Feb. 6, 1968 C. J. STEVENS ETAL 3,367,262

CALENDER ROLL-OUT MECHANISM

Filed Sept. 9, 1965 2 Sheets-Sheet 1

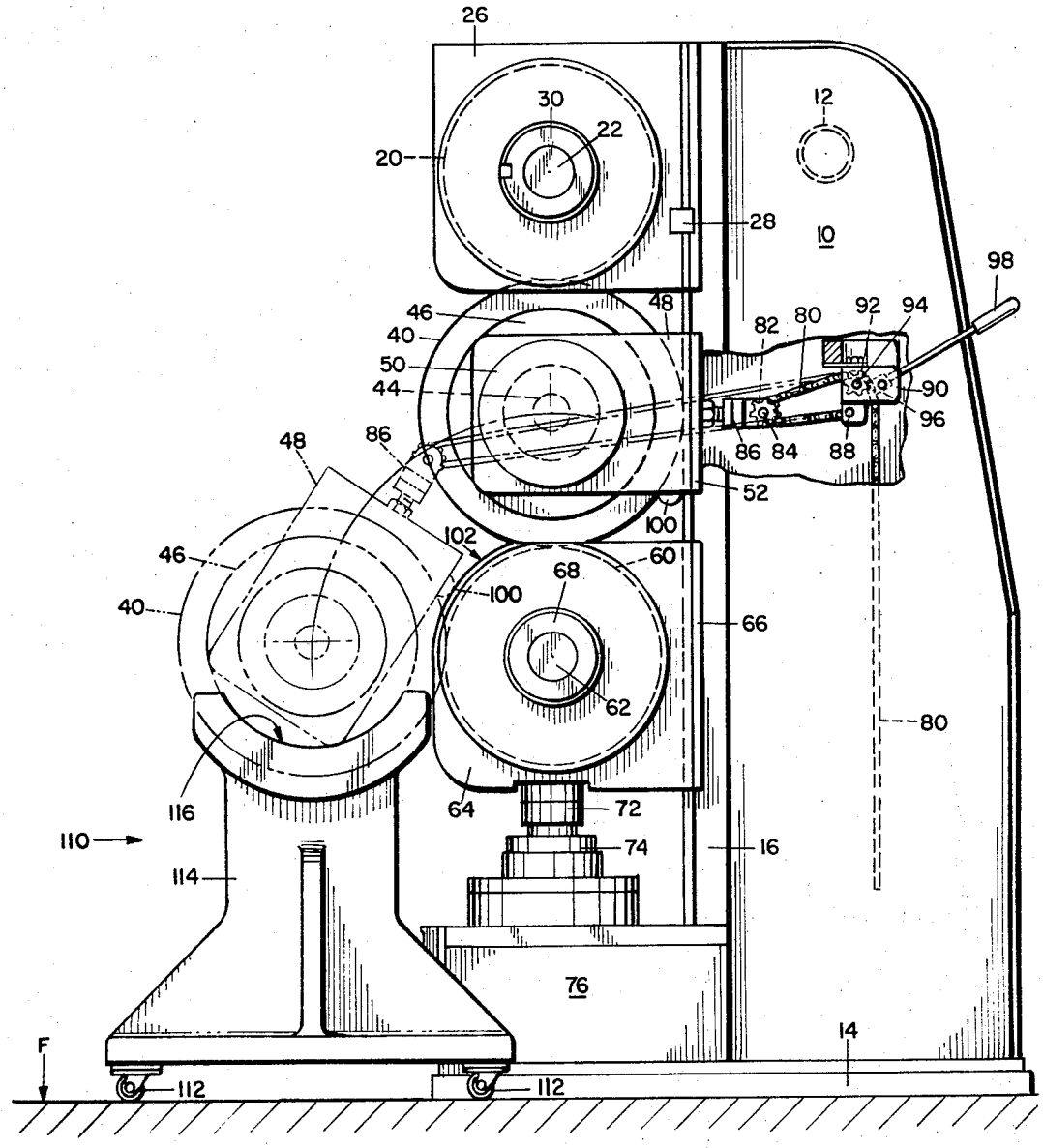


FIG. 1

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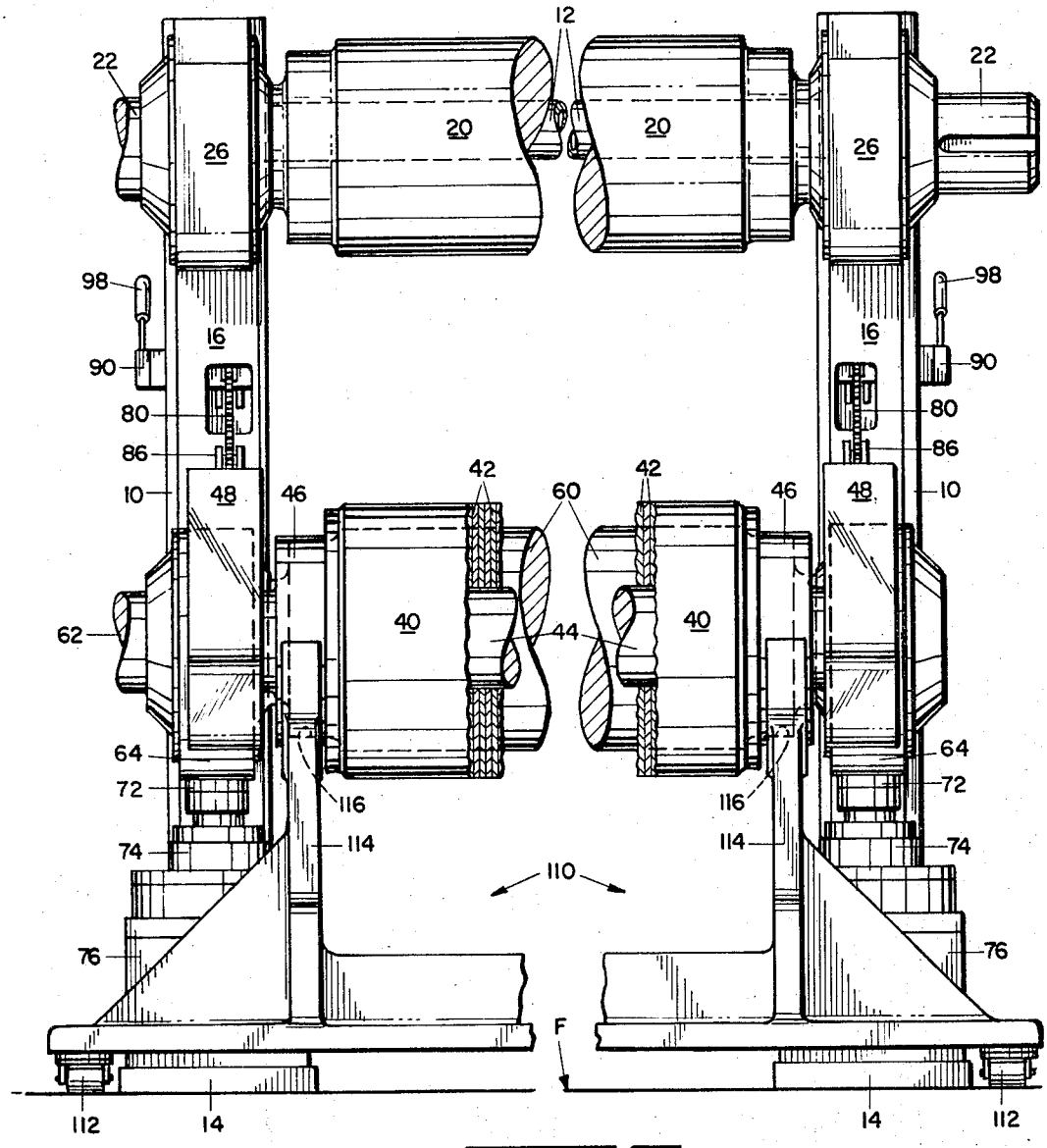


FIG. 2

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CALENDER ROLL-OUT MECHANISM

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ABSTRACT OF THE DISCLOSURE

A calender with means for moving one or more filled resilient rolls into and out of stacked relation to the plurality of stacked rolls of the calender.

Our invention relates to improvements in calenders or rolling mills or like apparatus having coacting rolls such as are used in the paper, textile and other industries for purposes of calendering, pressing, smoothing, ironing or otherwise conditioning webs or strips of flexible material and it is directed more particularly to a construction to facilitate the quick and ready removal of a roll from the apparatus frames or end stands and/or insertion of a roll thereinto.

It will be helpful to an understanding of our invention first to briefly consider some of the essential points and more important features and aspects thereof, so that same may be kept in mind during subsequent reading of the detailed description of the practical embodiment of our improvements and illustration thereof in the hereunto annexed drawings.

The invention is especially directed to means for easily and readily changing rolls so as to obviate the usual overhead hoists and slings and/or outside riggers normally requisite for such purposes.

In multi-roll calenders, for example, such as one mounting three rolls or more, the penultimate or second roll from the bottom as well as others in the stack, are usually filled rolls, they being filled with any of a number of different ingredients such as cotton, wool, corn husk, or other fibres, or combinations thereof. Quite frequently, same have to be removed for the refinishing of their surfaces, as same become marred or otherwise damaged as a result of slight mishaps and sometimes of mere use. When such occurs, the marking, unless removed, will alter an otherwise perfect finish on the web of material passed through the nip thereadjacent. Also quite frequently, the surface of such a filled roll will become burned and, unless the roll is removed and a portion of its surface removed, the surface finish imparted to the web of material will again be imperfect.

The weight of these rolls is significant, running for example from as much as 4000 pounds on a typical 50 inch machine to as much as or more than 13,000 pounds on an 118 inch machine. Thus, in a typical installation, roll removal and/or replacement may represent a quite overwhelming problem, involving many people, much heavy rigging equipment and considerable down time, not to mention extraordinary patience. By way of illustration, one particular mill is known to take four men from three to four hours each to remove such a roll and to replace it with an alternate one, and a second mill is known to take for its particular machine four men from seven to eight hours each for such work.

The result is that in the case of too many installations, poor quality fabrics or papers, as the case may be, are processed because of the lack of available time with which to change a roll when it so becomes defective therebecause.

Heretofore, these desirable and practical roll change procedures either have been avoided or have been agonizingly endured but only at the expense of considerable work effort and costly down time.

It is the chief object of this invention to eliminate the foregoing difficulties by providing simple and easily-operable mechanism enabling a single machine operator to make the necessary changes from one roll to another in a minimum of time and with a maximum of ease, all wherewith substantial increases in the work capacity of the machine are realized.

Other objects hereof are to minimize the skill and labor normally necessary incident to changing a roll, to eliminate the hitherto normal need for unusual strength or agility therefore, and generally to facilitate such changing and to reduce the time required to make same.

Still other objects are to provide for speeding up the roll changing operation and for making such operation more convenient for all concerned and to provide these results with a simplicity of apparatus and an ease of operation, and more, with an adaptability of the means to existing calenders or mills.

The roll-out device contemplated by the invention is intended to overcome all of the existing problems by permitting a relatively quick roll change, it being estimated that a facility using same could realize a roll change in anywhere from a one-half hour time minimum to a one and one half hour time maximum, with the variation being dependent on whether or not the alternate roll, replacing the just-removed roll, would already have its bearings mounted, it being conceivable that in some cases the bearings might have to be first removed from the defective roll for second placement on the alternate spare roll.

In the drawings, we have elected to illustrate one only of the numerous embodiments in which the invention may appear, selecting the exemplification from the standpoints of convenience in illustration, satisfactory operation, and clear demonstration of involved principles.

The stated objects and other incidental ends and advantages will in part be obvious and apparent and will in part be more fully pointed out in the progress of the disclosure below.

To the end of attaining these objects and others hereinafter reasonably appearing, it will be explained that the invention consists substantially in the combination, construction, configuration, location and function of parts, as herein detailed, although it will be apparent that the physical embodiment delineated, albeit the preferred exemplification, is only indicative of but one of the multiplicity of ways in, and purposes for, which the principles of the invention may be employed.

Same is submitted with a view to illustrating and explaining the precise nature of the principles of the invention and their embodiment for practical use, in order that others skilled in the art to which the invention pertains may be enabled to adapt and modify them in any of the numerous possible variations and modifications, as may be best adapted to the conditions of any particular use.

The characteristic features which we consider to be novel with our invention will be better understood from a consideration of the now proffered description when read in conjunction with the accompanying drawings in which:

FIG. 1 is a view in side elevation of a calender or mill and incorporating the roll-changing embodiment of the invention; and

FIG. 2 is a view in front elevation of the calender or mill shown in FIG. 1 with the changed-roll being shown in a rolled-out position.

With continued reference now to the drawings, which illustrate the said typical and preferred embodiment, we have shown that portion of a textile machine known as the calender or calender stack, although the instant invention may have utility in other fields of pressing, smooth-

ing, ironing or like treating of a strip or web of flexible material.

The operation of such a calender is well known and understood in the art, its purpose being to aid in compacting the textile material and to provide it with a desired quality of finish.

We show a three-roll-in-vertical-alignment calender, although it is to be appreciated that the calender may include any desired number of rolls, the height of the calender obviously varying according to the number of employed rolls.

Such calender broadly comprehends a pair of vertically-disposed upright main frames or standards or end stands **10** which are tranversely-spaced as to each other and are desirably interconnected as by one or more transversely-extending tie rods or I-beams **12** secured to each said frame for the well known purpose of lending rigidity and are preferentially additionally firmly secured to a fixed mounting such as a floor F or base plates **14** by conventional suitable means.

Frames **10**, **10** may be in the form of castings or of fabrications from welded-together steel components, as desired.

The exemplified frame construction is of the open-frame design, wherefor the rolls and journal means thereof can be presented to and retracted from the frame assembly at what, for the sake of orientation, will be identified as the front side of the machine, i.e. the left hand side as viewed in FIG. 1.

The frames may be provided with vertically-extending machined ways **16** along which the rolls, or certain of them, may slide relative thereto and to other rolls. The ways may be otherwise in the form of separate elongated guides secured to the front faces of the frames as by securing bolts or equivalent means releasably mounting the ways in engagement with the frames and in respective guiding positions.

Thereby, bearing housings, to be described, may be slidably adjusted relative to the respective of the supporting frames upon which they are mounted.

In conventional calender designs, the penultimate lowermost roll is sometimes identified as the queen roll resting upon a lowermost king roll, the king roll being provided with necks rotatably mounted in bearings, sometimes in stationary or fixed positions, in the lower portions of the frames or end stands, as distinguished from the bearings of other rolls thereabove which may be so mounted as to slide freely in vertical directions for adjustment purposes. The rolls are so mounted that the entire weight of each roll rests on the roll therebelow. The full weight of a plurality of heavy rollers is thus applied to the web passing through the bottom nip in the stack, the king roll being usually formed with a slight crown or enlarged cross-sectional area at its middle to compensate for downward deflection as brought about by the application of the weight of the rolls thereabove, all with the applied loading or pressure being exploited to obtain the desired finishing effect.

The fixed bearings of the king roll are such that when a substantial load is applied across the top area of the roll, there is a tendency for the middle portion of the roll to be deflected downwardly from the "normal" generally horizontal axis of the roll. The general practice of having a crown formed in the center of the roll compensates for this deflection. Actually, the crown may be formed so that the deflection of a given load is such as to create a substantially horizontal upper nip-defining surface for the roll, or the crown may be slightly greater so as to provide somewhat greater pressures at the central portion of the nip than at the edges thereof. In any event, a particular type of paper in the ordinary calender requires a specific amount of crown for a specific total loading at the nip.

In the illustrated embodiment, it is the topmost or uppermost roll **20** which is the stationary or fixed position roll. For purposes of the invention, it matters not which of the rolls of the stack is so fixed or stationary. Said roll **20** is preferentially formed of steel and is provided with a hardened and ground or highly polished mirror like finished roll face. Said topmost roll is a stationary or fixed roll adapted to cooperate with an adjustable and removable next lower filled roll, to be described, by the movement of the said next lower roll into and out of nipping confrontation with the said topmost roll, the said next lower roll, in turn, being adapted to cooperate with a bottom roll, also to be described.

Topmost roll **20** is mounted upon a top roll shaft **22** or opposite stub shafts journalled in the usual oppositely-disposed bearings (of spherical or tapered type) or equivalent anti-friction devices mounted in trunnions or bearing housings **26** each carried by a respective adjacent frame and secured thereto such as by suitable bolting or keying **28**.

Each bearing is held relative to its respective bearing housing **26** as by a suitable outer end plate **30** mounted on its bearing housing, thereby to hold the shaft or stub shafts against axial movement and to retain the usual bearing lubricant.

An intermediate resilient filled pressure roll **40**, filled with layers of a non-metallic material such as heat-resistant cotton **42**, is mounted upon such as a heavy forged steel shaft **44**, the filling being pressed thereon and held under endwise pressure as by end members **46** locked to the shaft, all in known manner.

Filled intermediate roll **40** is mounted upon bearings or equivalent journalling devices supported in trunnions or bearing housings **48** at each end of its shaft.

The bearings are held in their respective bearing housings as by outer end plates **50** each secured to the respective bearing housing as by suitable bolting thereby to hold the ends of the shaft against axial movement relative to its trunnions and to retain a lubricant therewithin.

Each bearing housing is slidably mounted upon a respective frame, by means of a tenon **52** which is slidable in a guideway or groove in the respective frame, the guideway or groove being defined by the respective way thereof.

A bottommost roll **60** is also preferably formed of steel with a hardened and ground or polished roll face. As with the topmost roll, it is mounted upon a roll shaft or stub shafts **62** journalled at opposite roll ends in the usual journalling devices, each being mounted in a bearing housing **64** carried by the respective adjacent frame and slidably mounted thereto as by means of a suitable tenon **66** so as to be slidable in the provided vertically-extending groove or slideway in the front face of the respective cooperating frame.

Each bearing is held in its respective bearing housing as by an outer end plate **68** secured to the bearing housing by any suitable means, thereby to hold its end of the shaft against axial movement relative to its bearing housing and to retain the bearing lubricant.

The bearing housings for the bottommost roll are motivated relative to the rolls thereabove by any suitable hydraulic or power actuated mechanisms or cylinder motors, each of which may include such as a hydraulic ram **72** arranged in the bore of a cylinder assembly **74** mounted in a foot or pedestal **76** of the respective frame. Said cylinder may be closed at its upper end by a removable closure or cap. Fluid under pressure is passed in known manner to and from the cylinder through a suitable conducting means (not shown) for urging its ram toward and away from the respective bearing housing.

When pressure is so applied, the rams may move upwardly, parallel to the frame ways, to exert a loading on the bottoms of the bearing housings for the well known function of closing the nips.

A screw jack, not shown, may be provided with each ram for fine nip closing adjustment and for permitting allowances for changes in the roll diameters.

When pressure is charged to cylinder **74** below ram **72**, the ram will be urged upwardly to provide upward pressure upon the respective bearing housing and hence the roll neck and when pressure is discharged from the cylinder, the ram will be urged downwardly to allow for a downward pressure upon the respective roll neck and hence the bearing housing. Pressure may be applied to the roll necks at both ends of the roll, either individually, so that a desired amount may be applied to one roll neck independently of that applied to the other, or in unison, so that equal amounts may be applied to each roll neck, all by means of the conventional valve pressure lines communicating with a suitable source of pressure.

One end of one of the roll shafts, normally that of the lowermost roll, may be extended as by a drive extension in manner to accept a drive from a main power supply (not shown) through any convenient means such as direct-connected, gear driven, roller chain driven, V-belt driven or the like. One roll being the normally mechanically-driven roll, same in turn contacts and drives the roll immediately thereadjacent and so on, which rolls so contact driven cooperatively act upon the web or strip as it passes through the calender nip or nips, as known.

By being locked in situ, the uppermost roll is precluded from backing off wherefor a uniform nip with the intermediate roll is ensured, and by being slidably adjustable, the lowermost main roll is permitted to be motivated toward, in press-applying direction, and away from, in pressure-relieved direction, the uppermost and intermediate roll.

Therewith, it is possible to adjust the pressures of the rolls and thereby to provide for even and uniform pressures therebetween.

By the adjusting feature, the lowermost bearing housings may be allowed to slide vertically downwardly so as to lower the lowermost roll accordingly, all so as to relieve the pressure thereof from the to-be-removed filled intermediate roll **40** and in turn to relieve the nipping relationship between rolls **40** and **20**.

Intermediate roll **40** and its bearing housings **48**, according to the invention, are removable as an assemblage from its situs between the spaced frames **10** and from between the uppermost and lowermost rolls **20** and **60**.

To remove removable intermediate center filled roll **40** from its position between the bottom steel roll **60** and the top steel roll **20**, the tenons **52** at the frames are removed as by removing their securing bolts so that the roll and the bearing housings of the assemblage are thus free to be withdrawn outwardly away from the frames.

By removal of the tenons, the frames, being open-faced, thus do not require openings through which the ends of the roll shaft and the bearing housings need be passed. Thereby, the novel features of the invention may be employed with presently existing calenders.

The means for engaging, supporting and manipulating the roll-bearing housings assemblage may comprise in the case of each bearing housing a chaining hoist of conventional ratchet and pawl lever type which will include a load chain **80** looped around a sprocket **82** mounted on a pin **84** transversely extending between and mounted in the bifurcated arms of a bracket **86** rigidly secured to the inboard end face of a respective bearing housing **48**. One free end of load chain **80** is fixed by a pin **88** to a chaining hoist housing **90**, and the opposite free end of the chain is passed between a ratchet wheel **92** coaxially mounted on a shaft **94** journalled within said housing, and a pawl **96** with said opposite free end of the chain being unattached and suspended below the chaining hoist housing.

The ratchet may be power driven or may be hand operated as by a conventional hand lever **98**, or the like.

Movement of the load chains from their upper locked positions to paying out positions are permitted by the hand levers so as to allow rolling out of the roll **40** with the roll periphery being in kissing relationship with and upon the roll periphery of the lowermost roll **60**, with

the load chains being of sufficient length to permit the roll to be lowered to the phantom line position shown in FIG. 1.

A caster guide **100** may be journalled in the lower planar surface of each bearing housing **48** so as to allow a rolling relationship between the adjacent bearing housings, as intermediate roll **40** is lowered or raised.

As best seen in FIG. 1, the forwardmost and uppermost end edge of lowermost bearing housings **64** are given a radius to provide arcuate slideways **102** upon which the caster guides may roll.

A cradle truck **110** is suitably positioned forwardly of bottommost roll **60** to receive the intermediate roll.

The cradle truck is preferably mounted upon rollers or casters **112** to facilitate its movement and includes a pair of spaced upright yoke-like end frames **114, 114**, each having an upwardly-facing arcuate and concave bedding surface **116** adapted to nestably support thereon end members **46** of intermediate roll **40**.

By the herein taught system, tenons **52** on intermediate bearing housings **48** may be disconnected whereupon the load chains secured to the bearing housings may be called into play by way of the cooperant hoist ratchets so as to allow the lowering of intermediate roll **40** by sliding movement relative to the lower roll to the point where it is lowered onto the cradle truck.

Preferably, the cradle truck will be of such height that it will receive the intermediate roll before the latter has passed below the center line of bottommost roll **60**, thereby reducing the load on chain **80**, permitting the use of a lighter chain.

In the sequence of operations, the cradle truck is first moved up to the calender. The removable filled intermediate roll is then released so as to be allowed to move from its up position, rolling in an arc over the periphery of the lower steel roll, with caster guides **100** on intermediate bearing housings **48** rolling along slideways **102** on lower bearing housings **64**, until the end members **46** of the filled intermediate roll are resting on bedding surfaces **116** of the cradle truck, at which time brackets **86** may be removed from the intermediate bearing housings to permit the roll and cradle truck to be removed to another situs for repair or replacement purposes, as necessary.

To reload, the sequence is reversed.

A new or repaired filled roll is mounted in the bearing housings and the assemblage is placed on the cradle truck and moved to a point of adjacency to the lower steel roll.

The brackets **86** are now attached to bearing housings **50**, whereupon intermediate roll **40** may be moved upwardly by manipulation of lever **98**, with caster guides **100** riding along slideway **102** on lower bearing housings **64**, and roll **40** rolling along the periphery of lower roll **60** until intermediate bearing housings **50** are in contact with main frames **10** whereupon tenons **52** are affixed to secure the bearing housings relative to the main frames.

From the foregoing, it will be obvious that we have provided simple and efficient means for easily and readily changing rolls so as to obviate the usual overhead hoists and slings and/or outside riggers normally requisite for such purposes.

We claim:

1. The combination in a calender of:

(a) a pair of end frames;

(b) bearing housings releasably mounted on said end frames;

(c) a plurality of stacked rolls journalled at their ends in said bearing housings;

(d) at least one of said plurality of stacked rolls being a filled resilient roll;

(e) a caster guide journalled in each bearing housing of said filled resilient roll;

(f) means for moving said filled resilient roll into and out of stacked relation to said plurality of stacked rolls;

(g) each said caster guide being rideable along the respective adjacent bearing housing disposed therebelow.

2. The calender as set forth in claim 1 with the respective adjacent bearing housings being provided with arcuate slideways for the rolling of said caster guides.

3. The combination in a calender of:

(a) a frame having spaced vertical guides;

(b) pairs of bearing blocks releasably mounted on the guides of the frame;

(c) a plurality of rolls;

(d) each roll being supported by one of the pairs of bearing blocks;

(e) at least one of the rolls being a filled resilient roll;

(f) a caster guide journalled in each bearing block of the filled resilient roll;

(g) each said caster guide being rideable along the respective adjacent bearing housing disposed therebelow;

(h) roll-changing payout means for allowing movement of the filled resilient roll into and out of

stacked relation to the plurality of rolls by the rolling of the filled resilient roll upon the next adjacent roll.

4. In the calender combination of claim 3 including a self-contained roll stand movable into and out of roll receiving position for receiving the filled resilient roll as it is disengaged from and moved out of stacked relation and cradling the same as the roll stand is moved to another location.

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