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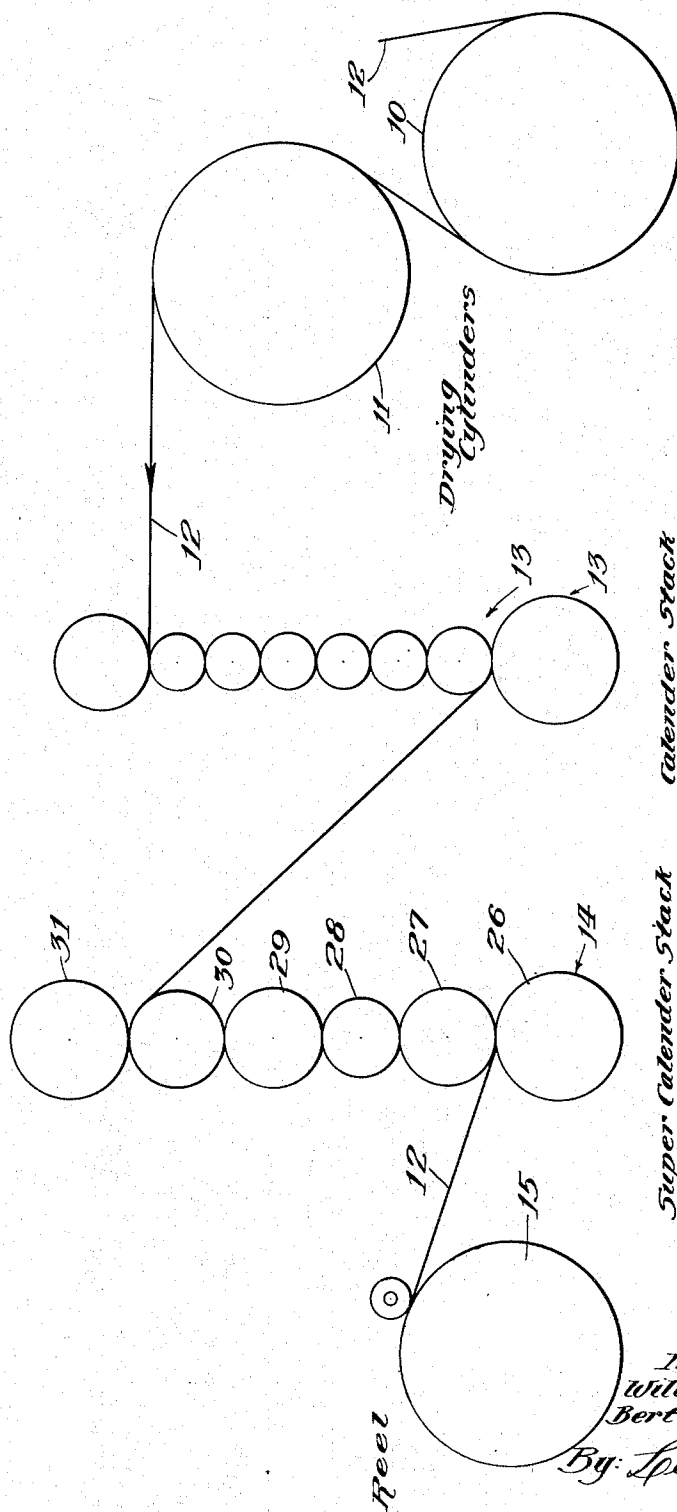
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2,300,994

CALENDER FOR PAPER

Original Filed March 12, 1936 3 Sheets-Sheet 1

Fig. 1



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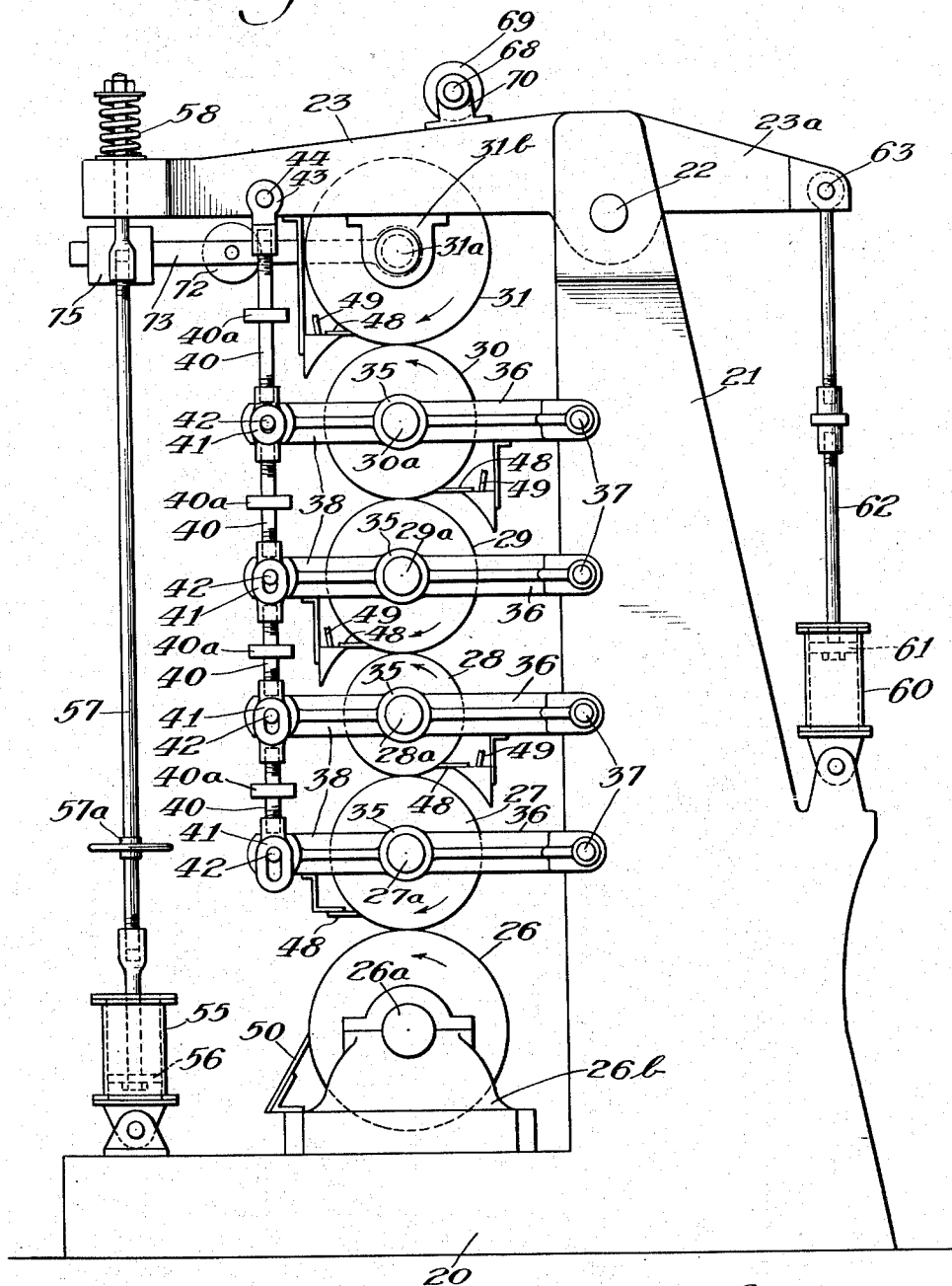
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Fig. 2.



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Fig. 3.

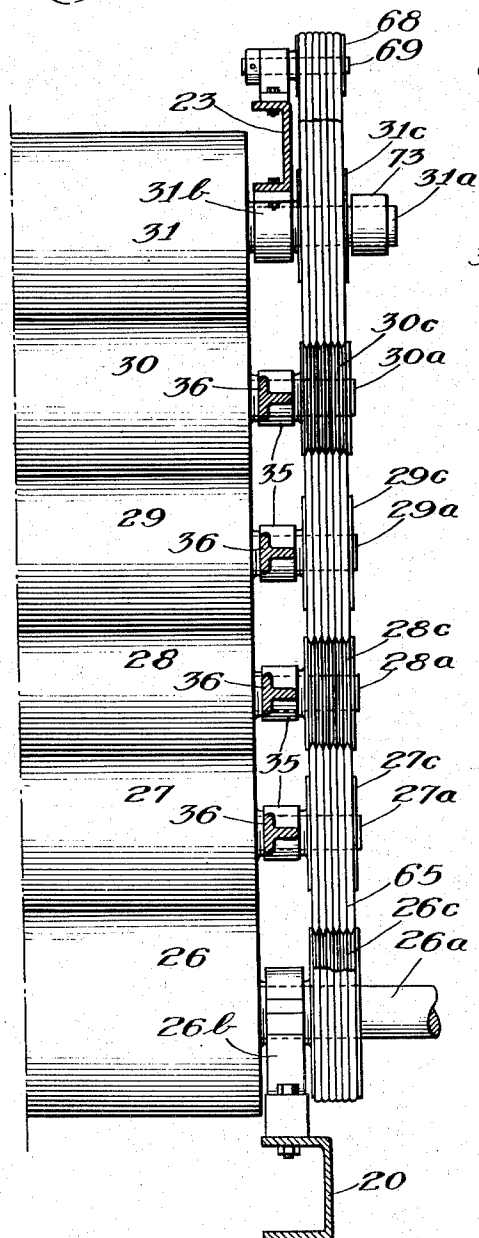
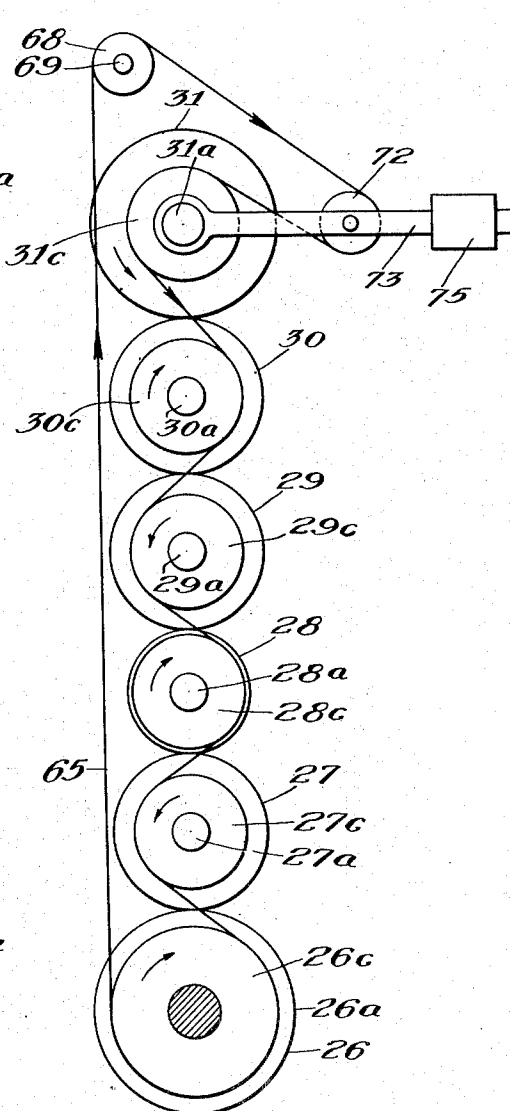


Fig. 4.



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UNITED STATES PATENT OFFICE

2,300,994

CALENDER FOR PAPER

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Continuation of application Serial No. 68,486, March 12, 1936. This application August 9, 1938, Serial No. 223,852

4 Claims. (Cl. 92-73)

This is a continuation of our pending application, Serial No. 68,486, filed March 12, 1936.

Our present invention has reference to the paper making art and more particularly to that phase of paper making known as calendering.

Up to the present time it has generally been considered impractical to operate super-calendering apparatus adjacent the "dry end" of a paper making machine, for directly receiving a web of paper from the machine for producing super-calendered paper, because of the great likelihood of injuring the highly finished surfaces of the super-calender rolls.

Super-calendering devices generally include a stack of superimposed rolls, some of which are provided with hard metallic surfaces such as chilled iron, steel, etc., while other rolls are provided with more or less resilient surfaces composed of material such as paper filling, cotton or combinations of cotton and paper and also cotton and asbestos, paper and asbestos, or paper, cotton and asbestos. A stack of super-calender rolls are usually arranged with a resilient surface roll positioned for contactual engagement with a highly finished metallic surfaced roll. This relationship tends to protect and preserve the highly finished metallic surfaced rolls, while producing desired characteristics in the finished calendered surface of the paper. The possibility of injuring the finished surfaces of these rolls, and particularly the resilient surfaced rolls, is greatest during the initial threading of the web of paper into the super-calendering device. It is well known that during this operation wads of paper are frequently passed through the bight of cooperating rolls of the stack, and such wads of paper frequently accumulate and produce depressions or indentations in these highly finished surfaces of the resilient surfaced rolls. If such injury becomes sufficiently serious the calendered finish of the paper is greatly impaired and is rendered unsuited for use. When this condition occurs it is necessary to remove the roll from the stack and refinish its external surface. The operation of refinishing the surface of either the metallic rolls or the resilient surfaced rolls is very expensive and adds materially to the cost of producing calendered paper.

The present invention is directed to a novel arrangement and provision of means directed to eliminate the foregoing difficulties by separating all of the rolls in the calender stack during the initial threading operation of the web of paper, and driving each roll while said rolls are in separated relation. This arrangement facilitates the

threading of the web of paper in a tortuous path through the series of rolls, and practically eliminates entirely the possibility of damaging the surface of the rolls by paper wadding being forced into the resilient surfaces of the rolls during the initial threading operation, as heretofore has been the case.

Another feature of our invention consists in providing a friction drive for the calender rolls which is capable of adjustment at will for varying the extent of frictional drive imparted to the rolls for producing certain desired characteristics in the finished calendered surface of the paper.

Other features and advantages of our invention will be manifest from the drawings taken in connection with the following description.

In the drawings,

Fig. 1 is a diagrammatic illustration of several mechanisms which may be employed at the "dry end" of a paper making machine, including a calendering device embodying our invention.

Fig. 2 is a side elevation of a super-calendering device constructed in accordance with our present invention.

Fig. 3 is a fragmentary sectional view through the far end of the super-calendering device as viewed in Fig. 2, showing the friction driving arrangement of the calender rolls.

Fig. 4 is a diagrammatic illustration in end view of the friction driving arrangement for the calender rolls.

Although the present invention may be applied to a conventional calendering device associated with a paper making machine, resulting in obtaining considerable advantage over present constructions now in use, such as facilitating the threading of a web of paper through the device and avoidance of possible injury to the finished surfaces of the calender rolls, it is believed that our device is particularly suitable and may be more advantageously employed in connection with a super-calendering device as illustrated in the accompanying drawings.

In order that a clear understanding may be had as to both the nature and scope of this invention we have illustrated diagrammatically in Fig. 1 of the drawings, apparatus which may be located at the "dry end" of a paper making machine, including a super-calendering device embodying our invention. Reference characters 10 and 11 designate what is known in the art as drying rolls from which a web of paper indicated at 12 is fed in a continuous matter to a calendering device indicated generally at 13. The web of paper 12 then travels through a

super-calendering device indicated generally at 14 from which the paper is then fed onto a storage reel indicated at 15. As is well known in the art the regular calendering device is composed of a stack of superimposed rolls all of which are provided with relatively hard metallic surfaces such as chilled iron, steel, etc., while in a super-calendering device the stack of rolls which are also arranged in superimposed relation consist of some rolls having hard metallic surfaces and some having resilient or soft surfaces. Super-calendering devices at no time have two rolls with hard metallic surfaces arranged in cooperating relation for engaging the web of paper therebetween, but on the contrary a soft or resilient surfaced roll is generally positioned for cooperative relation with a hard metallic surfaced roll for obtaining certain characteristics in the finished calendered paper, while also serving to protect the highly finished surface of the metallic roll.

In the super-calendering device illustrated in the drawings, reference character 20 designates base members for two upwardly extending side frames 21, to the upper ends of which are pivotally mounted as indicated at 22 longitudinally extending beams 23, the forward ends of which together with the side frames 21 serve to position and at times entirely support a plurality of calendering rolls arranged in superimposed relation. For convenience we have shown a super-calendering device composed of six rolls indicated as 26, 27, 28, 29, 30 and 31, and the rolls designated as 26, 28, and 31 may be understood to be provided with highly finished hardened metallic surfaces, while the other rolls, 27, 29 and 30 have resilient, highly finished surfaces of material such as paper, cotton, etc. It has been found, however, that very satisfactory results may also be attained when using a greater or lesser number of calender rolls. The bottom roll 26 is provided at opposite ends with stub shafts 26a, journaled in bearing 26b secured to the bases 20. One of the stub shafts 26a as indicated in Fig. 3 of the drawings is extended for connection to a main source of power. The upper roll 31 is provided with stub shafts 31a at its opposite ends, journaled in bearings 31b which are secured to the underside of the pivot beams 23. The other rolls 27, 28, 29 and 30 are each provided with stub shafts 27a, 28a, 29a and 30a at their opposite ends and are journaled in similar bearings designated as 35 which are formed as integral parts of lever arm 36, the ends of which are of yoke formation and are pivotally connected by pivot pins 37 to the respective side frames 21. Each of the lever arms 36 is provided with forward extensions 38 beyond said bearings 35, the outer ends of said extensions being connected together by the rods 40, and slotted links 41. Said links 41 are connected to the ends of the respective arms 38, by pins 42, and the upper end of each of the uppermost rods 40 is provided with an eye nut 43, pivotally connected at 44 to the pivoted beams 23. Each of the connecting rods 40 is provided with a turnbuckle 40a, for minute adjustment of the effective length of the connecting rods.

The slotted openings in the connecting links 41 vary, increasing from top to bottom for insuring proper separation and spaced apart relation of the respective calender rolls when the beams 23 are swung about the pivots 22 by means hereinafter described, for the purpose of

initially threading a web of paper through the stack of calender rolls. Associated with the upper five calender rolls are conventional doctors indicated at 48 which may be equipped with conventional compressed air nozzles indicated at 49. These doctors, as is well known in the art, function to keep the rolls free from specks and scabs of paper, lint, dirt, etc., and prevent the paper from running around the roll when it is fed into the stack during the threading operation. The bottom roll is provided with a conventional doctor indicated at 50 which is arranged in slightly different relation to the roll as compared with the other doctor 48, but functions in the same manner.

To apply pressure to the nip or bight of the rolls in excess of that furnished by the weight of the rolls themselves, fluid pressure is employed to react on the beams 23 and force said rolls toward each other. For this purpose there is provided two cylinders 55 containing pistons 56 connected by rods 57 to the forward ends of the beams 23 with coil springs 58 interposed between the beams and the ends of said rods 57. Fluid is admitted to the cylinder 55 under high pressure such as a range of 1500 to 3000 pounds per square inch, and for normal operation the fluid is admitted to the cylinder above the piston 56 causing the piston to travel downwardly to the end of the cylinder. The pressure is thus transmitted through the beams 23 to the entire stack of rolls. The pressure applied to the rolls may be varied some by means of turnbuckles 57a connected in the upright rods 57. The coil springs 58 serve the additional function of providing a yielding connection for imparting force to the beams 23, and it will be apparent that should paper of unusual thickness pass through the bight of any pair of cooperating super-calender rolls, when once set for thinner paper, the rolls will be permitted to separate by reason of the coil springs 58.

When it is desired to separate the rolls to facilitate threading of a web of paper therethrough in the tortuous path, the fluid pressure above pistons 56 is released and fluid pressure is then admitted to cylinders 60 located on the rear end of the frames 21, forcing the pistons 61 in a downward direction. These pistons are connected by rods 62, at pivots 63, to the rearward extension 23a of the pivoted beams 23, swinging said beams in clockwise direction with respect to the position seen in Fig. 2 of the drawings, and through the medium of the connecting rods 40 and links 41, the calender rolls are caused to be raised one by one in spaced apart relation to each other, about the pivot connections 37, of the lever bearings 36. As the successive connecting links 41 are moved upwardly, there is a limited range of lost motion, until the lower end of the slots engage the under side of the pin 42 at which time it picks up and raises the next calender roll carried by the adjacent supporting lever arms 38. The rolls may be returned to normal operating position again by merely releasing the fluid pressure in cylinders 60 above the pistons 61, and fluid under pressure may again be introduced above the pistons 56 in the cylinders 55. Any suitable valve arrangement desired may be employed for controlling the operation of these pistons in their respective cylinders.

Generally calender devices are operated by driving the bottom calender roll only, the remaining rolls being operated through friction with the rolls on which they rest. To carry out

our invention, however, each of the calender rolls is driven by means other than friction due solely to the weight of the rolls themselves. Rigidly mounted on the stub shafts of the respective calender rolls at one side of the device, as indicated in Fig. 3 of the drawings, are grooved pulleys indicated as 26c, 27c, 28c, 29c, 30c, and 31c over which are trained in proper driving relation flexible driving belts 65, as seen in Figs. 3 and 4, which may be V-type belts or Tex-ropes, and these flexible belts are trained over an idler sheave 68 mounted on a stub shaft 69 journaled in a bearing 70 secured on the upper edge of the adjacent pivoted beam 23. Said driving belts are also trained around an idler sheave 72 journaled on a laterally extending arm 73 which is mounted on the stub shaft 31a and is provided with an adjustable counterweight 75 at its outer end. This counterweight together with lever arm 73 tends to automatically take up any slack in the friction drive belt and maintains a uniform driving tension in the belt at all times. In this arrangement it will be observed that the upper five calender rolls are driven from the bottom roll 26 by means of the friction belt 65. However, it will be manifest that these rolls could, if desired, each be driven through separate power connections, or in other arrangements. The arrangement shown, however, is particularly suitable since it readily permits of automatic adjustment to enable the calender rolls to be driven even when the rolls are separated, to assist in threading a web of paper through the calender. By manual adjustment of the friction belt tightener while the calender rolls are operated under pressure, it may be possible to obtain some desired variation in the calendered finish of the paper.

When paper is super-calendered as a separate operation from a paper making machine, it is often found necessary to use paper carrying rolls known in the art as "fly rolls" to prevent wrinkles, calender cuts and poor running conditions of the paper. These difficulties are obviated in connection with the paper making machine due to the fact that when fly rolls are needed for super-calendering they are necessary to correct defects in the making of paper and when the super-calender is a part of the paper making machine, these defects become immediately apparent and may be readily corrected. However, should it be found necessary to employ "fly rolls" they may be added, and the web of paper may be threaded through the stack by means of "Sheenan carrier ropes" in lieu of the use of air through the doctors as used in the conventional manner.

In actually employing our invention in a commercial way we have found that very excellent results are obtained by merely separating the calender rolls approximately $\frac{1}{8}$ of an inch. It has been found that this amount of separation is adequate to prevent wadding of paper in a manner that would impair the finished resilient surfaced rolls during the threading of the web of paper in the calendering device. We have found by actual test runs of commercial quantities of paper in employing a super-calender constructed in accordance with our present invention that we were able to effect a saving in the cost of production of paper from at least three dollars to four dollars per ton. Not only will this substantial economy result from the use of our invention, but there is a considerable saving in time in that the super-calendering operation of paper is not

delayed by necessity of refinishing the resilient surfaced rolls.

As above indicated, although we have illustrated and described our invention in its preferred embodiment in connection with a super-calendering device, we believe that substantial benefit and advantage will result in the embodiment of our invention in connection with conventional calendering devices. It is also manifest that various other types of drives for the calender rolls and other types of separating mechanisms therefor may be employed without departing from the spirit and scope of our invention. We do not, therefore, wish to be understood as limiting our invention to the particular embodiment herein illustrated and described, or its arrangement and association with a paper making machine, except as limited in the appended claims.

We claim as our invention:

1. A paper calender which comprises in combination a frame, a shaft carried upon said frame, a roll mounted upon said shaft, said roll having a stationary axis, a plurality of shafts positioned in substantially vertical alignment above said first mentioned shaft, rolls carried upon said shafts, means for movably supporting each of said plurality of shafts upon said frame, adjustable means connecting adjacent supporting means together, a lever pivotally mounted upon said frame, means for rocking said lever, adjustable means connecting said lever to said movable supporting means to move said plurality of rolls away from each other and away from said first mentioned roll when said lever is rocked, a flexible drive element, and means carried upon each of said shafts engaging the flexible drive element to drive said rolls when in separated relationship.

2. A paper calender which comprises in combination a frame, a shaft carried upon said frame, a roll mounted upon said shaft, said roll having a stationary axis, a plurality of shafts positioned in substantially vertical alignment above said first mentioned shaft, rolls carried upon said shafts, means for movably supporting said plurality of shafts upon said frame, adjustable links connecting adjacent movable means together, a lever pivotally mounted upon said frame, fluid actuated means for rocking said lever, an adjustable link connecting said lever to said movable supporting means to move said plurality of rolls away from each other and away from said first mentioned roll when said lever is rocked, a flexible drive element, and means carried upon each of said shafts engaging the flexible drive element to drive said rolls when in separated relationship.

3. A paper calender which comprises in combination a frame, a shaft carried upon said frame, a roll mounted upon said shaft, said roll having a stationary axis, a plurality of shafts positioned in substantially vertical alignment above said first mentioned shaft, rolls carried upon said shafts, means for movably supporting said plurality of shafts upon said frame, links having adjustable effective lengths connecting adjacent supporting means together, a member movably mounted upon said frame, means for moving said member, a link having adjustable effective length connecting said member to said movable supporting means to move said plurality of rolls away from each other and away from said first mentioned roll when said member is moved, a flexible drive element, and means carried upon

each of said shafts engaging the flexible drive element to drive said rolls when in separated relationship.

4. A paper calender which comprises in combination a frame, a shaft carried upon said frame, a roll mounted upon said shaft, said roll having a stationary axis, a plurality of shafts positioned in substantially vertical alignment above said first mentioned shaft, rolls carried upon said shafts, a plurality of pivoted levers for movably supporting said plurality of shafts upon said frame, adjustable means connecting adjacent levers together to space said rolls predetermined distances from each other, a member movably

5 mounted upon said frame, means for moving said member, means connecting said member to said pivoted levers to move said plurality of rolls away from each other and away from said first mentioned roll when said member is moved, a flexible drive element, and means carried upon each of said shafts engaging the flexible drive element to drive said rolls when in separated relationship, and separate means connected to said member to move the same in the opposite direction to move said rolls together.

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