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CALENDER ROLL PRESSURE CONTROL APPARATUS

Filed Aug. 31, 1949

2 SHEETS—SHEET 1

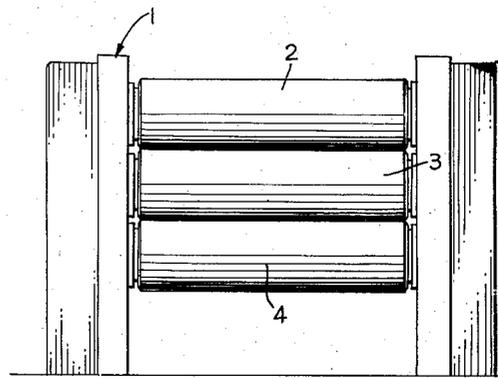
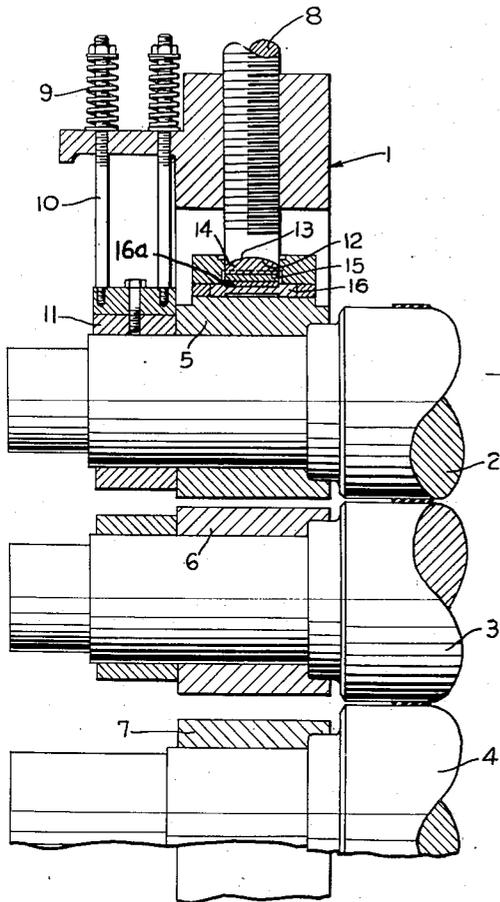


FIG. 1

FIG. 3

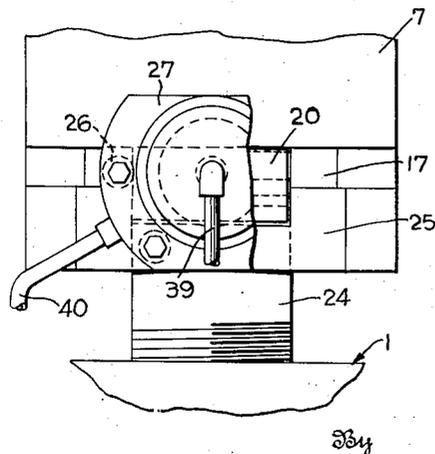


FIG. 4

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2 SHEETS—SHEET 2

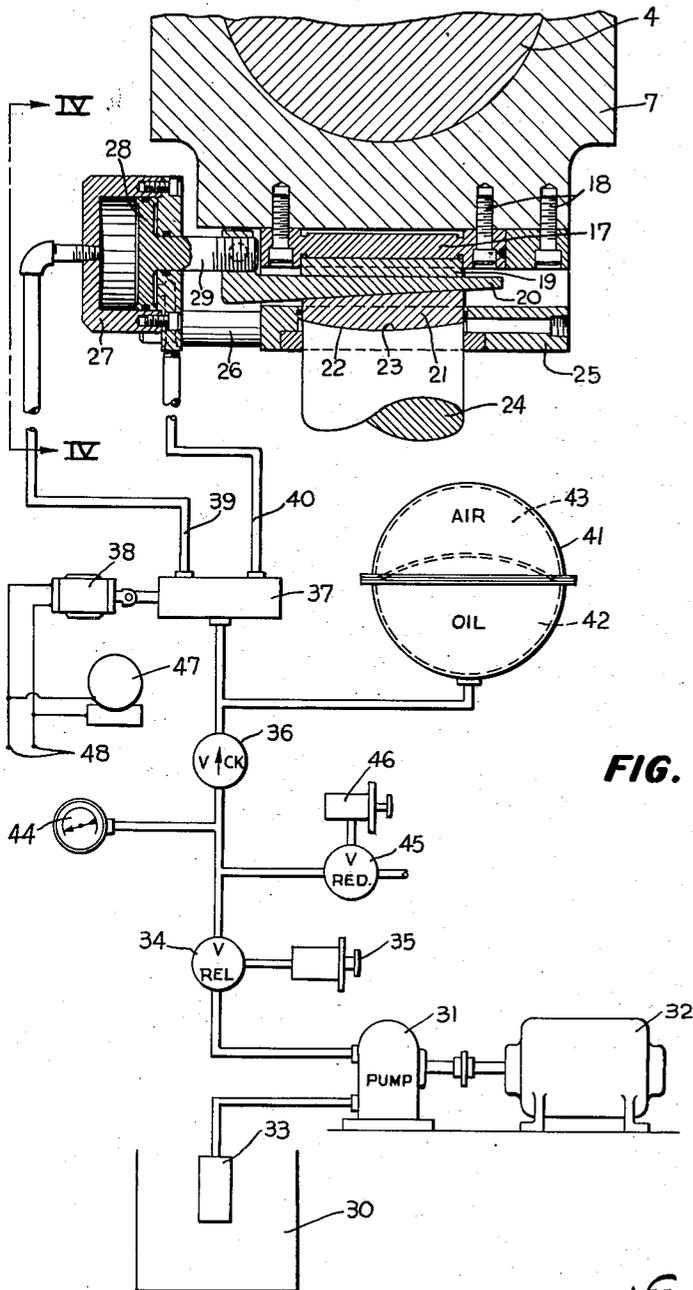


FIG. 2

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# UNITED STATES PATENT OFFICE

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## CALENDER ROLL PRESSURE CONTROL APPARATUS

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9 Claims. (Cl. 18—2)

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This invention relates to calenders for performing sheeting and like operations upon plastic materials, and, more particularly, is concerned with calenders of the type described and including wedges in association with the calender roll bearings, the wedges being adapted to be moved to quickly relieve pressure between the calender rolls.

Heretofore, it has been the usual practice to associate with calender, mill, and like rolls some mechanism for relieving excessive pressure between roll surfaces. Such means have taken the form of shear plates having a reduced area of metal which it will punch or shear out in plug or other form to permit the rolls of a mill or calender to separate when subjected to excessive loads, and to thereby save marking or other damage to the rolls.

Additionally, it has been conventional practice to back up calender and like roll bearings with screw-downs to permit the clearance or pressures between the rolls to be adjusted by appropriately adjusting the screws.

It has also been proposed heretofore to employ wedges behind calender roll bearings, which wedges can be adjusted in and out to control the clearance between the calender rolls.

However, none of the foregoing means have been found to be satisfactory in conjunction with calendering operations upon relatively soft plastic materials, such as polyvinyl chloride materials. In calendering operations of this type, the films or sheets produced are so thin, as a general rule, and are often formed with a surface "tooth" or feel that calendering operations are quite difficult, particularly with respect to maintenance of gauge over the full width and length of the sheet within commercial tolerances, which are often quite close. In addition, it has been found that if, for any reason, the calender is shut down for only a few seconds' time, the calender rolls may become marked, or the "tooth" on the rolls will be damaged to the point where it becomes necessary to regrind and refinish the calender rolls. With known apparatus of the type heretofore discussed, it is impossible to relieve the pressure of the screw-downs within the very short period of time required to avoid marking of the calendered rolls.

It is the general object of the invention to avoid and overcome the foregoing and other difficulties of and objections to known calendering apparatus by the provision of improved mechanism for substantially instantaneously relieving the pressure between the calender rolls when the rolls are stopped for any reason.

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Another object of the invention is to provide in combination with a calender hydraulically-positioned back-up wedges behind the roll journals, these wedges being automatically moved to pressure-relieving position when the flow of electric current to the motor driving the calender rolls is cut off for any reason.

Another object of the invention is to provide a calender combination of the character described including hydraulic cylinder means for operating the wedges, the hydraulic cylinder means being connected through a solenoid operated valve to a hydraulic accumulator, and the solenoid valve being connected electrically with the motor driving the calender rolls.

Another object of the invention is the provision of a calender construction including shallow ball-and-socket joints between the screw-downs and the wedge plates of the present invention.

The foregoing objects of the invention, and other objects which will become apparent as the description proceeds, are achieved by the provision in a calender of a pair of rolls, a pair of bearings for each roll, a pair of wedges behind one of the pairs of bearings, hydraulic cylinder means associated with each wedge and controlling its position, a hydraulic accumulator, and solenoid valve means connecting the accumulator alternately to opposite ends of all of the hydraulic cylinders. Preferably the solenoid valve means are tied in with the drive to the calender rolls so that, should the flow of current be cut off for any reason to the motor driving the calender rolls, the solenoid valve will be actuated in a direction to relieve the pressure between the calender rolls. The wedges are positioned between the roll bearings and the screw-downs for moving the calender rolls towards each other, and are normally associated with wedge plates having shallow ball-and-socket connection with the end of each screw-down.

For a better understanding of the invention, reference should be had to the accompanying drawings wherein Fig. 1 is a front elevation of a substantially conventional calender incorporating the features of the invention;

Fig. 2 is a schematic diagram of the hydraulic and electrical system incorporated in the apparatus of the invention and illustrating in vertical cross-section, and on an enlarged scale, the manner of associating the wedges with the roll bearings;

Fig. 3 is a vertical sectional view through the calender roll ends, particularly illustrating the screw-down for the upper calender roll, this fig-

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ure being on a scale substantially midway between the scale used in Figures 1 and 2; and

Fig. 4 is a fragmentary elevational view taken substantially on line IV—IV of Fig. 2.

Having particular reference to the drawings, the numeral 1 indicates generally the calender frame supporting rolls 2, 3, and 4. Each of the calender rolls is formed with a reduced neck or journal portion received, respectively, in bearings 5, 6, and 7. The frame 1 carries screw-down means 8 of adjustable type which can be turned to move the roll 2 towards the roll 3 and thereby adjust the clearance and pressures between these rolls. The bearings 5 at each end of the upper roll 2 are held up against the screw-down 8 by means of compression springs 9 carried on rods 10 and connected to ring bearings 11. The bottom end of each screw-down 8 is formed with a shallow socket 12 which receives the complementary ball-shaped portion 13 of a two-part wedge plate 14. The wedge plate 14 engages the upper surface of a wedge 15. A shear plate 16 rests on the upper end of the bearing 5, and supports the under side of wedge 15 by means of a hardened shear plate facing 16a.

A better understanding of the relationship of these parts will be had by referring to Fig. 2, which shows the same mechanism, but in larger scale, associated with the bearing 7 of lower roll 4. A shear plate 17 is secured by bolts 18 to the under side of the bearing 7. Engaging with the shear plate 17 is a hardened shear plate facing 19 which rests on top of a wedge 20 having a straight upper surface and an inclined lower surface. The inclined lower surface engages with a wedge plate 21 which has rounded or ball-shaped surface 22 received in a shallow socket 23 formed in the upper end of the bottom screw-down 24.

Secured to the bottom of the bearing 7 is a bracket 25 which supports and positions the wedge plate 21, and which also serves to carry on post extensions 26 a hydraulic cylinder 27. The hydraulic cylinder 27 includes a piston 28 having a piston rod 29 fastened to the wedge 20.

With the piston 28 of the hydraulic cylinder 27 to the right, in the manner illustrated in Fig. 2, the wedge 20 holds the bearing 7 and the roll 4 in the position to which it has been adjusted by means of the screw-down 24. On the other hand, when the piston 28 is actuated to move it to the left-hand end of the hydraulic cylinder 27, the wedge 20 is pulled out partially from between the shear plate facing 19 and the wedge plate 21 to allow the bearing 7 to drop by this amount and to thereby relieve the pressure between the roll 4 and its associated roll 3.

In order to effect the operation of the hydraulic cylinder 27, a sump 30 is provided for the oil or other hydraulic fluid used from which a pump 31, driven by an electric motor 32, draws fluid by way of a filter 33. The fluid is passed from the pump through a check valve 36 to a four-way valve 37 controlled by a solenoid 38. Conduits 39 and 40 extend to opposite ends of the hydraulic cylinder 27 so that in one position of the valve 37, hydraulic fluid is applied to the left-hand side of the piston 28 and pressure is relieved to the sump 30 on the right-hand side of the piston, and in the other position of the four-way valve 37, pressure is applied to the right-hand side of the piston 28 and the left-hand side of the piston is connected to the atmosphere by way of the sump 30. Connected into the hydraulic line as it enters the four-way valve 37 is a hydraulic

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pressure accumulator 41 which will contain a body 42 of the hydraulic fluid, and a pocket 43 of air. Also, a pressure gauge 44 can be connected to hydraulic pressure conduit, as can be a reducing valve 45 operated by a control 46.

One of the features of the invention is that the solenoid 38 of the four-way valve 37 is connected in parallel with the motor 47 adapted to drive the calender rolls, the parallel connection being illustrated in Fig. 2 of the drawings, and including a source 48 of electricity. This electrical connection is such that, should the electric power to the motor 47 fail for any reason or be cut off for any reason, the electric current to the solenoid valve 38 is likewise cut off, and the four-way valve 37 automatically moves or returns to the position so as to connect hydraulic pressure through conduit 40 to the right-hand side of the piston 28 to move the wedge 20 to pressure-relieving position.

It will be recognized from the foregoing description that the various objects of the invention have been achieved by the provision of a particularly simple and yet foolproof apparatus for automatically relieving pressure between calender rolls upon stoppage of the calender. This apparatus does not interfere in any way with the normal adjustment of the calender roll clearances or pressures. The apparatus works regardless of the adjusted clearance between the calender rolls, and will operate even though there has been a failure in hydraulic pressure concurrently with the failure of electric power to the roll-driving motor 47 or to the hydraulic pressure motor 32. The check valve 36 and the hydraulic pressure accumulator 41 insure this operation.

While certain representative embodiments and details have been shown for the purpose of illustrating the invention, it will be apparent to those skilled in this art that various changes and modifications may be made therein without departing from the spirit or scope of the invention.

What is claimed is:

1. In a calender for performing sheeting and similar operations on plastic materials, the combination of a frame, a pair of cooperating rolls, bearings supporting the rolls in the frame for movement to and from each other, adjustable screw-downs carried by the frame, a wedge plate having a shallow ball and socket connection with the end of each screw-down, a shear plate secured to each bearing, a wedge between the wedge plate and its associated shear plate, a hydraulic cylinder controlling the position of each wedge, a hydraulic system including a pressure accumulator for operating the hydraulic cylinder, a solenoid actuated valve for controlling the passage of fluid from the system to the cylinder, a motor for driving the calender rolls, and electrical means connecting the motor and solenoid valve in parallel relation whereby when the rolls are not driven, the pressure on the rolls is relieved by movement of the wedges.

2. In a calender for performing sheeting and similar operations on plastic materials, the combination of a frame, a pair of cooperating rolls, bearings supporting the rolls in the frame for movement to and from each other, adjustable screw-downs carried by the frame, a wedge plate having a shallow ball and socket connection with the end of each screw-down, a wedge between each wedge plate and a roll bearing, a hydraulic cylinder controlling the position of each wedge, a hydraulic system including a pressure accumulator for operating the hydraulic cylinder, a solenoid actuated valve for controlling the pas-

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sage of fluid from the system to the cylinder, a motor for driving the calender rolls, and electrical means connecting the motor and solenoid valve in parallel relation whereby when the rolls are not driven the pressure on the rolls is relieved by movement of the wedges.

3. In a calender for performing sheeting and similar operations on plastic materials, the combination of a frame, a pair of cooperating rolls, bearings supporting the rolls in the frame for movement to and from each other, adjustable screw-downs carried by the frame, a wedge plate associated with the end of each screw-down, a wedge between each wedge plate and a roll bearing, a hydraulic cylinder controlling the position of each wedge, a hydraulic system including a pressure accumulator for operating the hydraulic cylinder, a solenoid actuated valve for controlling the passage of fluid from the system to the cylinder, a motor for driving the calender rolls, and electrical means connecting the motor and solenoid valve in parallel relation whereby when the rolls are not driven the pressure on the rolls is relieved by movement of the wedges.

4. In a calender for performing sheeting and similar operations on plastic materials, the combination of a frame, a pair of cooperating rolls, bearings supporting the rolls in the frame for movement to and from each other, adjustable screw-downs carried by the frame, a wedge plate associated with the end of each screw-down, a wedge between each wedge plate and a roll bearing, a hydraulic cylinder controlling the position of each wedge, a hydraulic system for operating the hydraulic cylinder, a solenoid actuated valve for controlling the passage of fluid from the system to the cylinder, a motor for driving the calender rolls, and electrical means connecting the motor and solenoid valve in parallel relation whereby when the rolls are not driven the pressure on the rolls is relieved by movement of the wedges.

5. In a calender for performing sheeting and similar operations on plastic materials, the combination of a frame, a pair of cooperating rolls, bearings supporting the rolls in the frame for movement to and from each other, adjustable screw-downs carried by the frame, a wedge plate associated with the end of each screw-down, a wedge between each wedge plate and a roll bearing, a hydraulic cylinder for controlling the position of each wedge, a hydraulic system for operating the hydraulic cylinder, a solenoid actuated valve for controlling the passage of fluid from the system to the cylinder, a motor for driving the calender rolls, and electrical means

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connecting the motor and solenoid valve whereby when the rolls are not driven the pressure on the rolls is relieved by movement of the wedges.

6. In combination in a calender, a pair of rolls, screw-downs for moving the rolls towards each other, a wedge between each screw-down and the roll, hydraulic means for controlling the position of each wedge, a motor for driving the calendar rolls, and means for simultaneously actuating the motor and the hydraulic means.

7. In combination in a calender, a pair of rolls, a pair of bearings for each roll, a pair of wedges behind one of the pairs of bearings, hydraulic cylinder means associated with each wedge and controlling its position, a hydraulic accumulator, and solenoid valve means for connecting the accumulator alternately to opposite ends of all of the hydraulic cylinders.

8. In combination in a calendar, a pair of rolls, screw-downs for moving the rolls towards each other, a wedge plate having a shallow ball-and-socket connection with the end of each screw-down, a movable bearing supporting one roll, a shear plate secured to the bearing, a wedge interposed between the wedge plate and the shear plate, ring bearings adjacent the movable bearings, yieldable means associated with the ring bearings urging the movable bearings against the screw-downs, and means secured to the movable bearings for moving each wedge from between the wedge plate and shear plate to quickly relieve pressure between the rolls.

9. In combination in a calender, a pair of rolls, screw-downs for moving the rolls towards each other, a wedge plate having a shallow ball-and-socket connection with the end of each screw-down, a movable bearing supporting one roll, a shear plate secured to the bearing, a wedge interposed between the wedge plate and the shear plate, and means secured to the movable bearings for moving each wedge from between the wedge plate and shear plate to quickly relieve pressure between the rolls.

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## REFERENCES CITED

The following references are of record in the file of this patent:

## UNITED STATES PATENTS

Number	Name	Date
65,930	Mecutchen	June 18, 1867
1,003,496	Olier	Sept. 19, 1911
1,092,084	Stuting	Mar. 31, 1914