United States Patent [19]

Edes et al.

[11] **3,889,895**

[45] **June 17, 1975**

[54] **WEB-TENSION SENSING AND CONTROL APPARATUS**

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[73] Assignee: **Air-Trol Systems, Inc.**, Addison, Ill.

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[21] Appl. No.: **428,367**

[52] **U.S. Cl.** **242/75.43**

[51] **Int. Cl.** **B65h 23/08**

[58] **Field of Search** 242/75.43, 75.53

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Primary Examiner—John W. Huckert
Assistant Examiner—John M. Jillions
Attorney, Agent, or Firm—Charles B. Cannon

[57] **ABSTRACT**

A web-tension sensing and control apparatus for sensing and controlling the tension of the webs of feed rolls and webs of paper, plastic resinous films, and the like, fed from such rolls. Pneumatic sensing means senses the tension or slack in the web and actuates pneumatic braking means which brakes the action of the feed roll for the web and thus takes up the slack in the web.

5 Claims, 21 Drawing Figures

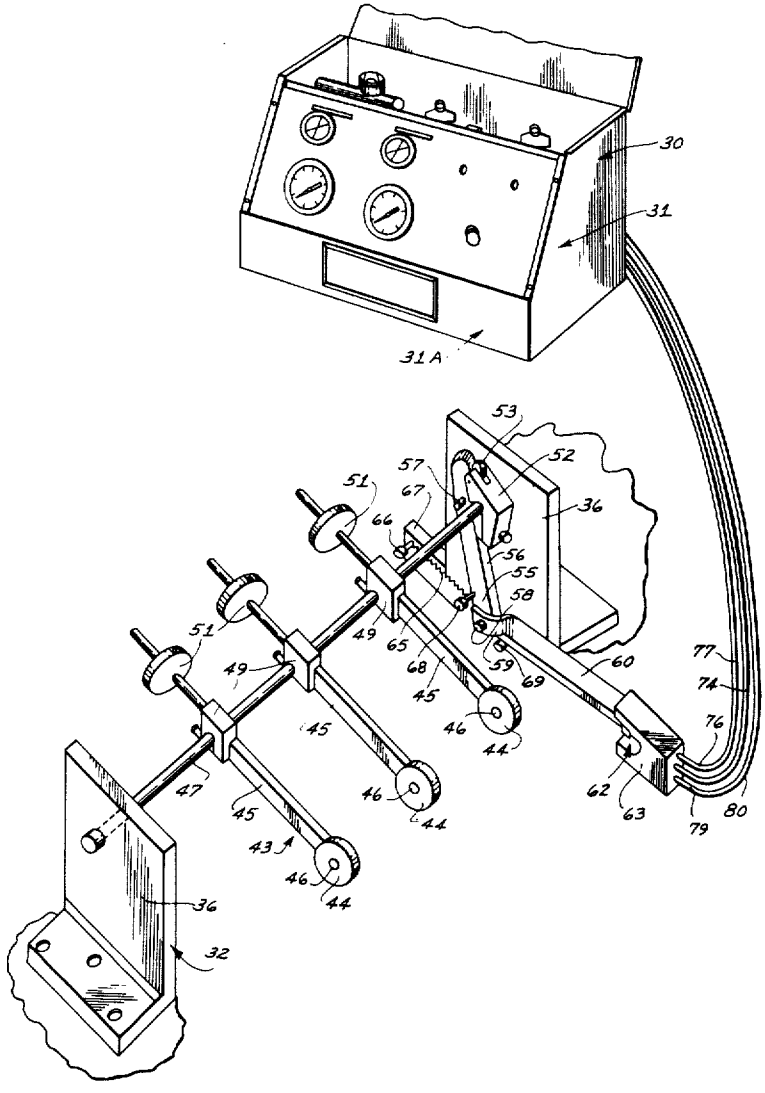


FIG - 1

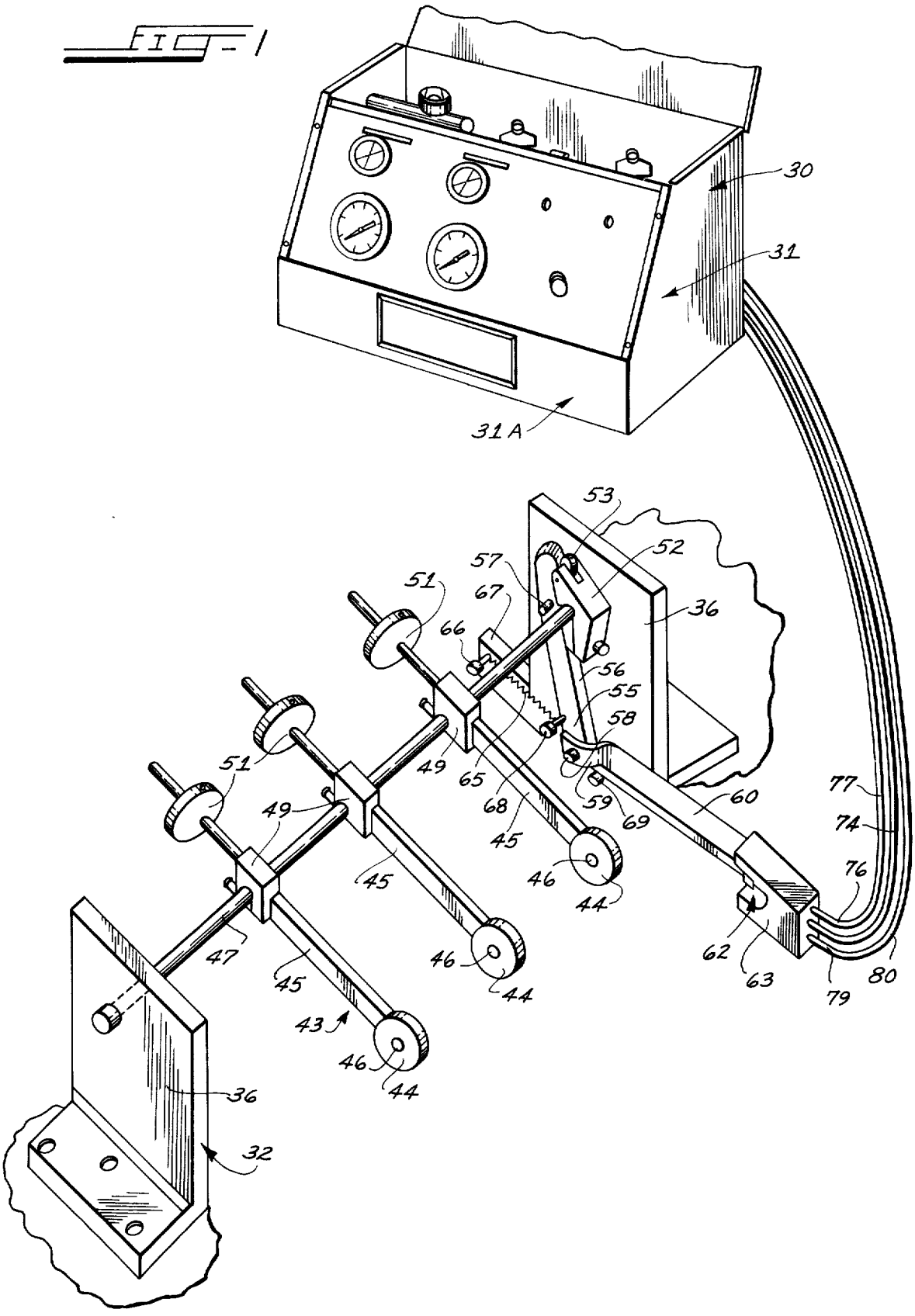

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FIG - 2

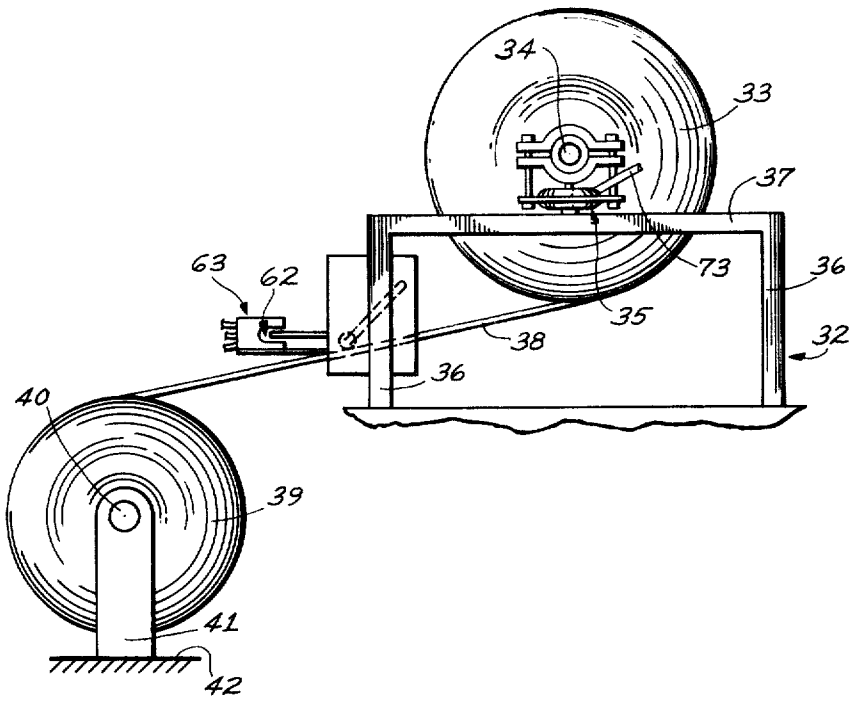

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FIG - 3

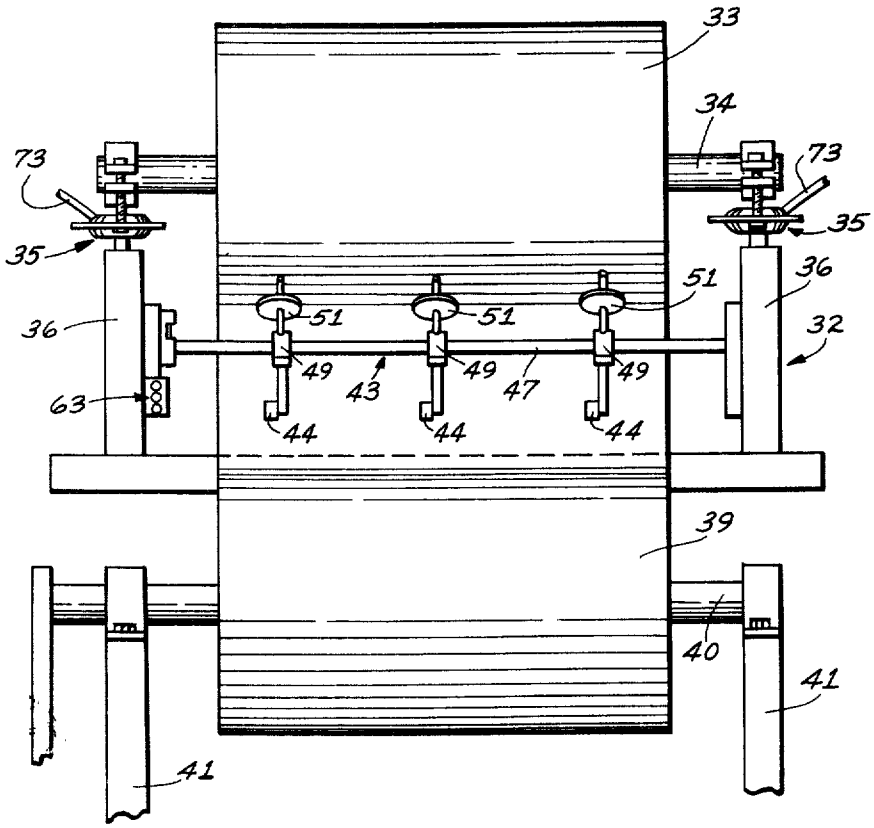

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FIG. 4

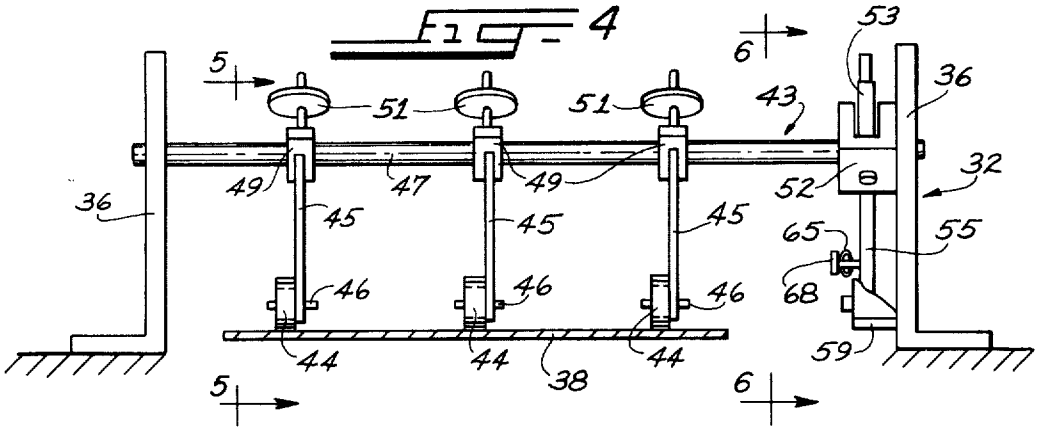


FIG. 5

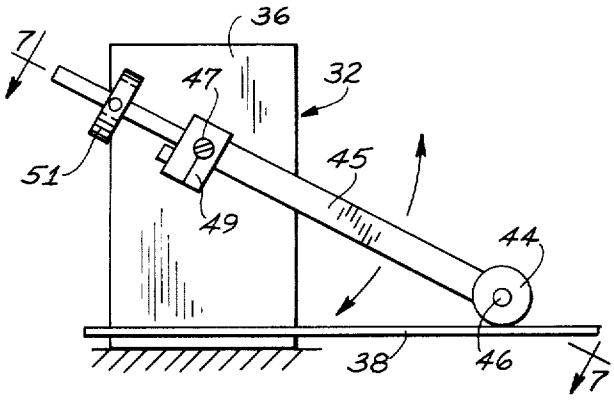


FIG. 6

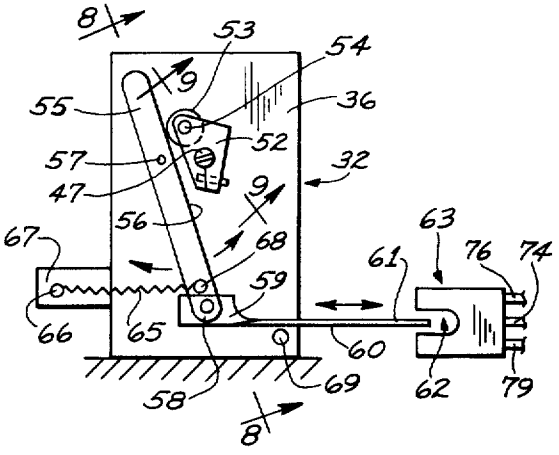


FIG. 7

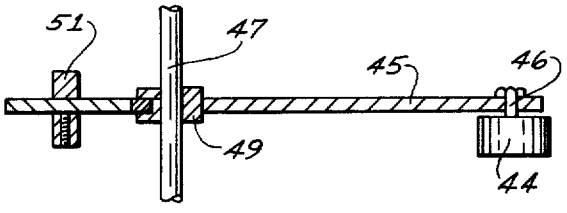


FIG. 8

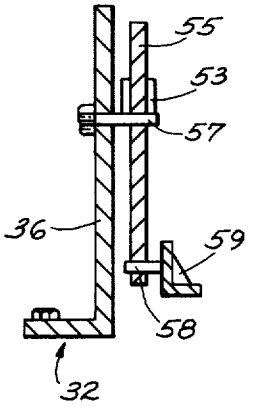


FIG. 9

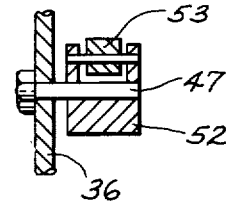


FIG - 10

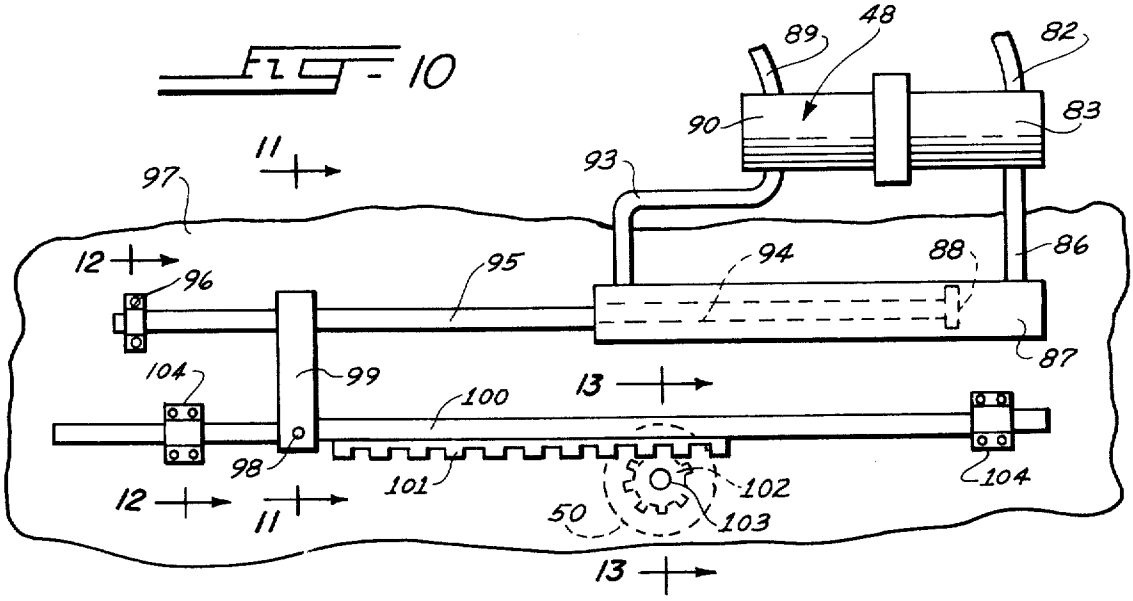


FIG - 11

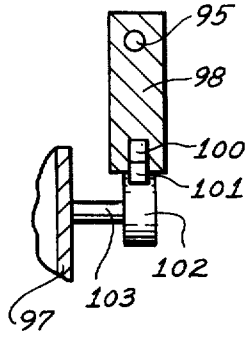


FIG - 12

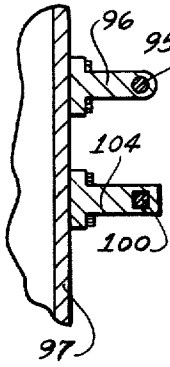


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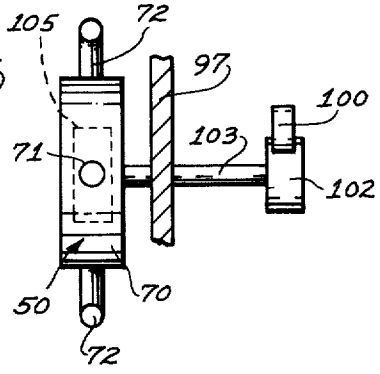


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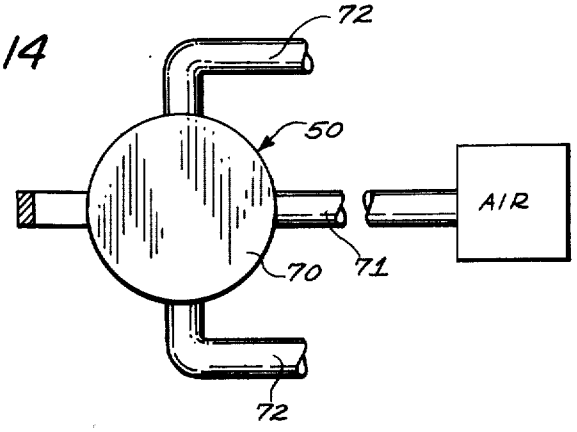


Fig-15

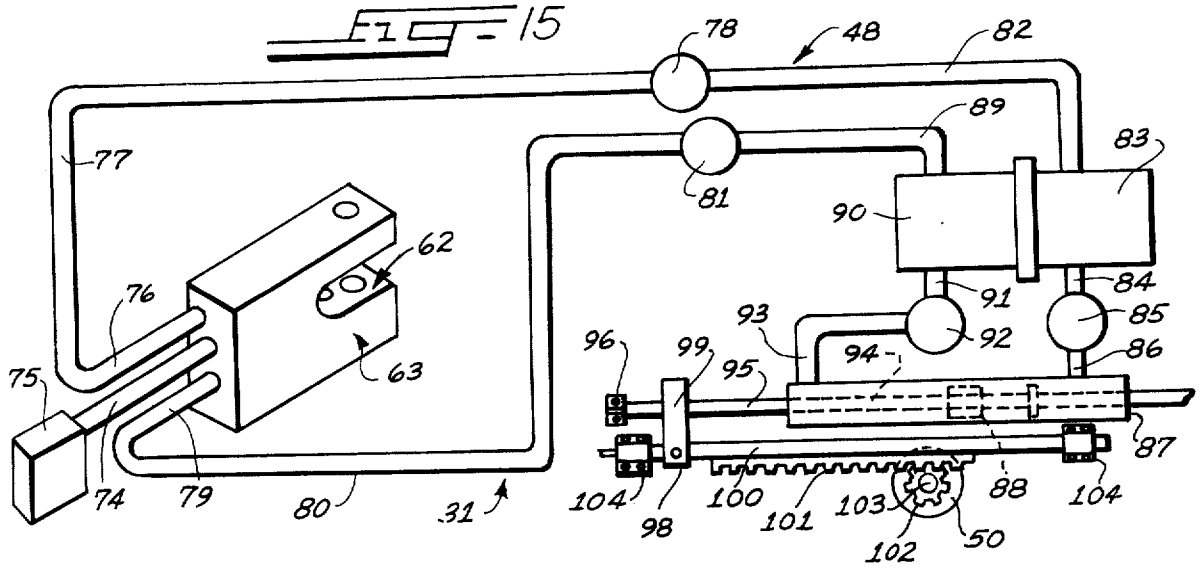

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FIG - 16

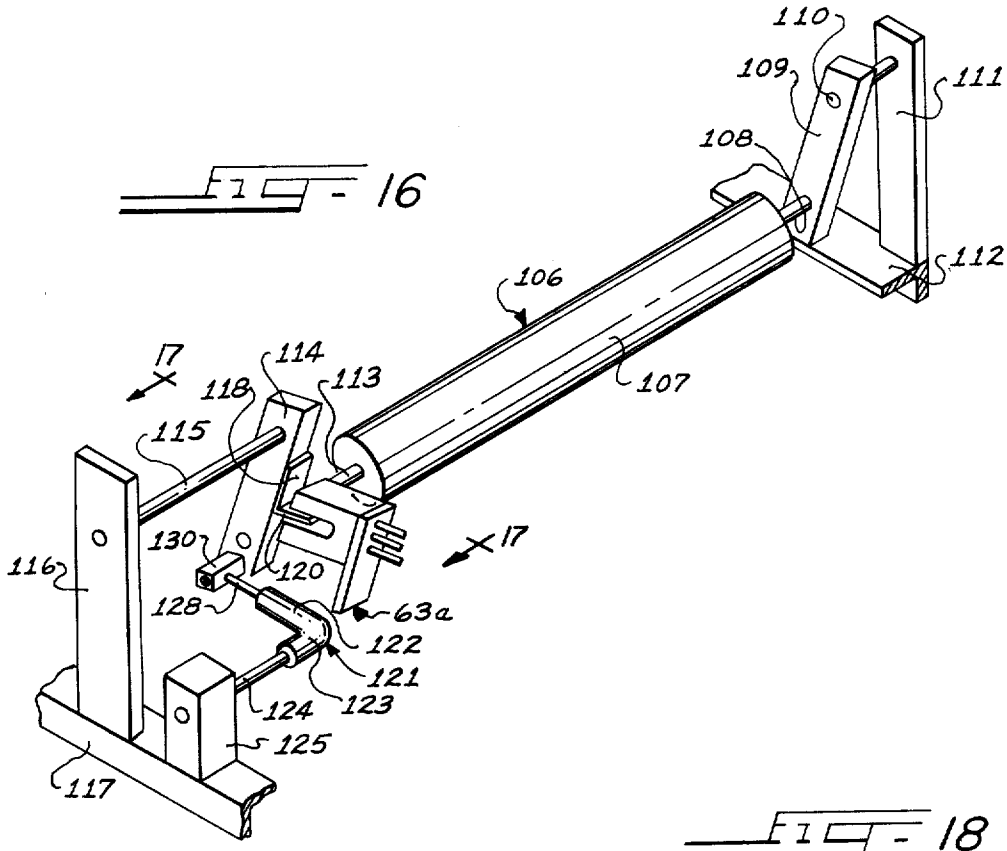


FIG - 17

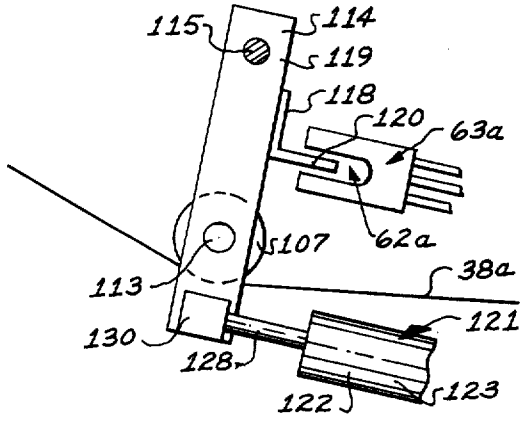


FIG - 18

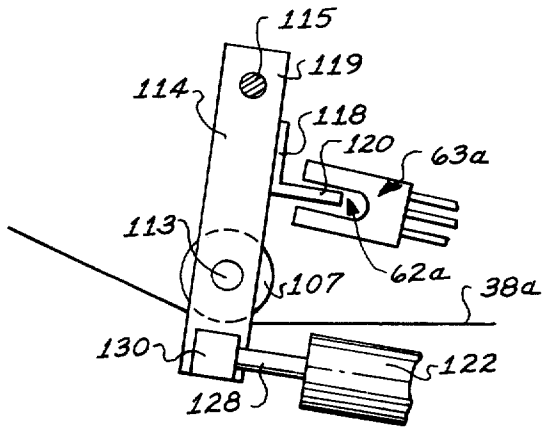
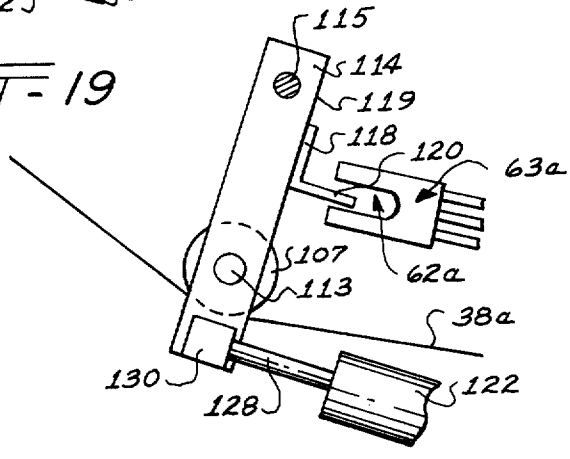


FIG - 19



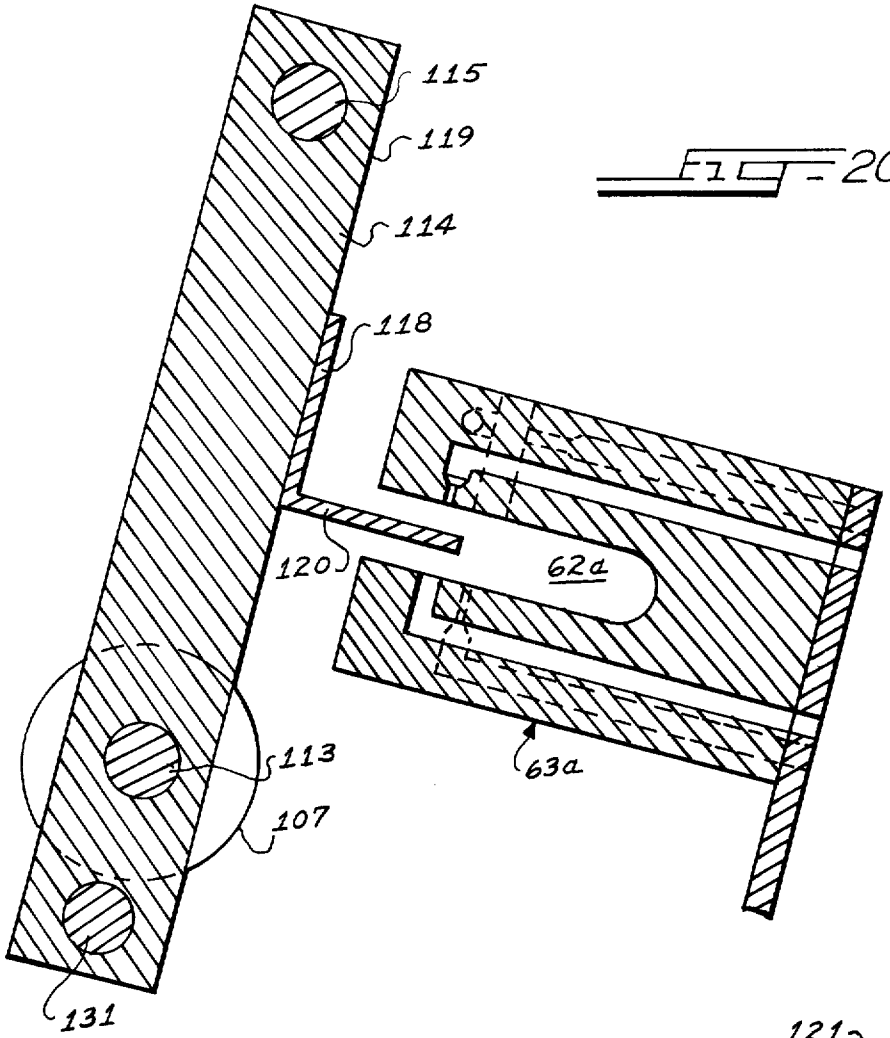

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FIG - 20

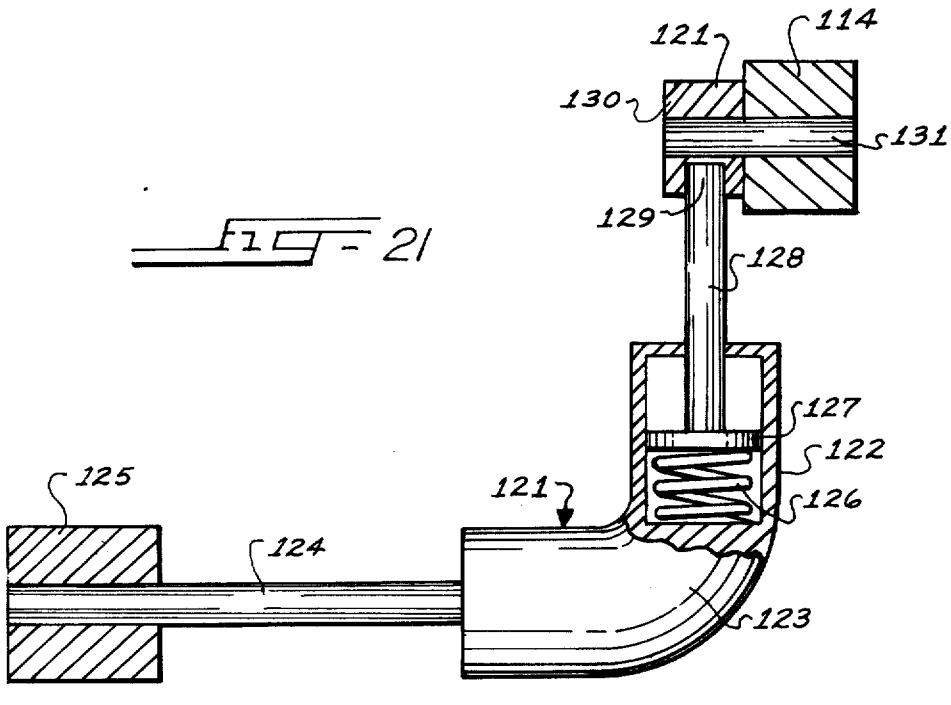

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FIG - 21

WEB-TENSION SENSING AND CONTROL APPARATUS

OBJECTS

An object of the invention is to provide a new and improved web-tension sensing and control apparatus for tensioning a roll and web of paper, plastic resinous film, and the like, and for maintaining the proper and desired tension thereon.

Another object of the invention is to provide a new and improved web-tension sensing and control apparatus for tensioning a web of paper, plastic resinous film, and the like, which embodies, in combination, pneumatic sensing means which senses the relative tension or slack in the web and actuates peumatic braking means to brake the rotation of the feed roll for the web and thus increase the tension on the web and take up the slack therein.

Another object of the invention is to provide a new and improved web-tension sensing and control apparatus in which the tension on the web of paper, flexible plastic resinous film, or the like, may be pre-selected and the tension maintained constant as the roll unwinds and the feed roll for the web becomes smaller or decreases in diameter.

Other objects will appear hereinafter.

DESCRIPTION OF FIGURES IN THE DRAWINGS

FIG. **1** is an exploded perspective view of the web-tension sensing means and the pneumatic sensing and control unit which are embodied in the invention;

FIG. **2** is a side elevational view illustrating a feed roll and a take-up roll for a web of paper, plastic resinous film, or the like, having the new web-tensioning apparatus applied thereto;

FIG. **3** is an elevational view of the parts of the invention shown in FIG. **2,** as seen from the left hand side in FIG. **2**;

FIG. **4** is an elevational view, partly in section, of the web-tension sensing and control means embodied in the invention;

FIG. **5** is a view on line **5—5** in FIG. **4,** partly in section and partly in elevation, illustrating parts of the web-tension sensing and control means;

FIG. **6** is a view on line **6—6** in FIG. **4,** partly in section and partly in elevation, showing parts of the control means for the web-tension sensing means embodied in the invention;

FIG. **7** is a sectional detail view on line **7—7** in FIG. **5**;

FIG. **8** is a sectional detail view on line **8—8** in FIG. **6** illustrating parts of the control means for the web-tension sensing means embodied in the invention;

FIG. **9** is a sectional detail view on line **9—9** in FIG. **6**;

FIG. **10** is an elevational view illustrating the power transmission means for operating the air valve control means for the pneumatic braking means for the web roll-supporting shaft;

FIG. **11** is a sectional detail view on line **11—11** in FIG. **10**;

FIG. **12** is a sectional detail view on line **12—12** in FIG. **10**;

FIG. **13** is a sectional detail view on line **13—13** in FIG. **10**;

FIG. **14** is an elevational view of the pneumatic air control valve for the braking means for the web feed roll supporting shaft;

FIG. **15** is a diagrammatic view of parts of the pneumatic air control circuit and the operating means for the air control valve for the braking means embodied in the invention;

FIG. **16** is a perspective view of a modified form of the new web-tension sensing and control apparatus;

FIG. **17** is a view partly in section and partly in elevation illustrating parts of the pneumatic sensing and control means embodied in the modified form of the invention illustrated in FIGS. **16** to **21,** inclusive;

FIG. **18** is a view partly in section and partly in elevation and is similar to FIG. **17** but showing certain of the parts in a different position;

FIG. **19** is a view similar to FIGS. **17** and **18,** but showing parts of the web-tension sensing and control unit in still another position;

FIG. **20** is an enlarged sectional view of the pneumatic sensing and control unit embodied in the form of the invention illustrated in FIGS. **16** to **21,** inclusive; and

FIG. **21** is a view partly in section and partly in elevation showing parts of the motion-limiting means for the pneumatic sensing and control unit embodied in the form of the invention illustrated in FIGS. **16** to **21,** inclusive.

DETAILED DESCRIPTION OF THE PREFERRED FORM OF THE INVENTION ILLUSTRATED IN FIGS. 1 TO 15, INCLUSIVE

a.

The Web-Tension Sensing and Control Device (Figs. 1 to 8, Inclusive)

A typical and preferred embodiment of the invention is illustrated in FIGS. **1** to **15,** inclusive, of the drawings, wherein it is generally indicated at **30,** and comprises a portable pneumatic web-tension sensing and control unit, generally indicated at **31** (FIG. **1**) and which includes a portable housing in which major components of the web-tension sensing and control unit **31** are embodied.

The web-tension sensing and control **31** is disclosed in detail in applicants' U.S. Pat. No. 3,759,457, granted Sept. 18, 1973 and entitled "Web-guiding Apparatus and Position-Sensing and Control Unit Therefor," reference being had particularly to FIGS. **1, 4** to **15,** inclusive, and **19** and **20** of the drawings of said patent and those parts of the specification relative thereto, all of which are by reference incorporated herein and made a part hereof; the web-tension sensing and control unit being adopted to be positioned at a suitable point adjacent to a roll of paper, plastic resinous film, or the like, as will be described hereinafter.

A supporting frame is generally indicated at **32** and supports a feed roll **33** for a web of paper, plastic resinous film, or the like, which is rotatably mounted on a roll-supporting shaft **34,** which is journaled in bearings (not shown) which are mounted on upright parts **35-3-6-37** of the supporting frame **32.** A flexible web **38** of paper, plastic resinous film, or the like, is unwound from the feed roll **33** onto a take-up roll **39** which is carried by a take-up roll shaft **40** which is rotatably journaled in upright supporting members **41** which are mounted on a supporting frame **42** (FIGS. **2** and **3**).

The new web-tension sensing and control apparatus **30** includes a web-tension sensing unit, generally indicated at **43**, and which includes a plurality (shown in FIGS. **1** and **3**) of web-tension sensing members in the form of rollers **44** which ride and bear upon the upper surface of the web **38**. EAch of these web-tension sensing members or rollers **44** is rotatably mounted, as at **46**, on the lower end portions of sensing roller-supporting arm **45**, each of which is pivotally or rockably mounted on a horizontal rocker shaft **47** having end portions which are rotatably mounted in upright supports **36** which are mounted on the supporting frame **32** (FIGS. **2**, **3**, **4** and **5**). The sensing roller-supporting arms **45** are secured to the horizontal rocker shaft **47** by clamping means in the form of clamping collars **49** and tension-adjusting counterbalancing weight members **51** are adjustably mounted on the roller supporting arms **45** for adjustable movement therealong.

The rocker shaft **47** has a bifurcated yoke **52** mounted on one end portion thereof (right hand end portion, FIGS. **1**, **2**, **4**, **6** and **9**) and this yoke **52** has a cam roller **53** rotatably mounted thereon, as at **54**, (FIGS. **1**, **4** and **6**). The cam roller **53** rides on or against one lateral edge surface **56** of an upright operating arm **55** which is pivotally mounted between its ends, as at **57**, on one of the upright supporting members **36** (FIGS. **1**, **6** and **8**). The lower end portion of the operating arm **55–56** is pivotally connected, as at **58**, to one end portion **59** of a pneumatic sensing and control arm **60** which is slidably guided over a supporting pin **69** which is attached to one of the upright supporting members **36** (FIG. **6**). The other end portion **61** of the pneumatic sensing arm **60** extends into the throat **62** of a pneumatic sensing and control head **63** which forms part of the web-tension and sensing control unit **31** and which is described in detail in the applicants' earlier U.S. Pat. No. 3,759,457 referred to above. The operating arm **55** is normally urged, by a spring **65**, against the cam roller **53**; one end portion of the spring **65** being connected, as at **66**, to an arm **67** on one of the upright supporting members **36** and the other end portion of the spring **65** being attached, as at **68**, to the lower end portion of the operating arm **55** (FIGS. **2** and **6**).

b.

The Braking Means for the Web Roll-Supporting Shaft **34** (FIGS. **2** and **3**)

The braking means for the web roll-supporting shaft **34** (FIGS. **2** and **3**) are generally indicated at **35** (FIGS. **2** and **3**) and are associated with and are adapted to brake the rotation of the web roll-supporting shaft **34** for the roll **33** of paper, flexible film, or the like.

The braking means **35** for the web roll-supporting shaft **34** may be of any suitable pneumatically operated or other type but a suitable and preferred braking device for this purpose is the pneumatically operated diaphragm brake manufactured by the Horton Manufacturing Co., Inc. of Minneapolis, Minnesota, and known as its Model K diaphragm brake. As shown in FIGS. **2** and **3**, two of these braking units **35** are employed in the invention, one in association with each end portion of the web roll-supporting shaft **34**, and they are mounted on the upright supporting members **36**.

c.

The Pneumatic Control Valve means for the Braking Means (FIGS. **10** to **14**, Inclusive)

The pneumatic braking units **35** for the web roll-supporting shaft **34** are under the control of an air valve which is generally indicated at **50** (FIGS. **10**, **13** and **14**), and which may be of any suitable type. However, a suitable air control valve **50** for the diaphragm braking devices **35** is a constant bleed regulator air valve manufactured by the Bastion-Blessing Company of Chicago, Ill., and known as its ¼inch Model 8702PB, having a variable capacity of from 0 to 160 p.s.i.

It will be noted, by reference to FIGS. **13** and **14**, that the air control valve **50** includes a generally cylindrical body **70** having an air inlet **71** and air outlets **72** which are connected to the air inlets **73** of the diaphragm brake units **35** (FIGS. **2** and **3**).

d.

The Pneumatic Control and Operating Means For the Air Control Valve **50** (FIGS. **10**, **11**, **12**, **13** and **15**)

The pneumatic control means and the operating means for the air control valve **50** are generally indicated at **48** (FIGS. **10**, **11**, **12**, **13** and **15**), and are under the control of the pneumatic web-tension sensing and control system **31** and the pneumatic sensing head **62** which is embodied therein, as will now be described.

As described in applicants' U.S. Pat. No. 3,759,457 (FIGS. **19** and **20**) the pneumatic sensing head **63** has a low pressure air supply line **74** which is connected to a suitable source of compressed air **75**, and the pneumatic sensing head **63** has a low pressure air outlet **76** which is connected to a low pressure air supply line **77** in which is arranged a three-way pilot-operated high pressure air flow control valve unit **78** which is normally closed but is adapted to be opened by a supply of low pressure air from the pneumatic sensing head **63** by way of the low pressure air supply line **77**.

The pneumatic sensing head **63** has a second low pressure air supply outlet **79** which is connected to a second low pressure air supply line **80** in which is arranged a second normally closed three-way pilot-operated high pressure air valve **81**. A high pressure air supply line **82** leads from the normally closed high pressure air flow control valve **78** into a hydraulic reservoir **83** for oil or other fluid, and an oil line **84** leads from the oil reservoir **83** to an oil flow control valve **85** which is connected, by way of an oil line **86**, to a hydraulic cylinder **87** at one side of a piston **88** which is slidably mounted in the cylinder **87** (FIGS. **10** and **15**).

Similarly, the normally closed high pressure three-way pilot-operated air flow control valve **81** leads by way of a high pressure air supply line **89** to a hydraulic reservoir **90** for oil or like hydraulic fluid and the hydraulic oil reservoir **90** leads by way of an oil supply line **91** to an oil flow control valve **92** which leads to the cylinder **87** at the opposite side of the piston **88** (FIGS. **10** and **15**).

The piston **88** is mounted on a piston rod **94** which has a lateral extension **95** which projects externally of the cylinder **87** and is slidably guided, as at **96**, on a supporting frame **97** (FIGS. **10**, **12** and **15**). The lateral extension **95** of the piston rod **94** is connected, as at **98**, by a connecting or tie bar member **99** to a slidable rack member **100** which has a row of teeth **101** on its lower

edge. The rack of teeth **101** mesh with a spur gear **102** which is rotatably mounted on a shaft **103** which is rotatably mounted on the supporting frame **97** and has a movable valve body **105** of the air valve **50** mounted thereon (FIG. **13**); the rack member **100** being slidably mounted and guided on the supporting frame **97** by brackets **104** (FIGS. **10** and **12**).

OPERATION OF THE PREFERRED FORM OF THE INVENTION ILLUSTRATED IN FIGS. 1 to 15, INCLUSIVE

When the web **38** is in proper tension and the tension sensing arm **60–61** is in its normal position, as in FIG. **6**, the high pressure air flow valve control valves **78** and **81** in the pneumatic sensing and control system **31**, are closed so that air under high pressure is not supplied by way of either the two high pressure air supply lines **82** and **89**, respectively, to either of the hydraulic cylinders **83** and **90** for the hydraulic cylinder-piston power means **87–94–95**, with the result that the web tension sensing roller members **44** and their supporting arms **45** and attached counterbalance members **51** remain in their normal operating position relative to the web **31**.

However, in the event that the web **38** from the roll **33** of paper, plastic resinous film, or like flexible sheet material looses tension or becomes too slack, the counterweighted web tension sensing roller members **44** and their supporting shafts **45** and the counterbalance members **51** thereon will pivot on the rocker shaft **47** (clockwise, FIGS. **1** and **5**). This movement of the rocker shaft **47** causes the bifurcated yoke **52** and the cam roller **53** carried thereby to move away from the operating arm **55** whereupon the spring **65** will cause the operating arm **55** to pivot, at **57**, (clockwise, FIG. **6**) and thereby withdraw the pneumatic sensing arm member **60–61** outwardly relative to the throat **62** in the body of the sensing head **63** (right to left, FIG. **6**) from the position in which the pneumatic sensing arm member **60–61** is shown in FIG. **6**.

When the pneumatic sensing arm **60–61** is thus moved outwardly relative to the throat **62** in the pneumatic sensing head **63** (right to left, FIG. **6**), a supply of air under relatively low pressure is allowed to flow in the pneumatic system **31**, from the air reservoir **75** by way of the low pressure air supply line **77** to the normally closed high pressure three-way pilot-operated air control flow valve **78** through the high pressure air supply line **82** to the hydraulic cylinder **83**, thereby forcing oil under pressure through the oil line **84–85–86** into the hydraulic cylinder **87** at one side of the piston **88** and thereby moving the piston **88** and the piston rod **94–95** on which it is mounted (right to left, as seen in FIG. **15**). This movement of the piston **88** and the piston rod **94–95** acts, through the connecting or tie member **99**, to move the rack member **100–101** slidably in the same direction and this movement of the rack member **100–101** acts, through the spur gear **102**, to rotate the shaft **103** on which the spur gear is mounted, and also to rotate the movable valve member **105** on the shaft within the body of the air flow control valve **50**, thereby allowing air to flow from the air valve **50** by way of the air lines **72** and the inlets **73** into the diaphragm braking units **35** to brake the rotation of the web roll-supporting shaft **34** and the roll **33** of paper, plastic resinous film, or the like, carried thereby, and thus taking up the slack in the web **38**.

However, after the proper tension has thus been restored to the web **38**, and the web **38** has been returned to its normal position, the movement of the web **38** back into its normal position raises the web-tension sensing roller members **44** which ride thereon and thus causes the web tension sensing rollers **44** and their supporting shafts **45** and the counterbalance members **31** thereon to rotate on the rocker shaft **47** (counterclockwise, FIGS. **5** and **6**). This movement of the rocker shaft **47** and the yoke **52** thereon causes the cam roller **53** to be urged against the edge surface **56** of the operating arm **55**, thereby pivoting the operating arm **55**, at **57**, counterclockwise (FIG. **6**). This movement of the operating arm **55** causes its lower end portion, through the pivotal connection **58**, to move the pneumatic sensing arm **60–61** back into its normal position in and relative to the throat **62** in the pneumatic sensing head **63** and into the position in which the parts are shown in FIG. **6**, thereby moving the pneumatic sensing arm **60–61** into position relative to the throat **62** and the sensing head **63** to enable air under relatively low air pressure to flow through the sensing head **63** by way of the low pressure air outlet **79** and the low pressure air line **80–81–89** into the hydraulic cylinder **90** and thus cause oil to flow by way of the oil line **90–92–93** into the cylinder **87** at the opposite side (left hand side as seen in FIG. **15**) of the piston **88**. This movement of oil under pressure into the cylinder **87**, by way of the oil line **90–92–93**, causes the piston **88** and the piston rod **94–95** to move back into their normal position (left to right in FIG. **15**) into the position in which the parts are shown in FIG. **15** and this movement of the piston rod **94–95** acts through the connecting or tie member **99** to move the rack **100–101** in the same direction, and the movement thus imparted to the rack **100–101** acts, through the spur gear **102**, to rotate the shaft **103** and the movable operating valve member **105** thereon back into their normal position, thus cutting off the supply of air through the air control valve unit **50** to the diaphragm braking devices **35** and thus releasing the braking action on the roll supporting shaft **34** which then becomes free to rotate at its normal predetermined speed to correspond with the desired movement of the web roll **33**.

The air flow control valve unit **50** for the diaphragm braking units **35**, as pointed out above, has a variable capacity from 0 to 160 p.s.i. but a preferred normal operating range is from 0 to 20 p.s.i.

DESCRIPTION OF THE CONSTRUCTION OF THE MODIFIED FORM OF THE INVENTION ILLUSTRATED IN FIGS. 16 TO 21, INCLUSIVE

A modified form of a web tension sensing and control device for use in the invention is illustrated in FIGS. **16** to **21**, inclusive, where it is generally indicated at **106**, and comprises a web tension sensing roll **107** having a trunnion **108** at one end which is rotatably mounted in a supporting arm member **109** which is pivotally mounted, as at **110**, in an upright supporting member **111** which is mounted on a supporting frame **112**. The web-tension sensing roll **107** has a second trunnion **113** at its opposite end which is rotatably mounted in a pneumatic web tension sensing member **114** which is pivotally mounted on a shaft **115** which is attached to an upright supporting bracket **116** which is carried by a supporting frame **116** (FIGS. **16** and **17**).

The pneumatic web tension sensing arm **114** has an L-shaped pneumatic web-tension sensing member **118** mounted on one side **119** thereof and this pneumatic web-tension sensing member **118** has a laterally projecting arm **120** which projects into the throat **62***a* in the sensing head **63***a* which corresponds in structure and in function to the sensing head **63** in the preferred form of the invention shown in FIGS. **1** to **15**, inclusive.

The modified form of the invention illustrated in FIGS. **16** to **21**, inclusive, embodies a motion-limiting device in the form of a dash pot unit which is generally indicated at **121** and includes a dash pot cylinder **122** which has a curved body portion **123** at one end thereof and this curved body portion **123** of the dash pot cylinder **122** is mounted, by means of a supporting rod member **124**, on an upright support **125** which is mounted on the supporting member **117** (FIG. **16**).

The dash pot cylinder **122** has a coil spring **126** therein which bears against a piston **127** which is connected to a piston rod **128** which projects externallly of the dash pot cylinder **122** and has an end portion **129** which is connected to a member **130** which is mounted on a shaft **131** which is rotatably mounted in the lower end portion of the pneumatic sensing arm **114** (FIGS. **16** and **21**).

DESCRIPTION OF THE OPERATION OF THE MODIFIED FORM OF THE INVENTION ILLUSTRATED IN FIGS. 16 TO 21, INCLUSIVE

As shown in FIGS. **16** to **20**, inclusive, the web tension sensing roll or cylinder **107** normally rides on the web **38***a* of paper, plastic resinous film, or the like, which may be fed from a roll of the same, such as the web roll **33** in the preferred form of the invention shown in FIGS. **1** to **15**, inclusive, and when the web **38***a* is under proper tension the pneumatic web tension sensing unit **114–118–120** is disposed, with respect to the pneumatic sensing head **63***a*, and the throat **62***a* therein, in the normal position in which the parts are shown in FIG. **17**, so that the pneumatic control means and the power means and the power transmission means for operating the air conttrol valve **50** for the diaphragm braking units **35**, will be disposed in their position to maintain the diaphragm braking units **35** in their normal position with respect to the web roll supporting shaft, such as **34**, with which they are associated.

However, when the web tension sensing roll **107** senses a slack condition in the web **38***a* it will pivot on its supporting trunnions **108** and **113** in a direction to move the pneumatic web tension-sensing unit **114–118–120** into position relative to the sensing head **63a** and its throat **62***a*, as shown in FIG. **19**, thereby enabling the pneumatic sensing head **63***a* to actuate the pneumatic control system **31** in such a manner as to allow air under relatively low air pressure to flow through the sensing head **63***a* by way of the low pressure air supply line **77** to the normally closed high pressure pilot-operated air valve **78** to allow air under high pressure to flow, by way of the high air pressure line **82** into the hydraulic cylinder **83** and thus allow oil from the hydraulic cylinder **83** to flow through the oil line **84–85–86** into the cylinder **87** at one side of the piston **88**, thereby moving the piston rod **94–95** and the rack **100–101** attached thereto, in a direction (right to left, FIGS. **10** and **15**), to rotate the spur gear **102** and the valve operating shaft **103** into a position to open the air flow control valve **50** and thus allow, air to flow by way of the lines **72–73–72–73** to the pneumatic diaphragm braking units **35** and thus brake the action of the web roll supporting shaft, as **34**.

However, when the web tension sensing roller **107** senses a taut condition in the web **38a** it will pivot on its supporting trunnions **108–113** into a position to move the pneumatic sensing unit **114–118–120** relative to the sensing head **63***a* and its throat **62***a* into the position in which the parts are shown in FIG. **18**, thereby allowing air under relatively low pressure to flow through the sensing head **63a** by way of the low pressure air supply line **80** to the normally closed three-way pilot-operated high pressure air valve **81**, to open the latter and thus allow air under high pressure to flow into the hydraulic cylinder **90** to force oil therefrom by way of the line **91–92–93** into the cylinder **87** at the opposite side of the piston **88** (left side, FIG. **15**), and thereby move the piston rod **94–95** and its attached rack **100–101** (left to right, FIG. **15**) relative to the cylinder **87**. This movement of the rack **100–101** causes the rack **100–101** to rotate the spur gear **102** and the valve-operating shaft **103** in a direction to cut off the flow of air through the air control valve **50** to the diaphragm braking units **35** and thus relieve the braking action on the web roll supporting shaft, as **34**.

In the use of the form of the invention illustrated in FIGS. **16** to **21**, inclusive, the motion limiting or dash pot device illustrated in FIGS. **16** to **19**, inclusive, acts by way of the spring **126**, piston **127**, piston rod **128** and parts **129–131**, to return the pneumatic sensing unit **114–118–120** to its normal position, as in FIG. **16**, after each operation thereof.

It will thus be seen from the foregoing description. considered in conjunction with the accompanying drawings, that the present invention provides a new and improved web tension device having the desirable advantages and characteristics and accomplishing its intended objects including those hereinbefore pointed out and others which are inherent in the invention.

We claim:

1. A web tension sensing and control apparatus for sensing and controlling the tension of a web of paper, plastic resinous film, or the like, fed from a roll thereof carried by a roll-supporting shaft, comprising:

a. supporting means;

b. web-tension sensing means movably mounted on the said supporting means and adapted to bear upon the said web above the latter;

c. pneumatically operated braking means on the said roll-supporting shaft for braking the action of said roll-supporting shaft;

d. air supply means for supplying air under pressure to the said pneumatically operated braking means;

e. first air valve control means for controlling the flow of air to said pneumatically operated braking means to actuate the latter;

f. power means for operating the said first air valve control means;

g. pneumatically controlled power transmission means for operating the said power means;

h. pneumatic control means under the control of the said web-tension sensing means for controlling the operation of the said pneumatically controlled power transmission means and including

1 a pneumatic sensing head having therein (a) a throat portion;

2 a sensing member operable by and responsive to movement of the said web-tension-sensing means and having a portion movable into and out of the said throat portion of the said pneumatic sensing head; and

3 second air valve control means under the control of the said pneumatic sensing head and the said throat portion thereof and the said portion of the said sensing member and responsive to the position of the said portion of the said sensing member in and relative to the said throat portion of the said pneumatic sensing head for controlling the operation of the said pneumatically controlled power transmission means.

2. A web tension sensing and control apparatus as defined in claim **1** in which the said pneumatic control means is in the form of a portable unit adapted to be disposed adjacent said web and in which the said portable unit includes flexible air conducting lines interconnecting the said pneumatic control means and the said second air valve control means.

3. A web tension sensing and control apparatus as defined in claim **1** in which the said web tension sensing means includes

a a plurality of web-tension sensing members adapted to ride upon the said web and arranged in spaced relationship transversely of the said web above the latter; and

b means for rotatably mounting the said web-tension sensing rollers in spaced relationship above the said web.

4. A web tension sensing and control apparatus as defined in claim **1** in which

a the said web-tension sensing means is in the form of a single cylindrical web tension sensing roller member rotatably mounted on the said supporting means and adapted to bear upon the said web above the latter.

5. A web tension sensing and control apparatus as defined in claim **1** in which

a the said pneumatic sensing head is in the form of a portable unit adapted to be positioned at a selected point adjacent the said web.

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