

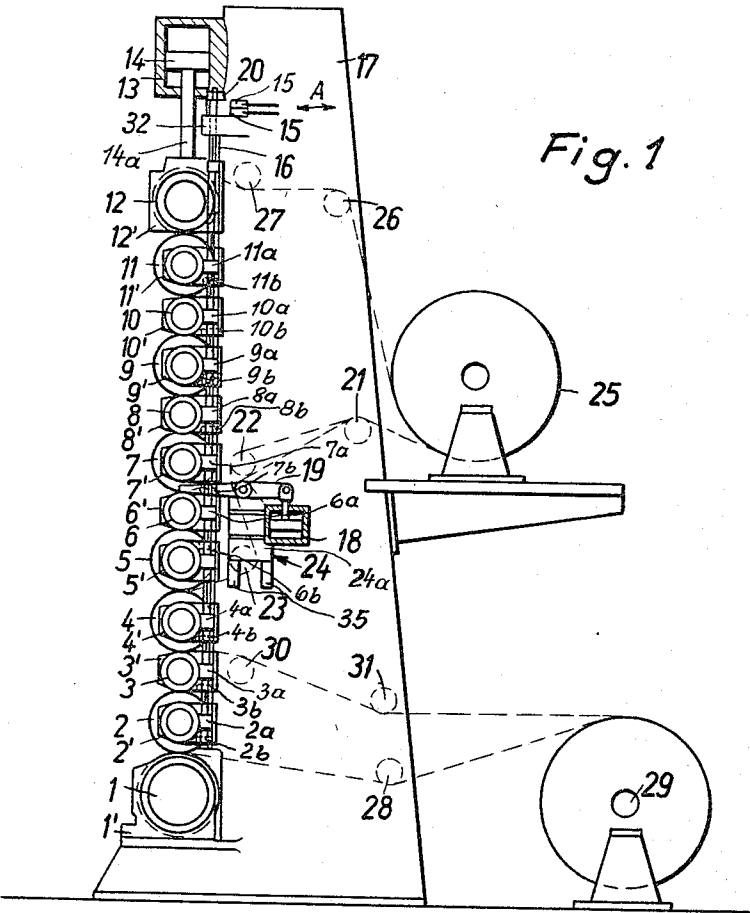
March 19, 1968

H. JAEGER
CALENDER

3,373,681

Filed Oct. 18, 1965

4 Sheets-Sheet 1



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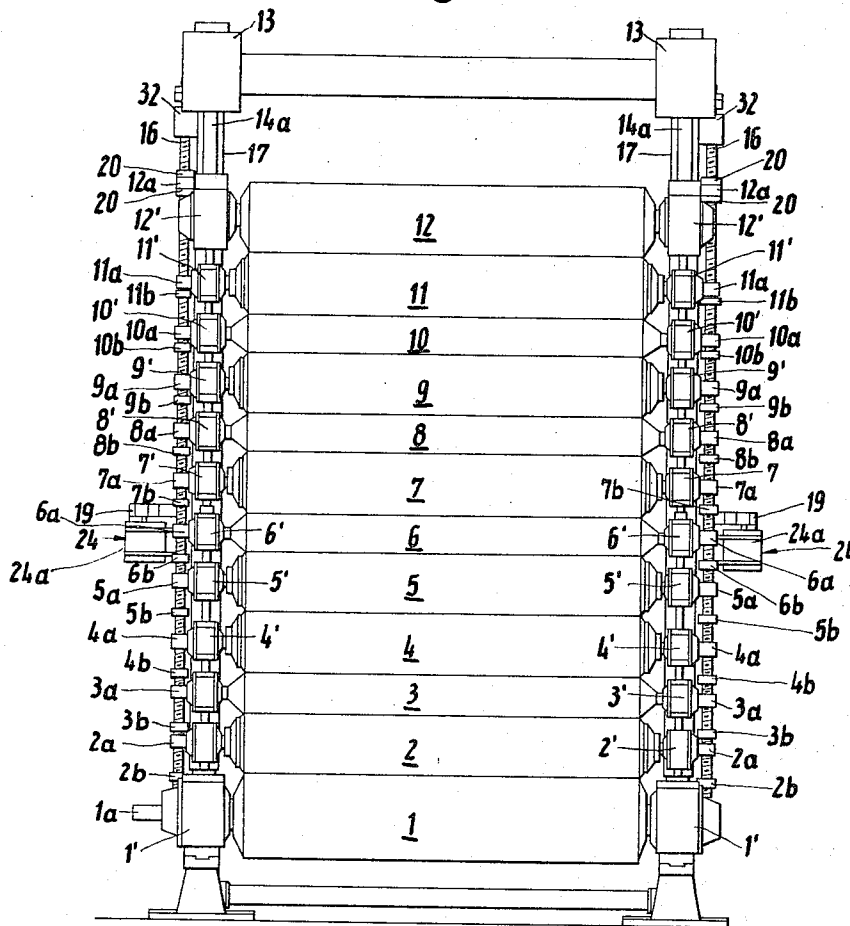
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Fig. 2



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12/1/67

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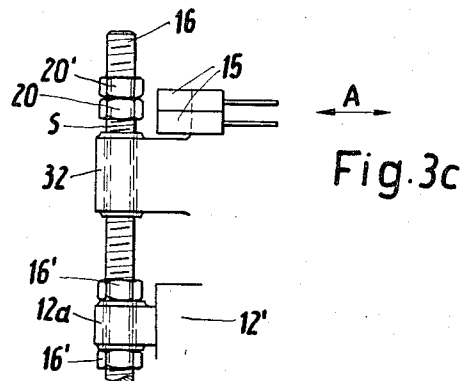
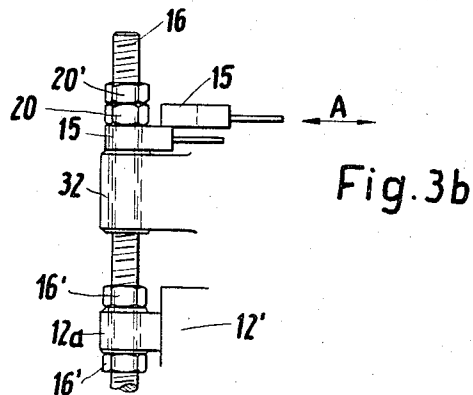
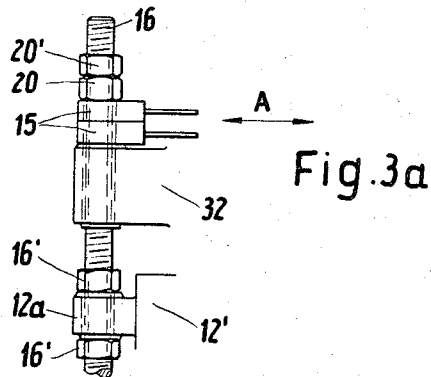
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CALENDER

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4 Sheets-Sheet 3



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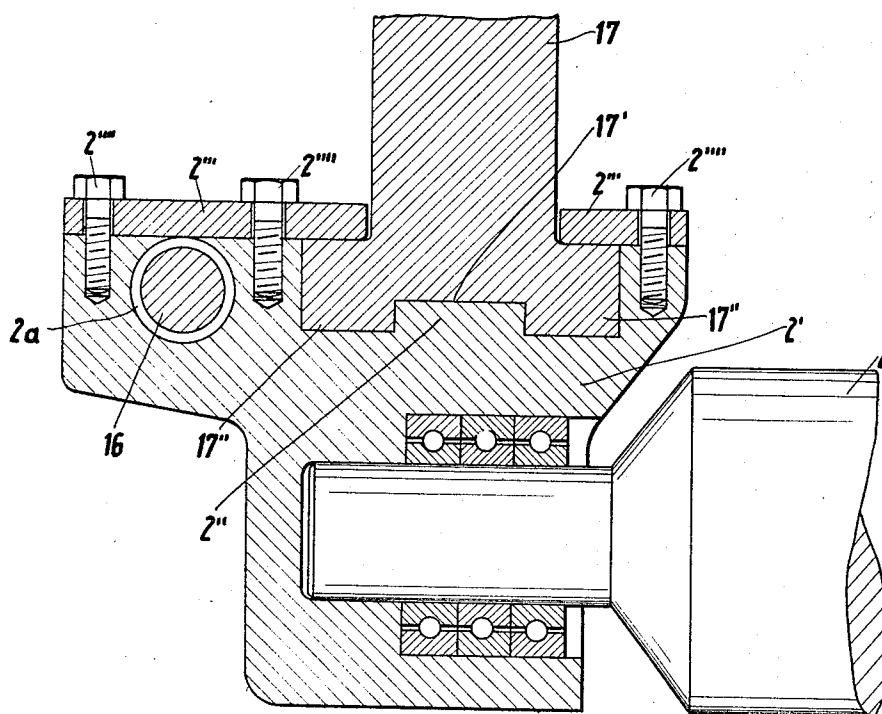
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4 Sheets-Sheet 4

Fig. 4



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3,373,681
CALENDER

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E 27,965

9 Claims. (Cl. 100—163)

ABSTRACT OF THE DISCLOSURE

A calender having a plurality of calender rolls mounted on support means in a row adjacent each other and preferably one above each other with the axes of the rolls extending substantially parallel to each other and in such a manner that pressure applied to the uppermost roll of the row will be transmitted to the rolls beneath the uppermost roll, and in which the calender is provided with lifting means permitting to lift the rolls, starting with the uppermost roll, successively from each other.

Such calenders are especially used for finishing the surfaces of an elongated web of paper, whereby the web of paper wound about peripheral surface portions of adjacent rolls is taken along by surface friction during rotation of the rolls so that the web of paper as it passes through the gap of adjacent rolls while the same are pressed toward each other is provided with smooth and glossy surfaces. Sometimes, it is however desired to obtain by this finishing operation only a smooth but not a glossy paper. Up to now it was common practice to use for finishing a paper web with smooth but not glossy surfaces a calender having for instance four rolls, whereas for finishing paper with smooth and glossy surfaces, calenders having a much greater number of rolls than four have been used. Therefore, two different calenders, that is one calender with a small number of cooperating rolls and another calender with a very great number of cooperating rolls have been necessary to finish paper with either smooth or with smooth and glossy surfaces.

It is an object of the present invention to provide a calender which is suitable for selectively producing therewith paper having smooth but not glossy surfaces and paper having smooth and glossy surfaces.

It is an additional object of the present invention to provide for a calender of the aforementioned kind which can easily be adjusted for the production of paper having smooth and glossy surfaces as well for the production of paper having smooth but not glossy surfaces.

It is a further object of the present invention to provide for a calender of the aforementioned kind which is composed of relatively few and simple parts so that the calender may be constructed at very reasonable cost and will stand up perfectly under extended use.

With these objects in view, the calender of the present invention mainly comprises support means, a plurality of rolls mounted on the support means in a row adjacent each other with the axes of the rolls extending substantially parallel to each other and in which the rolls, except one roll at one end of the row of rolls, are mounted on the support means movably substantially normal to the axis thereof toward and away from each other. The calender of the present invention further comprises first pressure applying means cooperating with the roll at the other end of the row of rolls for pressing the roll at the other end toward the roll at the one end of the row of rolls so that the pressure will be transmitted to the other rolls of the row and for moving at least the roll at the other end of the row of rolls away from the remaining group of rolls, additional pressure applying means for pressing

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the rolls of the remaining group of rolls which is spaced farthest from the roll at said one end of the row of rolls toward the latter so as to press the rolls of the remaining group of rolls toward each other, and means for feeding an elongated web about the periphery of the rolls which are pressed against each other.

The rolls are preferably mounted on the support means one above the other and movable in substantially vertical direction and the first pressure applying means is in this case operatively connected to the uppermost of the row of rolls, whereas the lowermost of the row of rolls is mounted on the support means only turnably about its axis but not movable in direction normal to the axis.

Preferably each of the rolls is mounted in bearing means turnable about its axis and the bearing means of all rolls except that of the lowermost of the rolls are mounted on the support means movable toward and away from the bearing means of the lowermost of the rolls. The bearing means, except that of the lowermost roll, are connected to each other preferably in such a manner so as to lift the bearing means of the roll adjacent to the uppermost roll, after the bearing means of the latter has been lifted to a predetermined extent, and to successively lift the bearing means of the following rolls, starting with the second bearing means from the top, one after the other during increasing lifting of the bearing means of the uppermost roll so that by sufficiently lifting the uppermost of the rolls a selected number of rolls beneath the uppermost roll will be successively lifted out of engagement with each other.

The additional pressure applying means is preferably mounted on the support means movable to and to be held in a plurality of vertically adjusted positions so as to be adapted to apply pressure against the uppermost of the group of rolls which have not been lifted in vertical direction to press the peripheral surfaces of this remaining group of rolls toward each other. In this way it is possible to press the peripheral surfaces of a selected number of rolls against each other and to thereby use a selected number of rolls for finishing the surfaces of paper with a selected greater or lesser gloss or with no gloss at all.

The calender according to the present invention may also include means for connecting the first pressure applying means to the additional pressure applying means.

The arrangement may also include means for holding the lifted rolls in the lifted position thereof.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a schematic side view of the calender of the present invention;

FIG. 2 is a view showing the same calender in a front view;

FIGS. 3a-3c show a detail of the calender in an enlarged side view in three different positions;

FIG. 4 is a schematic horizontal section of a bearing means of the calender rolls movable arranged in vertical direction in the frame portions of the calender.

Referring now to the drawing, it will be seen that the calender of the present invention comprises two substantially upright support means 17 arranged in spaced relationship parallel to each other and forming part of the calender frame in which the calender rolls on both ends thereof are supported by suitable bearing means secured to the support means 17.

In the support means 17 of the calender frame a plurality of rolls, for instance 12 as shown in the drawing are

arranged one above the other with the axes of the rolls extending parallel to each other. The rolls 3, 6, 8 and 10 are preferably cast iron rolls, whereas the other rolls, that is the rolls 1, 2, 4, 5, 7, 9, 11 and 12 have elastic peripheral surfaces, for instance each of these rolls may be provided with an outer sleeve formed from elastically compressible material, for instance rubber. Only one of these rolls, preferably the lowermost roll 1 is driven by a motor (not shown) the rotating shaft of which is coupled in a suitable manner with the outer end of the shaft 1a (FIG. 2) of the roll which extends through the adjacent bearing and projects over the outer side of this bearing, whereas the other rolls are rotated about their axes by engagement with the web running through the gaps between the rolls.

To achieve this each of the rolls is turnably mounted at opposite ends thereof in bearing means respectively designated as 1', 2', 3' and so on. The bearing means 1' of the lowermost driven roll 1 of the row of rolls are fixed in any convenient manner on the wall-like or beam-like supporting means 17, whereas the other bearing means 2'-12' are mounted on the upright support means 17 movable in vertical direction toward and away from the lowermost bearing means 1'. As shown in FIG. 4 in connection with the bearing means 2' of the roll 2, each of the bearing means 2'-12' may be provided at the rear end thereof with a projection 2'' engaging in a corresponding groove 17' in the upright support means 17, and furthermore with brackets or the like 2''' which are secured at the bearing means by screw bolts 2'''' and which are engaging over flanges 17'' of the support means 17. By this arrangement the bearings 2'-12' carrying the rolls 2-12 are releasably secured and at the same time slidably supported on the support means 17 for vertical movements.

The calender comprises further first pressure applying means cooperating with the two bearing means 12' of the uppermost roll 12 for moving the latter toward the lowermost roll 1 and for pressing thereby the peripheral surfaces of the rolls beneath the roll 12 toward each other or for lifting the bearing means 12' in upward direction. This first pressure applying means include two cylinders 13 mounted each on one of the both supporting means 17 in the region of the upper end thereof, a piston 14 in each of these cylinders 13 slidably guided in the cylinder and connected by means of the piston rod 14a to the upper bearing means 12' respectively to move the latter during feeding of pressure fluid into the cylinders 13 to one or the other side of the pistons 14 in one or the other direction. Pressure fluid, for instance oil, is fed to one side of the pistons 14 and discharged from the other side thereof and vice versa in a known manner and the means for supplying pressure fluid to the cylinders 13 consisting principally in a power driven pump, which is connected to the cylinders 13 by feed and discharge conduits, and valve elements for directing pressure fluid to the one chamber of the cylinders 13 while discharging the other chamber of the cylinders and vice versa are, therefore, not shown.

Preferably, connecting means are provided which connect the bearings means of the rolls, with the exception of that of the lowermost roll, with each other in such a manner so as to lift the bearing means of the roll adjacent to the uppermost roll after the bearing means of the latter have been lifted to a predetermined extent and to successively lift the bearing means of the following rolls one after the other during increasing lifting of the bearing means of the uppermost roll 12.

These connecting means may include two elongated rods, preferably threaded rods 16 one on each end of the rolls mounted adjacent the bearing means slidable in vertical direction and the rods are fixedly connected to the bearings 12' of the uppermost roll 12 for movement with the bearing means 12' in vertical direction which, as mentioned above, may be effected by means of the cylinders 13. To connect the rods 16 to the bearing means 12' the latter are provided with projections or bushes 12a through which the elongated rods 16 extends. The

rods and the bushes are fixedly coupled by means of clamping nuts 16' arranged on the rods 16 (FIG. 3). As will be seen best in FIG. 2 and 4 the connecting means include further a plurality of projections or bushes 11a, 10a, 9a and so on respectively mounted on the bearing means 11', 10', 9' and so on through which the elongated rods 16 extend and a plurality of collars or stop nuts 11b, 10b, 9b and so on arranged on the rods 16 and respectively downwardly spaced from the corresponding projections 11a, 10a, 9a and so on. The spacing between the bottom face of the respective projections or bushes from the top face of the collar or nut adjacent thereto increases slightly from the projection 11a and the collar or stop nut 11b and adjacent thereto to the projection 2a and the stop nut 2b adjacent thereto so that during lifting of the bearing means 12' and the rods 16 fixed thereto by means of the cylinders 13, the bearing means 11' will be lifted after the bearing means 12' has been moved upwardly to a predetermined extent, for instance 0.12 inch, and the following bearing means 10', 9' and so on will be lifted one after the other during increasing upward movement of the uppermost bearing means 12', for instance after further movements of 0.12 inch respectively. Therefore, only one or a group of rolls, beginning from the uppermost roll 12, may be lifted by the cylinders 13 depending upon the extent of the displacements of the pistons 14 in the cylinders 13.

The projections or bushes respectively fixed to the bearing means and the collars or nuts respectively cooperating with the projections or bushes form therefore a plurality of pairs of cooperating engaging means forming part of the connecting means connecting the bearing means of the rolls with the exception of the lowermost roll with each other so as to lift the bearing means of the roll adjacent to the uppermost roll after the bearing means of the latter has been lifted a predetermined extent and to successively lift the bearing means of the following rolls stepwise one after the other during increased lifting of the bearing means of the uppermost roll.

The arrangement includes also means for holding the rolls lifted away from the remaining group of the unlifted rolls and the holding means may include abutment members, for instance nuts 20 and 20' screwed onto the upper end portions of the threaded rods 16 and two projections 32 one on each support means 17 beneath the nuts 20 and having a top face facing the bottom face of the nuts 20, so that when all rolls are in unlifted position, the distances between the nuts 20 and the projections or bushes 32 is very small (FIG. 3c). Two pairs of spacer members 15 are movable between the bottom face of the nuts 20 and the top face of the projections 32 in the direction of arrow A after the rods 16 has been lifted during lifting of the bearing means 12' through a given distance so that a predetermined number of rolls beneath the roll 12 are lifted. The height of the spacer members 15 is chosen in such a manner or the nut 20 adjusted along the length of the rod 16 in such a manner that after such movement the bottom face of the nuts 20 will be spaced from the top face of the projections 32 such a distance that one spacer member of each pair of the spacer members 15 will snugly fit between the bottom face of the nut 20 and the top face of the projection 32 to thus hold the rods 16 in the lifted position and thereby a selected number of rolls, for instance the rolls 7-12 also in lifted position spaced from each other and from the rolls beneath the roll 7 (FIG. 3b). Increasing now the lifting movement of the rolls the distance between nuts 20 and projections 32 reaches an extent great enough to move each pair of the spacer members 15 in working position, as shown in FIG. 3a. In this position all rolls with exception of the roll 1 are lifted.

The calender of the present invention includes also additional pressure applying means 24 for applying pressure to the bearing means of the uppermost roller of the group of rollers which have not been lifted away from

each other. The two additional pressure applying means 24 are mounted on the support means 17 movably in vertical direction and so that it may be fixedly held in a selected position adjacent to any of the bearing means 11'-2'. The means for moving the additional pressure applying means 24 in vertical direction consist in vertical slots 35 in the side walls of the supporting means 17, in which horizontal projections of the pressure applying means engage in such a manner that the projections slide in the slots, if the pressure applying means are moved in vertical direction. Clamping means for instance clamping nuts (not shown) are provided to clamp the pressure applying means in any desired position. The length of the slots may have such an extent, that the pressure applying means may be moved from a position adjacent the roll 2 to a position adjacent the roll 11. In many cases short lengths of the slots are sufficient to move the pressure applying means from a position near roll 5 to a position near roll 7 (FIG. 1). Other means for moving the additional pressure applying means 24 in vertical direction and to hold the same in any selected position may be used, for instance the additional pressure applying means 24 may include mounting means 24a slidably mounted on a side face of the support means 17 and a threaded vertical spindle turnably mounted on the support means 17 may operatively engage the mounting means of the additional pressure applying means 24 for moving the latter in vertical direction during turning of the spindle in one or the other direction about its axis. The additional pressure applying means 24 includes two cylinders 18 each mounted on a mounting means 24a, arranged on the opposite ends of the rolls near the two bearings of the rolls, a piston movable in each of these cylinders and respectively connected to one end of double-armed levers 19 pivotally mounted intermediate its ends on the mounting means 24a and adapted to engage with the other end thereof the bearing means (one the left and the other the right bearing) of the uppermost roll of the group of rolls which have not been lifted away from each other. As shown in the drawing the left end of the double-armed levers 19 engage the top face of the bearing means 6' so as to press this bearing means in downward direction to thereby press the peripheral surfaces of the rolls 6-1 towards each other. The cylinder 18 and the double-armed lever 19 may be mounted on the mounting means 24a in such a manner that the left end, as viewed in the drawing, of the double-armed lever may be moved in transverse direction out of the space between two adjacent bearing means so that during vertical movement of the additional pressure applying means to a selected position the left end of the lever will not interfere with the bearing means. Instead of this arrangement to move the pressure applying means the rolls lying in the way of the levers 19 may be released by releasing the screws 2''' (FIG. 4) and removed from the calender frame. After displacement of the pressure applying means the roll or rolls removed from the frame are put back in the frame and fastened by means of the screws 2'''.

The calender includes further a supply roll 25 turnably mounted on the support means 17 as well as a take-up roll 29 turnably mounted on the floor adjacent the support means 17, and a plurality of guide rolls 21, 22, 23, 26, 27, 28, 30 and 31 for a purpose as will be described later on.

The above described calender will operate as follows:

If the calender is used to produce a glossy paper, the paper web from the supply roll 25 is fed over the guide rolls 26 and 27, over the peripheral surface of the upper calender roll 12 and from there the paper is threaded in a meandering way about the peripheral surfaces of the rolls 11-2, and guided over the guide roll 28 onto the take-up roll 29. To facilitate such threading, the bearing means 12' of the uppermost roll 12 is lifted by feeding pressure fluid into the cylinders 13 beneath the pistons

14 slidably mounted therein to such an extent (ten times 0.12 inch, that is 1.2 inch for instance) to disengage the peripheral surfaces of all the rolls from each other by means of the rods 16 and the pairs of cooperating engaging means respectively fixed to the rods and the respective bearing means of the rolls. After the threading operation has been performed, pressure fluid is fed into the upper portion of the cylinder 13 while pressure fluid is discharged from the lower portion thereof so as to move the pistons 14 and the bearing means 12' connected thereto in downward directions to press thereby the peripheral surfaces of the rolls toward each other.

If the calender is to be used for finishing paper to provide thereon smooth but not glossy surfaces, the paper is threaded in a meandering way only about the peripheral surfaces of some of the rolls provided in the calender, for instance, the paper may be wound about the peripheral surfaces of the rolls 4-6. For threading the paper all the rolls are lifted again as described above and the paper web is fed from the supply roll 25 over the guide rolls 21 and 22 between the peripheral surfaces of the calender rolls 7 and 6 and then in a meandering way over the rolls 5 and 4 and over the guide rolls 30 and 31 onto the take-up roll 29. The rolls 7-12 are then held in the lifted position by pushing the lower spacer members 15 (FIG. 3b) between the nuts 20 on the upper end of the rods 16 and the projections 32 on the support means and pressure fluid is then fed into the cylinders 18 beneath the piston therein to tilt the double-armed levers 19 into engagement with the bearing means 6' to press the latter in downward direction.

The paper web may also be fed only over the roll 4 in which case the web is fed from the supply roll 25 over the guide rolls 21, 22 and 23 through the gap between the rolls 5 and 4 and over the left half, as viewed in FIG. 1, over the calender roll 4 and then over the guide rolls 30 and 31 onto the take-up roll 29. In this case, the additional pressure applying means 24 are preferably moved downwardly so that the lever arms 19 engage the bearing means 5'.

The calender arrangement illustrated in the drawing may be modified by providing means for interconnecting the first pressure applying means 13, 14 with the additional pressure means 24.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of calenders differing from the types described above.

While the invention has been illustrated and described as embodied in a calender for finishing a paper web either to smooth and glossy surfaces or smooth surfaces only, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A calender comprising, in combination, upright support means; a plurality of superimposed calender rolls; bearing means on said support means and turnably supporting the ends of each of said superimposed calender rolls, said bearing means, except the bearing means for the lowermost of said superimposed rolls, being mounted on said support means movable in vertical direction; first pressure applying means cooperating with the bearing means of the uppermost of said superimposed rolls for

applying downward pressure thereto; means for lifting any roll of said plurality of superimposed rolls from the rest of said plurality of rolls; and an additional pressure applying means supported by said support means vertically movable along said plurality of superimposed rolls for applying downward pressure onto the bearing means of the uppermost roll of said rest of said plurality of rolls, said first and said additional pressure applying means constituting the only pressure applying means of said calender.

2. A calender as set forth in claim 1, and including holding means for holding the rolls lifted away from the remaining group of rolls in lifted position.

3. A calender as set forth in claim 1, wherein said lifting means include connecting means connecting the bearing means of said rolls with the exception of that of the lowermost roll with each other in such a manner so as to lift the bearing means of the roll adjacent to the uppermost roll after the bearing means of the latter has been lifted to a predetermined extent and to successively lift the bearing means of the following rolls one after the other during increased lifting of the bearing means of said uppermost roll.

4. A calender as set forth in claim 3, said connecting means including at least one elongated rod mounted adjacent said bearing means and slidably in vertical direction, said rod being fixedly connected to the bearing means of said uppermost roll, and a plurality of pairs of cooperating engaging means, one engaging means of each pair of engaging means being fixed to said rod and the other to a respective one of the bearing means of the rolls between the uppermost and the lowermost roll, the cooperating engaging means in each pair of engaging means being spaced from each other in vertical direction a small distance increasing from the pair of engaging means adjacent to the uppermost roll to the pair of engaging means adjacent to the lowermost roll.

5. A calender as set forth in claim 4 and including holding means for holding the rolls lifted away from the remaining group of rolls in lifted position, said holding means including a pair of cooperating elements respectively fixed to said rod and to said support means, and means cooperating with said cooperating elements for holding said rod in a predetermined fixed position relative to said

support means after said rod has been lifted together with said bearing means of said uppermost roll.

6. A calender as set forth in claim 4, and including holding means for holding the rolls lifted away from the remainders of rolls in lifted position, said holding means including an abutment member fixed to the upper end of said rod and having a bottom face extending transverse to the axis of the latter, a projection on said support means beneath said abutment member and having a top face facing said bottom face of said abutment member, and a spacer member of selected height movable between said bottom face of said abutment member and said top face of said projection after said rod has been lifted to a predetermined degree for thereby holding said rod in lifted position.

7. A calender as set forth in claim 1, wherein said additional pressure applying means include cylinder means, piston means slidably guided in said cylinder means, mounting means mounting said cylinder means movable in vertical direction along said support means, a two-armed lever pivotally arranged on said mounting means and pivotally connected at one end thereof to said piston means and adapted to operatively engage with the other end thereof a selected one of the bearing means of the rolls between the uppermost and the lowermost of said row of rolls.

8. A calender as set forth in claim 1, and including means for interconnecting said first pressure applying means with said additional pressure applying means.

9. A calender as set forth in claim 1, wherein said plurality of superimposed rolls have alternately peripheral hard and yieldable surfaces.

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