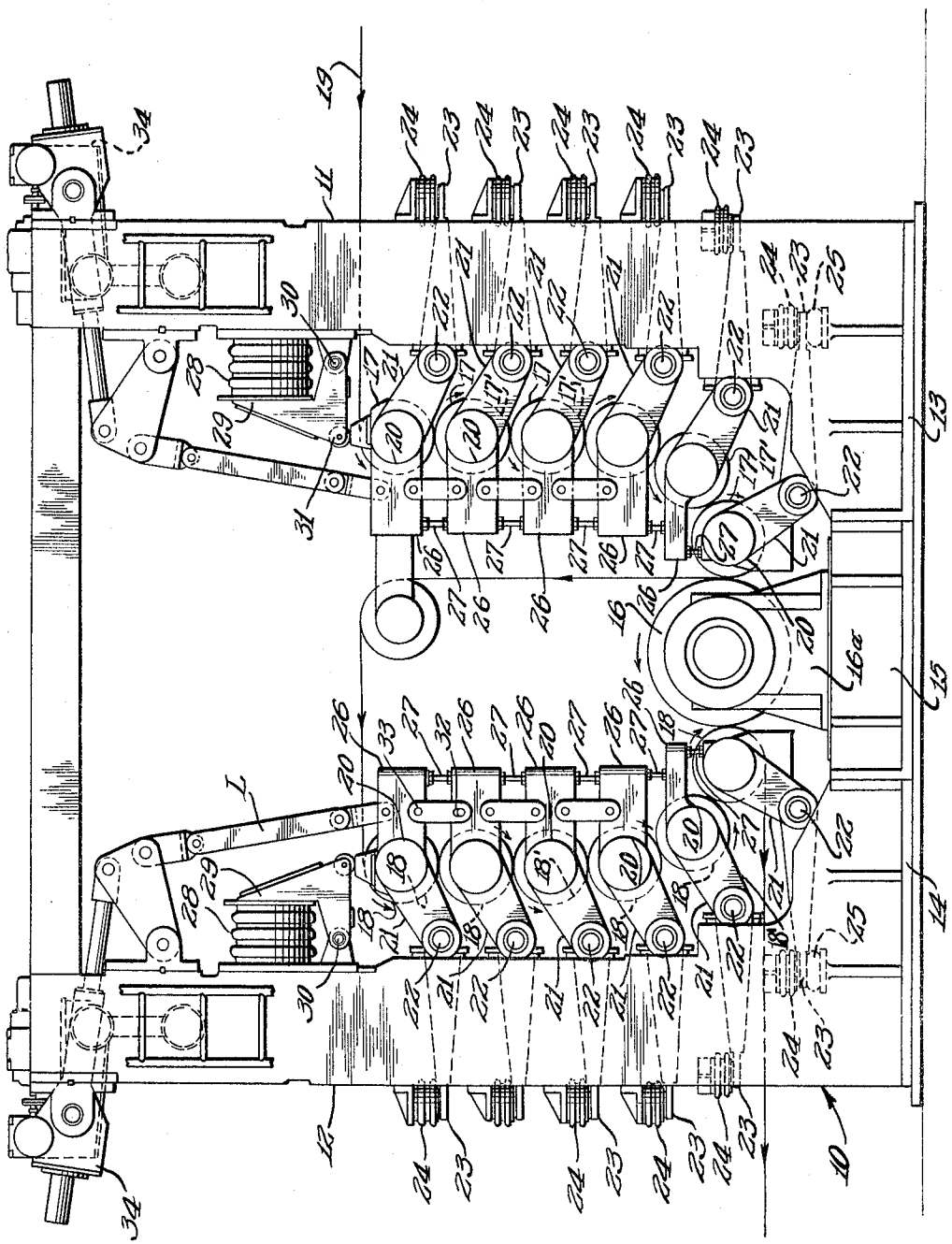
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CALENDER STACK

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CALENDER STACK

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This invention relates to improvements in papermaking machines and more particularly to an improved form of calender stack for use in such machines.

Although the instant invention may have utility in other fields involving the pressing, smoothing, ironing, or the like treatment of a strip of flexible material, a particularly preferred use is in the paper machine calender. The operation of the calender in paper machines is well known and understood in the art. The purpose of the calender is to compact the paper web to some extent and to give it a fine, smooth finish. This effect is obtained on both sides of the paper by the use of friction and pressure.

A conventional calender stack comprises a plurality of upright or vertically aligned calender rolls. The lowest or bottom roll of the stack is driven mechanically and it, in turn, may drive the roll immediately there above, and so on, by friction throughout the stack. On the other hand, calender stacks are also provided wherein there are separate drives for one or more of the other rolls above the bottom roll, either for the purpose of obtaining superior drive correlation, or for the purpose of deliberately effecting speed differentials at the nips in the calender.

In many instances, efficient calendering of paper requires a relatively large number of nip treatments. In general, the rolls are so mounted in the ordinary calender that the entire weight of each roll rests on the roll below. This is accomplished by mounting each roll so as to permit limited vertical movement thereof. The full weight of a plurality of heavy rollers is thus applied to the paper web passing through the bottom nip in the stack; and the bottom or king roll is usually formed with a slight "crown" or enlarged cross sectional area in the middle thereof in order to compensate for the deflection of the king roll downwardly which is brought about by the application of the rather substantial weight of the rolls above the king roll.

Crowning of rolls is achieved by means of intricate roll grinding equipment and the crown of the king roll must be changed whenever the number of web treating rolls in the calender stack is varied so as to accommodate various grades of paper to be processed. As will be appreciated crowning is a time consuming and expensive operation.

Other means for reducing or minimizing the effects of roll deflection have been devised such as the application of counteracting bending moments to the bottom roll journals but although such means have been found to greatly improve calender operation they are nevertheless expensive and require special operator skill.

In the production of newsprint paper and medium weight papers it is often necessary to use two calender stacks since the number of nips required for the treatment of the paper web is too large to be accommodated in one single stack. Load and stress considerations often lead to the necessity of dividing one large stack into two separate stacks and machine room height is often an important consideration with respect to the height of a calender stack.

The present invention successfully eliminates several of the above mentioned limitations in conventional calender stacks by means of a novel arrangement of the web treating rolls.

The present invention comprehends the incorporation of two calender stacks in a U-shaped framework utilizing a single bottom roll or king roll for the two stacks, and the web treating rolls are so arranged and supported by the bottom roll that the total weights of each of the stacks act in opposition on the bottom roll thereby eliminating deflection of the bottom roll. Generally speaking the invention comprises a king roll, a first plurality of rolls positioned on one side of said king roll to exert a first deflection force on said king roll, a second plurality of rolls on the other side of king roll to exert a second deflection force on the said king roll, said rolls positioned to form a series of consecutive web treating nips, said first and second rolls defining with said king roll a U-shaped assembly so that the components of said first and second deflection forces of respectively said first rolls and said second rolls act in opposition against each other on said king roll. More specifically the invention consists of a roll assembly in which a stack of rolls is arranged generally vertically defining a series of web treating nips in which each successive nip is spaced further outwardly and below the preceding nip.

An important object of the present invention, therefore, is to provide an improved form of calender stack arrangement and method of calendering.

A further object of the invention is to eliminate the necessity of crowning the king roll regardless of the number of web treating rolls used.

Another object of the invention is to provide an improved form of calender stack in which a single king roll is used to accommodate two distinct stacks of web treating rolls.

Still another object of the invention is to provide an improved form of calender stack comprising a king roll, first and second pluralities of web treating rolls positioned on each side of said king roll to form a series of web treating nips and forming with said king roll a U-shaped assembly so that the deflection forces of said first and second plurality of rolls act in opposition against said king roll thereby eliminating any deflection in the plane defined by the nip lines and a line drawn through the longitudinal axis of the web treating rolls.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawing which is a view in side elevation of a calender stack constructed in accordance with the principles of the present invention.

In the embodiment of the invention illustrated in the drawing we have shown a calender stack **10** comprising a first pair of spaced upright posts **11**, **11** and a second pair of spaced upright posts **12**, **12**. The posts in each of the pairs **11** and **12** are suitably connected in parallel spaced relation with respect to each other.

Posts **11** and **12** each have a base **13** and **14** extending horizontally therefrom and terminating in bearing supports **15**, **15**. The bearing supports **15** are adapted to receive the bearings housings **16***a*, **16***a* of a king roll **16**. The king roll **16** is located centrally between the posts **11** and **12**.

Extending from each side of the king roll **16** and supported on said roll is a series of web treating rolls **17**, **17** and **18**, **18** providing a series of web treating nips between said rolls with ecah of the rolls **17** and **18** defining a web treating nip with the roll immediately below it. The roll series **17**, **17** and **18**, **18** are so arranged that the total weight of each series acts in exactly the opposite direction on the king roll **16**. The king roll therefore is free of any deflection in a plane drawn through the nips.

The king roll **16** is the driven roll of the calender stack and may be driven from a suitable source of power in a conventional manner (not shown). The rolls **16**, **17** and **18** may have a chilled and hardened surface ground to a

precise finish or the rolls 17 and 18 may alternately be paper filled rolls as indicated by the numerals 17^1 and 18^1. The superposed rolls 17 and 18 are driven by contact with a web 19 trained through the nips thereof and the nips between the king roll 16 and the immediately adjacent rolls 17 and 18.

The roll 18 immediately adjacent the king roll 16 may be driven by means of a helper drive for the purpose of increasing the peripheral speed of the rolls superposed on this roll 18 so as to take up any increase in web length which might occur during treatment in the previous nips.

Each of the rolls 17 and 18 is journaled at its opposite ends in antifriction bearings (not shown) mounted in bearing housings 20, 20 on the outer ends of the lift arms 21, 21 in a conventional manner. The lift arms 21 extend rearwardly of the bearing housings 20 along the inner sides of the upright posts 11 and 12 and are transversely pivoted thereto on bearing supports 22, 22 in a conventional manner. The arms 21 extend further rearwardly from the bearing housings 22 and are provided with pressure pads 23 at the extreme ends thereof. The pressure pads 23 are engaged by air bellows 24 which provide an upward force to the bearing housings 20 so as to relieve the overhang weight of these bearing housings substantially as described in Lloyd Hornbostel U.S. Patent No. 2,850,952.

The pressure pads of the arms 21 extending from the rolls 17 and 18 immediately adjacent the king roll 16 are equipped with an additional set of air bellows or other suitable loading means 25, 25 enabling the rolls 17 and 18 to be urged towards the king roll 16. At times it may be necessary to remove a number of rolls from either one of the roll series 17 or 18. This will create an in-balance in forces applied to the king roll 16 and additional force may be applied to the king roll 16 by means of the air bellows 25 via the roll 17 or 18 immediately adjacent the king roll 16.

The bearing housing 20 of the web treating rolls 17 and 18 are provided with arms 26, 26 extending forwardly from said bearing housings. The arms 26 are provided with adjustable stops 27 by means of which the arms 26 may be spaced apart sufficiently to provide for a gap between their respective web treating rolls. The adjustable stops provide for a convenient means for decreasing the number of web treating nips in each of the stacks.

Mounted a short distance above each of the roll stacks are loading means 28, 28 which may be in the form of air bellows or other suitable means. One end of the loading means 28 is mounted to the upright posts 11 and 12 and the other end is connected to a pivotally mounted pressure arm 29. The arms 29 are pivotally mounted to the upright posts 11 and 12 by means of pivots 30, 30. Each of the arms 29 is equipped with pressure rollers 31, 31 which engage the bearing housings 20 of the upper rolls of each of the stacks. It will thus be seen that this loading mechanism provides for a convenient means for increasing the nip pressures in the respective web treating nips and also affords load compensation for the king roll 16 in the event that one or more of the web treating nips are eliminated in either one of the roll stacks by means of the adjustable stops 27. This load compensation is thus achieved by loading the remaining web treating nips with the loading means 28 via the adjustable stops 27.

Overhead lifting links L, L are provided in a conventional manner to permit limited vertical lifting movement of each of the bearings 20. The oversize connections such as at 32 in the lifting link 33 permit limited vertical movement of the bearing 20 when the web treating rolls are spaced apart by means of the adjustable stops 27. When it is desired to lift all of the bearings for shutdown and repair, the linking arms L are raised upwardly by means of the lifting jacks 34, 34.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages

which are obvious and which are inherent to the apparatus.

In the claims as well as in the description, parts are at times identified by specific means for clairity and convenience, but such nomenclature is to be understood as having the broadest meaning consistent with the context and with the concept of our invention as distinguished from the pertinent prior art. The specific apparatus shown and described is therefore not to be considered as limiting the scope of the invention, intended limitations being specifically set forth in the claims.

We claim as our invention:

1. A calender roll assembly comprising in combination:
a king roll,
a first set of calender rolls on one side of said king roll,
a second set of calendar rolls on the opposite side of said king roll,
said first and second sets of calender rolls including a pair of horizontally opposed calender rolls engaging said king roll in diametrically opposed relation with respect to each other,
a next adjacent pair of calender rolls spaced outwardly of and above said horizontally opposed calender rolls and having calendering nips therewith,
a vertical stack of calender rolls supported on said next adjacent calender rolls,
bearing support means mounting said first and second sets of calender rolls for movement toward and from each other,
and pressure applying means for each set of calender rolls applying pressure to the uppermost of said calender rolls of each set of calender rolls for forcing said horizontally opposed calender rolls toward said king roll to direct diametrically opposed deflection forces thereon.

2. The structure of claim 1,
wherein adjustable spacers are provided between said bearing support means for said first and second sets of calender rolls for regulating the pressure nips between said calender rolls, and
wherein lifting means independent of the spacers are connected with said bearing support means for lifting said vertical stacks of calender rolls with respect to said next adjacent pair of calender rolls.

3. In a calender stack,
a king roll,
a pair of horizontally opposed adjacent calender rolls having pressure nip engagement with said king roll,
a next adjacent pair of calender rolls spaced outwardly of and above said pair of horizontally opposed adjacent calender rolls and having a pressure nip therewith, and
a pair of vertical stacks of calender rolls spaced outwardly of and above the next adjacent pair of rolls and having pressure nip engagement therewith,
said calender rolls, other than the king roll being mounted on swing arms which are pivoted below and outwardly of the respective calender roll.

4. The structure of claim 3,
wherein pressure means are provided for pressurizing the uppermost of said calender rolls and maintaining a predetermined pressure nip between said calender rolls and said king roll.

5. The structure of claim 4,
wherein the swing arms extend inwardly of the calender rolls, and
wherein adjustable stop means are provided between the inwardly extending portions of said swing arms to enable adjustment of the calender nip between said calender rolls.

6. The structure of claim 5,
wherein linkage means connect the inwardly extending portions of said swing arms of said vertical stacks of calender rolls together, and

wherein lifting means are provided to lift said vertical stacks of calender rolls above said next adjacent calender rolls.

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