. The bushing **44**, friction ring **42**, and grooved shaft **26** constitute a slip clutch **43**. The shaft, or bail rod, **26** is a support for the torque exerted on the roller **12** by the slip clutch **43** and by the one-way clutch **47**. The shaft **26** also provides the mounting for the roller **12**, and transmits to it the force of springs **30** for gripping the paper. The slip clutch **43** and the one-way clutch **47** are in a connection between the feed roller **12** and the supporting bail **26**, and they are in series in that connection, for coupling the feed roll **12** to its support bail **26**. In FIG. 4, the shafts, or bails, **27** and **33**, are driven by gear **60** and are also restrained thereby against free rotation with their rollers **12** and **14**. In FIGS. 1 and 2 the shafts, or bails, **26** and **32** are nonrotatably secured in arms **28** and springs **34**, and are thereby restrained against free rotation with their rollers **12** and **14**.

I claim:

1. In combination in a work sheet holder, for a typewriter or the like, having (a) a platen movable in a for-

ward and a reverse direction for carrying a work sheet, (b) first and second rotatable pressure rollers for holding said work sheet against said platen for enabling said platen to move said work sheet, (c) means defining a work area having an entrance and an exit portion each of said pressure rollers being spaced from said work area along the direction of movement of said platen and said work sheet, (d) means coupled to said platen for moving said platen in said forward and said reverse directions, (e) a first fixed nonrotatable support for said first pressure roller, (f) first restraining means coupled to said first support for preventing displacement of said first support along the direction of motion of the surface of said platen and for opposing free rotation of said first support with said first pressure roller, (g) a second support for said second pressure roller, and (h) means urging said supports toward said platen for gripping a work sheet between said rollers and said platen, the improvement which comprises (j) a means for reducing slack in the portion of said work sheet positioned in said work area, said slack reducing means comprising first one-way clutch means coupled to said first pressure roller for opposing rotation thereof in a first direction to provide a drag force on said work sheet and for causing substantially free rotation of said first pressure roller in a second direction, and a first slip clutch coupled to said first one-way clutch means for causing said first pressure roller to rotate in said first direction whenever said drag force exceeds a predetermined value.

2. The combination of claim 1 wherein said first pressure roller, said first one-way clutch means, and said first slip clutch are positioned adjacent said entrance portion of said work area and said second pressure roller is positioned adjacent said exit portion of said work area so that said drag force is applied as said work sheet is moved through said work area from said entrance portion through said exit portion.

3. The combination of claim 1 wherein said second support comprises a fixed nonrotatable support and further including a second restraining means coupled to said second support for preventing displacement of said second support along the direction of motion of the surface of said platen and for opposing free rotation of said second support with said second pressure roller, and wherein said slack reducing means further includes second one-way clutch means coupled to said second pressure roller for opposing rotation thereof in said second direction to provide a drag force on said work sheet and for causing substantially free rotation of said second pressure roller in said first direction.

4. The combination of claim 3 wherein said slack reducing means further includes a second slip clutch coupled to said second one-way clutch means for causing said second pressure roller to rotate in said second direction whenever said drag force exceeds a predetermined value.

5. The combination of claim 4 wherein said first roller, said first one-way clutch means and said first slip clutch are positioned adjacent said entrance portion of said work area and said second roller, said second one-way clutch means and said second slip clutch are positioned adjacent said exit portion of said work area so that a drag force is applied to said work sheet as said work sheet is moved by said platen through said work area in both said reverse and said forward directions.

6. In combination in a work sheet holder, for a typewriter or the like, having (a) a platen movable in a forward and a reverse direction for carrying a work sheet, (b) first and second rotatable pressure rollers for holding said work sheet against said platen for enabling said platen to move said work sheet, (c) means defining a work area having an entrance portion and an exit portion, each of said pressure rollers being spaced from said work area along the direction of movement of said platen and work sheet, (d) means coupled to said platen for moving said platen in said forward and said reverse directions, (e) a first support for said first pressure roller, (f) first restraining means coupled to said first support for preventing displacement of said first support along the direction of motion of the surface of said platen and for opposing free rotation of said first support with said first pressure roller, (g) a second support for said second pressure roller, and (h) means urging said supports toward said platen for gripping a work sheet between said rollers and platen, the improvement which comprises (j) a means for reducing slack in the portion of said work sheet positioned in said work area, said slack reducing means comprising first overdrive means coupled to said first support and responsive to movement by said platen for driving said first pressure roller in a first direction at a peripheral speed greater than the peripheral speed of said platen, first one-way clutch means coupled to said first pressure roller for coupling rotary motion in said first direction between said first support and said first pressure roller and for causing substantially free rotation of said first pressure roller in a second direction, and a first slip clutch coupled to said first one-way clutch means for reducing the peripheral speed of said first pressure roller in said first direction whenever said slack is substantially eliminated.

7. The combination of claim 6 wherein said first pressure roller, said first one-way clutch means, and said first slip clutch are positioned adjacent said exit portion of said work area and said second pressure roller is positioned adjacent said entrance portion of said work area so that said slack is reduced as said work sheet is moved through said work area from said entrance portion to said exit portion.

8. The combination of claim 6 wherein said slack reducing means further includes a second overdrive means coupled to said second support and responsive to movement by said platen for driving said second pressure roller in said second direction at a peripheral speed greater than the peripheral speed of said platen, second one-way clutch means coupled to said second pressure roller for coupling rotary motion in said second direction between said second support and said second pressure roller and for causing substantially free rotation of said second pressure roller in said first direction, and a second slip clutch coupled to said second one-way clutch means for reducing the peripheral speed of said second pressure roller in said second direction whenever said slack is substantially eliminated.

9. The combination of claim 8 wherein said first pressure roller, said first one-way clutch means and said first slip clutch are positioned adjacent said exit portion of said work area, and said second pressure roller, said second one-way clutch means and said second slip clutch are positioned adjacent said entrance portion of said work area so that said slack is reduced as said work sheet is moved through said work area in both said forward and said reverse directions.

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U.S. Cl. X.R.

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