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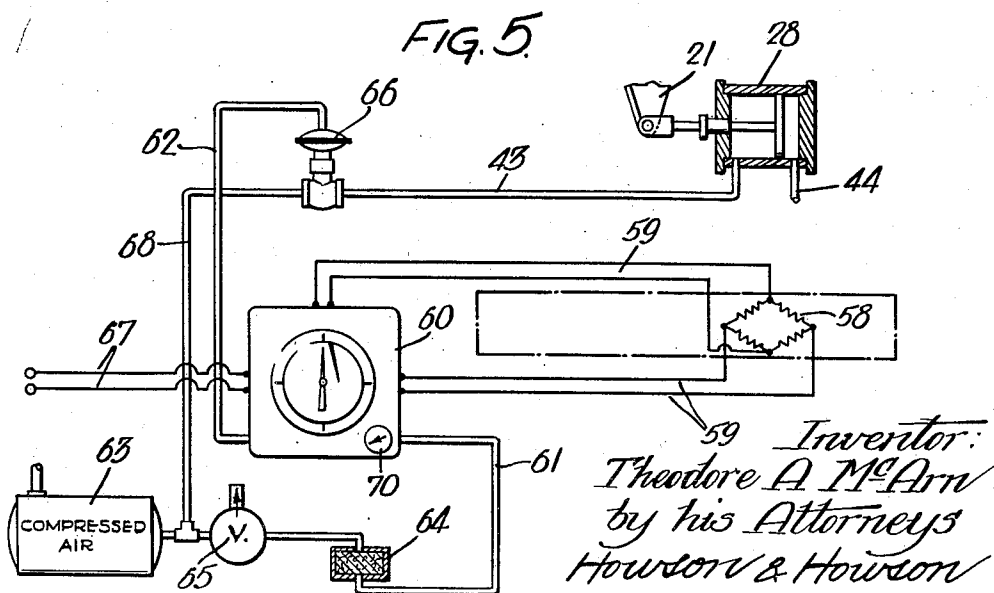
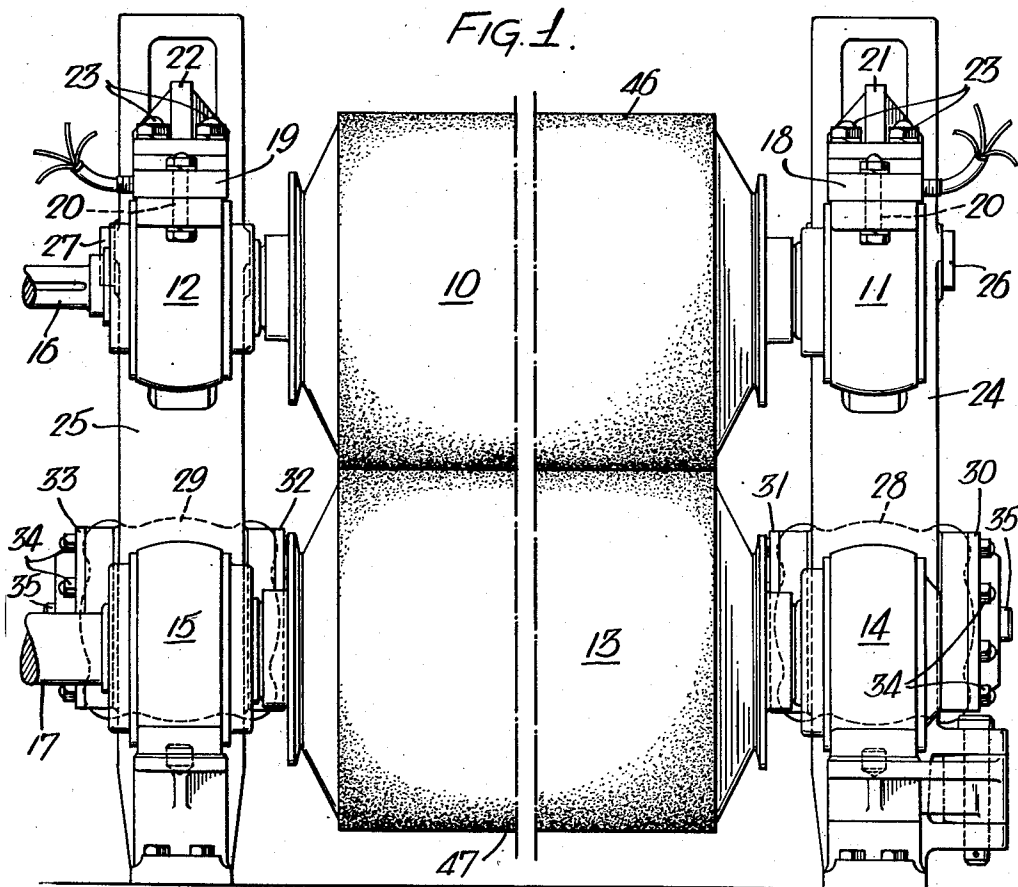
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2,691,326

ROLL PRESSURE INDICATING AND CONTROLLING SYSTEM

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2 Sheets-Sheet 1



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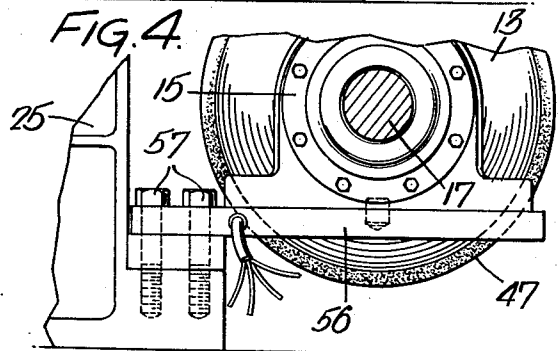
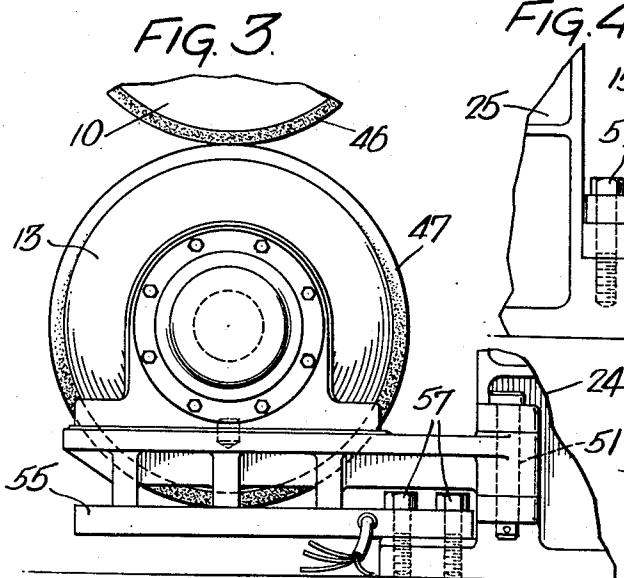
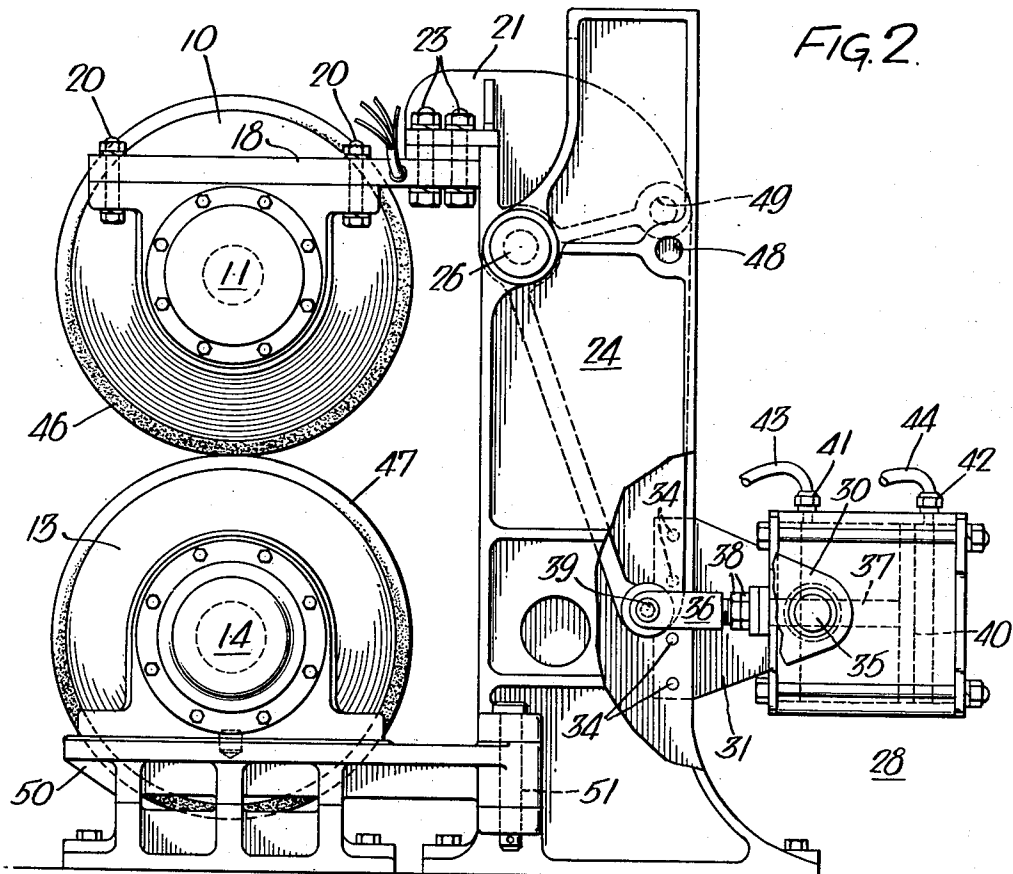
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2 Sheets-Sheet 2



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ROLL PRESSURE INDICATING AND CONTROLLING SYSTEM

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This invention relates to pressure control systems of the type used in conjunction with the rolls of paper making machinery.

In order to obtain the best results in the paper making art, it has been found essential to determine accurately the pressure applied between the various rolls of the machinery and to provide means for maintaining the desired pressure. Not only is it important that the pressure between the rolls (nip pressure) be kept constant, but the pressure at each end of the rolls must be equalized within fairly close limits.

The proper control of nip pressures has a very substantial bearing upon the quality and cost of the product. In the first place, uneven pressure across the face of the rolls greatly decreases the life of felts due to the increased frictional wear. Secondly, since the cost of removing water in the dry section greatly exceeds the cost of removing water in the wet section, the proper control of nip pressures throughout the drying process insures that maximum drying is taking place at all times. A specific example of the reduction of cost due to proper nip pressures is the fact that over-dry or under-dry edges mean excessive trim and tonnage loss, as well as substandard sheet sizes. Constant pressures along the roll insure maximum production of a uniform product.

The present invention is readily adapted to water removal by press rolls, the production of the desired finish in the case of calenders, and maximum pulping in the case of beaters. Previous loading systems for any of the above purposes have proved unsatisfactory because inaccurate nip pressure readings have been obtained due to friction of fulcrum pins, rusty knife edges, piston leakage, and other causes such as friction of packing glands, etc. Obviously a fluid pressure gauge does not convert for these factors. Insofar as is known, no previous system has been devised which will not only indicate and/or record the actual nip pressure, but which will automatically make the necessary corrections for deviations from a predetermined setting.

A primary object of the invention therefore, is to provide an accurate indicating and recording system for roll nip pressures.

A further object of the invention is to provide a roll nip pressure control system which is extremely sensitive and quickly responsive to pressure variations.

A still further object of the invention is to eliminate substantially all sources of error in a nip pressure indicating system.

Further objects will be apparent from the specification and drawings in which:

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Fig. 1 is a front view of a pair of press rolls and supporting stands on which a nip pressure indicating device constructed in accordance with the invention has been installed;

Fig. 2 is an end view of the structure of Fig. 1;

Fig. 3 shows a modified installation of the roll pressure device as applied to the bottom calender roll;

Fig. 4 shows the opposite end of the press roll of Fig. 3; and

Fig. 5 is a schematic view of the control and indicating system.

The invention comprises essentially the modification of a standard roll stand to incorporate an electrical strain gauge at either end of the roll. The strain gauges are separately connected to a pressure indicator which in turn automatically controls the nip pressure at each end of the roll. It will be understood that the present invention is applicable to any machine in which it is desired to obtain accurate indication of mechanical as distinguished from fluid pressure readings. However, I have chosen to illustrate the invention as applied to a press roll stand.

Referring now to Figs. 1 and 2, a typical press roll stand has an upper press roll 10 journaled in bearing assemblies 11, 12 and a lower press roll 13 journaled in bearings 14, 15. The press rolls are driven through bearings 12 and 15 by means of shafts 16 and 17 respectively. Upper roll bearings 11 and 12 are secured to load beams 18 and 19 by bolts 20, 20, and beams 18 and 19 are in turn bolted to rocker arms 21 and 22 by means of bolts 23, 23. Arms 21 and 22 are pivotally mounted in stands 24 and 25 by means of journal pins 26 and 27. Nip pressure between rolls 10 and 13 is applied through arms 21 and 22 by means of hydraulic or pneumatic cylinders 28 and 29 which are pivotally mounted on brackets 30, 31 and 32, 33 attached to stands 24 and 25 by bolts 34. Cylinders 28 and 29 as well as their associated structures are identical and it is therefore believed necessary to illustrate and describe only one of these assemblies.

Referring to Fig. 2, cylinder 28 is pivotally mounted between brackets 30 and 31 on pin 35. A clevis 36 is adjustably secured to piston rod 37 by nuts 38, 38 and clevis 36 connects with arm 21 through clevis pin 39. A piston 40 is attached to the opposite end of rod 37 and its position in cylinder 28 is controlled by fluid introduced through fittings 41, 42 and conduits 43, 44. In this manner, movement of the piston 40 in the cylinder pivots arm 21 on pin 26 to control the nip pressure between the felt peripheries 46 and 47 of the rolls.

As is well known in the art, the upper roll 10 may be retained in a raised position by inserting a suitable pin through hole 48 in stand 24 when the arm 21 is pivoted to register hole 49 with hole 48. Then the pedestal 50 for lower roll 13 may be swung outwardly on pin 51 to permit changing of the main felt web (not shown).

The load beams 18 and 19 to which the upper roll 10 is secured may, if desired, be located in association with bearings 14 and 15 in lower roll 13. Figs. 3 and 4 illustrate such a modified location. In this event, the pin 51 carries no load and the entire support of each end of the roll 13 is carried by load beams 55 and 56 which in this case are secured to the bottom flange of the stands by means of cap screws 57, 57.

The construction of the load beams 18, 19 and 55, 56 forms no part of the present invention. These devices are available on the market, a typical example being the Baldwin-Southwark "SR-4." A short length of gauge wire is closely contained in the steel load carrying element so that any deformation of the element causes a slight change in the diameter of the gauge wire. This in turn changes its resistance, which is measured by a simple Wheatstone bridge 58 and such reading or change in reading, is utilized to indicate, record and control the pressure applied to the beam.

Referring now more particularly to Fig. 5, leads 59, 59 are connected to the strain gauge element of the load beam at one end and to a combined indicating and recording device 60 at the other end. The indicating and recording regulator 60 is in turn operatively associated with low pressure conduits 61 and 62, the former of which leads to a supply 63 of high pressure fluid, such as air, through filter 64 and reducing valve 65. The other line 62 connects regulator 60 to an automatic diaphragm-type metering valve 66. Regulator 60 is attached to a suitable source of electrical power by means of leads 67, 67 and the cylinder assembly 28 is connected to the source of compressed air 63 by means of high pressure conduits 43 and 68 on either side of valve 66. The regulator 60 may be adjusted by means of a suitable knob 70 so that when the pressure in the cylinder 28 falls below a predetermined value, valve 66 will be automatically opened to admit additional pressure to the cylinder 28 from tank 63 through conduits 68 and 43. In this way, both accurate nip pressure readings and automatic corrections are obtained.

Conduit 44 is connected to any source of high pressure such as tank 63 by suitable conduits and valves (not shown) and is used only to raise upper roll 10 when it is desired to change or remove felts. The details and construction of automatic pressure regulating devices such as regulator 60 is well known and may be obtained from manufacturers such as Leeds & Northrup Company.

It will thus be understood that I have provided a nip pressure indicating and controlling system which is especially adapted to the rolls of heavy paper making machinery and which permits substantial improvements to be made in the quality control of a paper product. The errors in accurate nip pressure application and measurement that are inherent to any system of weights and levers or to a system which relies solely on a fluid pressure gauge at the cylinder, are eliminated. Mill operators are enabled to establish proper control technique and to keep suitable permanent records to show the correct loading for each grade

of paper made. These records make it possible to maintain specified calender density, opacity and finish under any set of operating conditions.

Having thus described my invention, I claim:

1. A pressure indicating and controlling system for roll stands and the like, which comprises a roll stand, a roll supported in said stand, journal means at each end of said roll, a load sensitive beam directly coacting with each of said journal means and carrying radial loads imposed on said journal means, means in said load beam for detecting deflection of the beam in accordance with the load applied thereto, an indicator electrically responsive to the deflection of each of said load beams, an electrical connection from each of the load sensitive beams to each of the indicators, means for applying pressure to the roll through each of the load beams, and means controlled by the indicating means for regulating the pressure applied to the roll.

2. A pressure indicating and controlling system for roll stands and the like, which comprises a roll stand, a roll supported in said stand, journal means at each end of said roll, a load sensitive beam directly coacting with each of said journal means and carrying radial loads imposed on said journal means, means in said load beam for detecting deflection of the beam in accordance with the load applied thereto, an indicator electrically responsive to the deflection of each of said load beams, an electrical connection from each of the load sensitive beams to each of the indicators, and means for applying pressure to the roll through each of the load beams.

3. A pressure indicating and controlling system for roll stands and the like, which comprises a roll stand, a roll supported in said stand, journal means at each end of said roll, a load sensitive beam directly coacting with each of said journal means and carrying radial loads imposed on said journal means, a Wheatstone bridge in said load beam for detecting deflection of the beam in accordance with the load applied thereto, an indicator electrically responsive to the detecting means in each of said load beams, an electrical connection from each of the detecting means to each of the indicators, a pair of fluid cylinders for applying pressure to the roll through each of the load beams, and means controlled by the indicating means for regulating the pressure supplied to the cylinders.

4. A pressure indicating and controlling system for roll stands and the like, which comprises a roll stand, a roll supported in said stand, journal means at each end of said roll, a load sensitive beam directly coacting with each of said journal means and carrying radial loads imposed on said journal means, means in said load beam for detecting deflection of the beam in accordance with the load applied thereto, an indicator electrically responsive to the detecting means in each of said load beams, an electrical connection from each of the detecting means to each of the indicators, a pair of fluid cylinders for applying pressure to the roll through each of the load beams, a source of fluid pressure, a conduit from said fluid pressure source to each cylinder, a regulating valve in each of said conduits, and means for actuating said regulating valves in accordance with the indicator readings.

5. A pressure indicating and controlling system for roll stands and the like, which comprises a roll stand, a roll supported in said stand, journal means at each end of said roll, a load sensitive beam directly coacting with each of said

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journal means and carrying radial loads imposed on said journal means, means in said load beam for detecting deflection of the beam in accordance with the load applied thereto, an indicator electrically responsive to the detecting means in each of said load beams, an electrical connection from each of the detecting means to each of the indicators, a pair of fluid cylinders for applying pressure to the roll through each of the load beams, a source of fluid pressure, a conduit from said fluid pressure source to each cylinder, a regulating valve in each of said conduits, means for actuating said regulating valves in accordance with the indicator readings, and means for varying the control pressure of the indicators.

6. A pressure indicating and controlling system for roll stands and the like, which comprises a roll stand, a roll supported in said stand, journal means at each end of said roll, a load sensitive beam directly coacting with each of said journal means and carrying radial loads imposed on said journal means, means in said load beam for detecting deflection of the beam in accordance with the load applied thereto, an indicator

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electrically responsive to the detecting means in each of said load beams, an electrical connection from each of the detecting means to each of the indicators, a pair of pneumatic cylinders, a rocker arm operatively connecting each of said cylinders with said roll, a source of fluid pressure, a high pressure air conduit from said source to each of said cylinders, a regulating valve in each of said high pressure conduits, a low pressure air conduit between each of said regulating valves and each of the indicators, a second low pressure conduit from each of said indicators to the source, and a reducing valve operatively associated with said low pressure conduits.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,489,622	Wilson -----	Apr. 8, 1924
2,090,188	Dahlstrom -----	Aug. 17, 1937
2,276,843	Hathaway -----	Mar. 17, 1942
2,312,310	Bradner et al. -----	Mar. 3, 1943