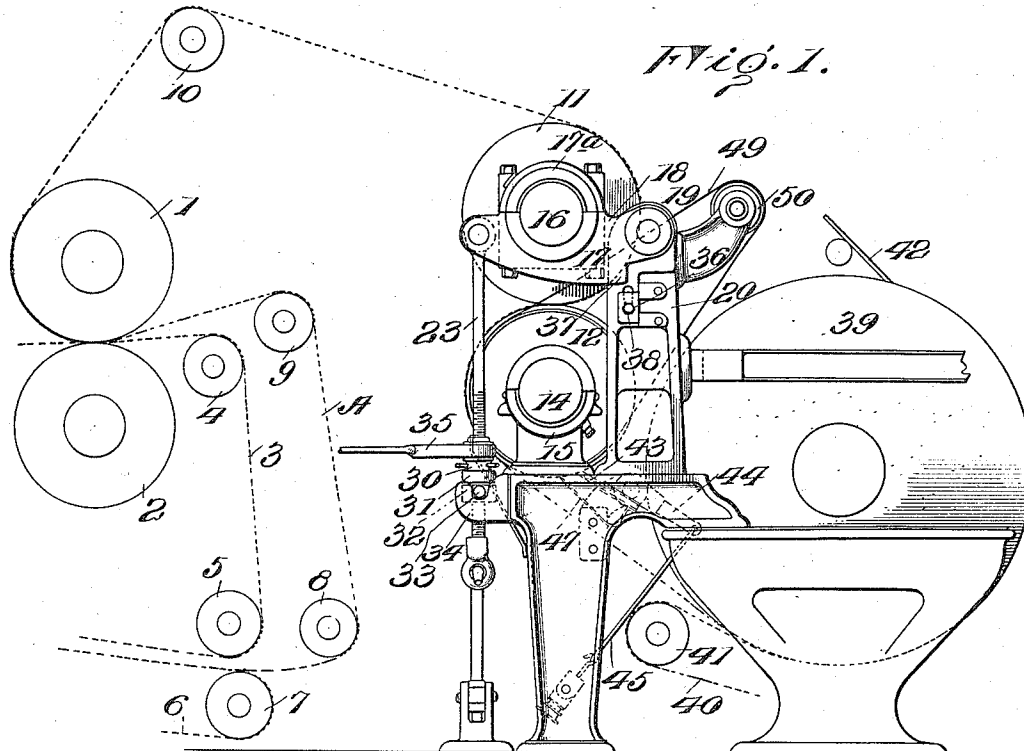
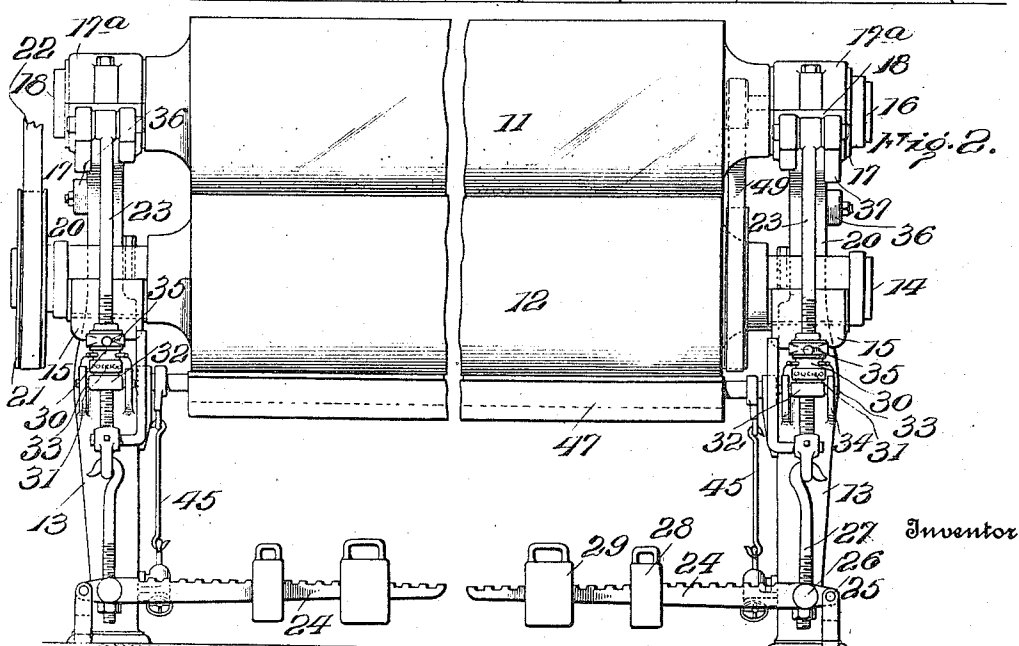


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SMOOTHING PRESS FOR PAPER MAKING MACHINES.
APPLICATION FILED JUNE 15, 1915.

1,168,629.

Patented Jan. 18, 1916.

2 SHEETS—SHEET 1.



Inventor
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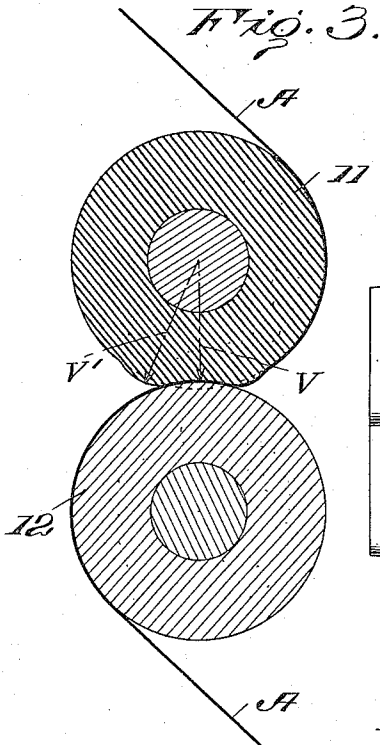
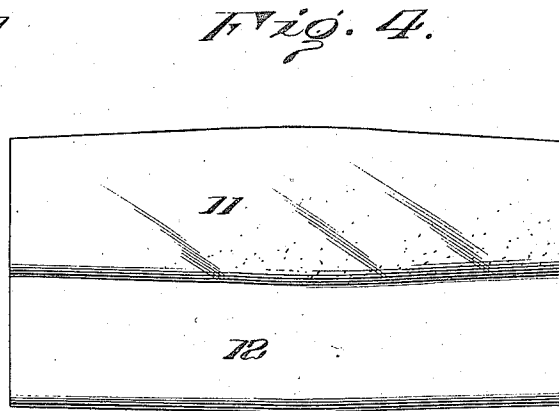
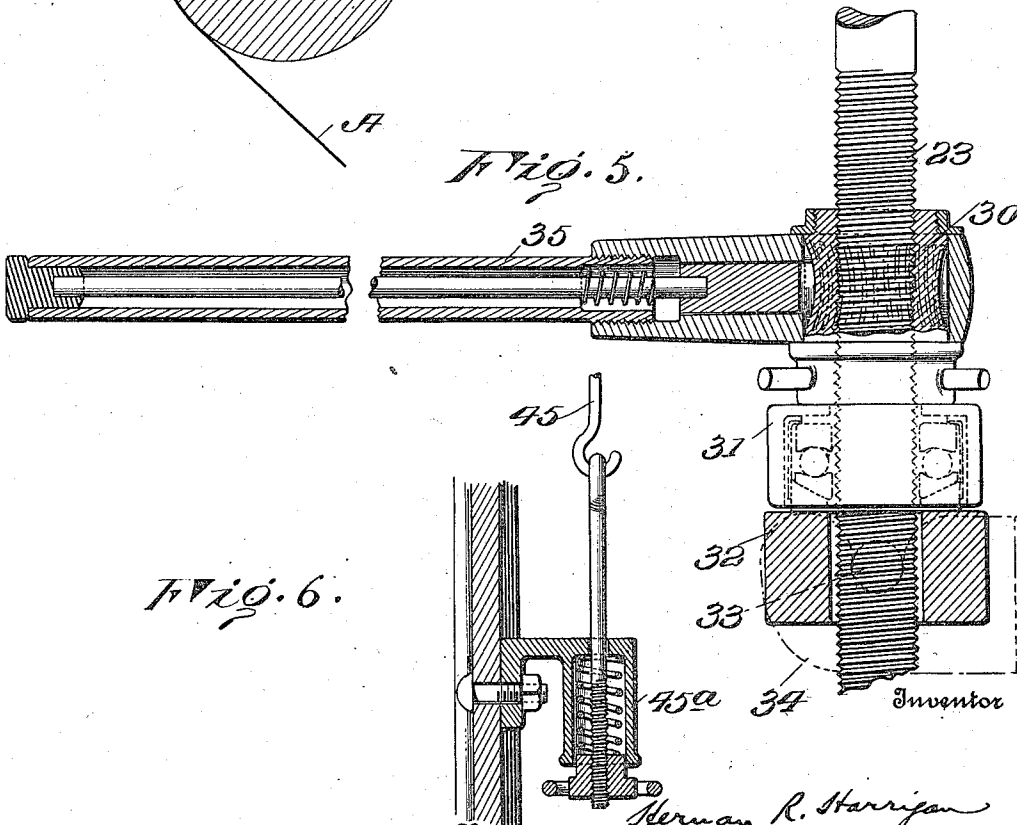
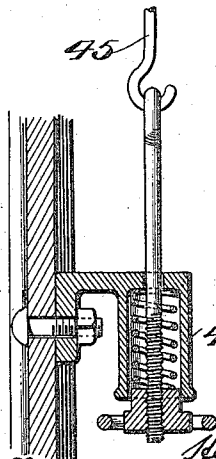


Fig. 6.



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UNITED STATES PATENT OFFICE.

HERMAN R. HARRIGAN, OF WILMINGTON, DELAWARE.

SMOOTHING-PRESS FOR PAPER-MAKING MACHINES.

1,168,629.

Specification of Letters Patent.

Patented Jan. 18, 1916.

Application filed June 15, 1915. Serial No. 34,305.

To all whom it may concern:

Be it known that I, HERMAN R. HARRIGAN, whose post-office address is care of the Pusey & Jones Co., Wilmington, Delaware, have invented a new and useful Improvement in Smoothing-Presses for Paper-Making Machines, which invention is fully set forth in the following specification.

The invention relates to smoothing presses adapted to be interposed between and used in combination with the press rolls and drier rolls of a paper-making machine of standard construction. The paper passes directly from the final press rolls to the smoothing press, and it is then in a sufficiently plastic condition to be easily acted upon to remove wire marks and felt marks. The paper is delivered from the smoothing press in a uniformly smooth condition and passes directly to the drier rolls.

The action of a smoothing press of the sort to which my invention relates is quite different from that of the ordinary calendering machines. The calendering machines are used after the paper is dried and the fibers thereof are firmly fixed and set. The effect, therefore, of the calendering action is simply to bend down the upstanding surface fibers of the paper; but the smoothing press acting upon the paper while still wet and plastic is able to move the fibers relatively to each other and to make a more compact and uniform mass.

By this invention I provide a smoothing press of improved construction and having an improved relationship with the press rolls and drier rolls with which it coöperates.

One object of the invention is to provide improved means for applying and regulating the pressure between the rolls and for separating the rolls to permit removal of one of them.

Another object of the invention is to provide improved means for threading the paper through the rolls upon starting.

Another object is to provide improved means for separating and collecting loose material from one of the rolls.

Still further objects of the invention will be apparent from the following specification and claims.

In the accompanying drawings, I have shown, for purposes of illustration, one machine embodying the invention, this being the machine which I now prefer. It will be understood, however, that the invention

can be embodied in other mechanisms differing from that shown.

Of the drawings, Figure 1 is a side view of the smoothing press, parts of the usual press mechanism and drier mechanism of a paper-making machine being also shown more or less diagrammatically; Fig. 2 is a front view of the smoothing press; Fig. 3 is an enlarged diagrammatic cross-sectional view of the smoothing rolls; Fig. 4 is a diagrammatic view of the smoothing rolls; Fig. 5 is a sectional detail view of a part of the lifting mechanism for the upper roll; Fig. 6 is a sectional detail view of the spring mechanism for the doctor for the lower roll.

Referring to the drawings, 1 and 2 are the final press rolls of the paper-making machine.

3 is the felt passing between the rolls 1 and 2 and around guide rolls 4 and 5.

6 is the lower felt passing around the guide roll 7.

A represents the paper which passes from the lower felt 6 around the guide rolls 8 and 9 to the press rolls 1 and 2. The paper passes around the upper press roll 1 over the guide roll 10 to the smoothing press, which will now be described.

11 and 12 are the two opposed rolls of the smoothing press, these being parallel to the press rolls 1 and 2 and being rotated so that the parts at the nip move backward toward the press rolls. One of the rolls is formed of or is covered with soft rubber, and the other roll is formed of or covered with a suitable hard unyielding material, as for instance, a suitable metal alloy such as gun-metal.

It will be understood that in referring to one of the rolls as formed of or covered with rubber, I do not mean to exclude other substances which may be found to be sufficiently soft and elastic and otherwise suitable to be used as a substitute for rubber.

With a paper-making machine of usual construction, the wire side of the paper is lowermost. It is found preferable to have the wire side of the paper contact with the rubber covered roll. This rubber covered roll is therefore placed uppermost, as indicated by 11 in the drawings. It will be understood, however, that when paper-making machines of other types are used the arrangement of the rolls can be varied accordingly. As will be hereinafter fully explained, the two rolls are forcefully pressed together,

and this pressure results in a tendency for the paper to stick to the rubber covered roll. However, the tendency is noticeably less when the wire side is next to the rubber, and it is for this reason that the arrangement above referred to is preferred.

By referring to the diagrammatic Fig. 3, it will be observed that because of the pressure the lower hard roll sets into and indents the upper soft roll. The effective radius of the upper soft rubber roll is therefore slightly less at the center of the nip than at the point immediately beyond the nip. The movement of the rubber roll from the shorter radius r to the longer radius r' serves to free the paper from the roll to prevent sticking and to enable it to follow the surface of the lower hard roll.

Preferably the initial roll, in this case the upper rubber covered roll, is relatively highly crowned as clearly shown in exaggerated form in Fig. 4. The paper in passing from the guide roll 10 to the first smoothing roll is unsupported for a relatively long distance and tends to sag at the center. The high crowning of the roll 11 not only serves to counteract in part this sagging tendency, but also serves to make the center of the paper travel a little faster than the sides, thus stretching the paper slightly at the center and preventing wrinkling.

It is very essential that the two rolls contact with the paper with uniform pressure throughout their lengths. If the rolls are not of the non-deflect type, either or both must be crowned, though for reasons already stated I prefer to crown the upper one only, as shown in Fig. 4. The rolls deflect by reason of their weight and added pressure and thus contact uniformly throughout.

In the manufacture of the smoothing press, it is essential to make sure that the rolls are so constructed that the pressure and the area of pressure is uniform from end to end, and to attain this, they are tried out by test and repeatedly ground until the indications are that the pressure is uniform and of equal area throughout. It will be understood that for a given set of rolls, the pressure can be varied only within relatively narrow limits as the deflection varies with the pressure. If it is desired to change from a very high pressure to a relatively low pressure, one set of rolls must be taken out and another set substituted.

By providing the soft rubber roll in combination with the hard composition roll, I am enabled to obtain pressure on the paper over an area of appreciable width, the action of the hard and soft rolls being in this respect quite different from the action of two hard rolls which would have contact with the paper along only a single longitudinal line. Not only is the pressure distributed and thus allowed to act on the paper for a

longer time, but the rubber also serves to prevent excessive pressure on the paper at any point to cut or crush it.

13—13 are the main frame elements or brackets upon which the rolls 11 and 12 are carried. One of the rolls, preferably the lower one, is rotatable about an axis fixed with respect to the frame elements and the other roll, preferably the upper one, is vertically adjustable with respect to the frame elements. The lower roll 12 is provided with trunnions 14—14 which, in the construction shown, are rotatable in bearings 15—15 fixedly mounted on the brackets 13—13. Preferably, as shown in the drawings, half-bearings are used, the tops of the trunnions being exposed.

The upper roll 11 is vertically movable, its trunnions 16—16 being mounted in vertically movable bearings 17—17. These bearings are provided with caps 17^a—17^a which can be removed to permit the removal of the roll. While any of a number of constructions can be used to permit vertical movement of the bearings 17—17, I prefer to form the bearings as parts of supplemental frames 18—18 which are horizontally pivoted at 19 on standards 20—20 secured to or formed as parts of the main frame elements 13—13.

At the driving side of the machine (the left-hand side as viewed in Fig. 2) the trunnion 14 is extended and fitted with a pulley 21 that is driven by a belt 22 from a suitable variable speed drive (not shown) so that the roll 12 may be driven at the exact speed desired, which is slightly in excess of the speed of press rolls 1 and 2. The roll 11 is driven by contact or through the paper.

By forcing the upper roll 11 downward to press it against the lower roll, rods 23—23 are provided which are pivoted at their upper ends to the supplemental frames 18—18, and which are connected at their lower ends with a suitable tension-applying mechanism. Preferably the tension-applying mechanism comprises for each rod a horizontal lever 24 fixedly pivoted at 25, and at 26 connected with the rod 23 by means of a suitable hooked member 27. The lever 24 is notched and weights 28 and 29 are adjustable along the lever, being held against accidental displacement by the notches.

It will be observed that by means of the weights and the lever and link mechanism, force can be automatically and continuously applied to press the upper roll downward against the lower roll. As has already been stated, this pressure can be varied only within relatively narrow limits for any given set of rolls. The weights, however, are adjustable over a wide range and can be made use of to give a high pressure for one set of rolls and a low pressure for another set of rolls, or for the same set of rolls if

re-ground with a new crown suitable for such weight pressure.

When the machine is idle, it is very essential that the pressure between the rolls be relieved in order to prevent the permanent indenting of the soft upper roll by the hard lower roll. A suitable mechanism is therefore provided for pushing upward on the rods to lift the upper roll out of contact with the lower one. The mechanism which I have shown for this purpose consists for each rod of a nut 30 threaded on the rod and adapted to rest on a ball thrust bearing 31 which surrounds the rod. Below the ball bearing is a collar 32 having trunnions 33 which rest in notches formed in lugs 34 extending from the side of the bracket 13. For turning the nut 30, a reversible ratchet mechanism is provided such as is shown at 35 in Fig. 6.

When the machine is in operation, the nuts are elevated so as not to interfere with the free vertical movements of the rods. However, when the machine is idle the nuts are turned in the direction to carry them downward. The nuts, when thus turned, engage the ball bearings which in turn engage the collars 32. In this way the rods are lifted, carrying with them the frames 18—18 and the upper roll.

It will be obvious that when the upper roll is to be removed from the smoothing press, this can be done simply by removing the caps 17^a of the bearings 17. To remove the lower roll, however, it is necessary not only to get the upper roll out of the way, but also to get the rods 23 out of the way of the trunnions 14—14. The rods are made use of in the way already described to lift the upper roll, and when it is sufficiently lifted, it is locked in elevated position by means of blocks 36 which are vertically adjustable on the standards 20—20. The frames 18—18 are provided with bosses 37—37 adapted to abut against the blocks when elevated. The blocks are held in elevated position by means of bolts 38—38 which extend through slots in the standards. The rods 23—23 are then released from the hooks 27—27 and are swung outward and upward, thus giving a clear space for the removal of the lower roll.

The paper A, as has already been explained, passes over and around the upper roll to the nip and from the nip downward and around the lower roll. From the lower roll the paper passes to the series of drier rolls of which one is diagrammatically indicated in the drawings at 39.

40 indicates the drier felt, and 41 is one of the guide rolls therefor.

42 is a doctor for the first drier roll.

A suitable doctor is provided for the lower smoothing roll 12, this being indicated in the drawings at 43. For pressing the doctor against the roll, there is secured to it a lever

44 which is connected by means of a rod 45 with a suitable adjustable spring mechanism 45^a shown in detail in Fig. 7. Attached to the doctor 43 is a crumb catcher 47 adapted to receive small detached particles of paper and to prevent their falling on to the paper sheet immediately beneath. It is obvious that inasmuch as the doctor is located immediately above the moving paper it is necessary to prevent the crumbs from falling on to the paper and being carried along to the drier rolls where they would be caused to adhere and form lumps.

Preferably, I provide a device for feeding the paper into the smoothing rolls upon starting, which device consists of a belt adjacent the ends of the rolls. The lower roll has secured to it a pulley 48 around which passes a belt 49. Mounted on the corresponding standard 20 is an idler pulley 50 for the belt, the pulley serving to tension the belt and hold it in position. By means of this belt the operator is enabled to readily thread the machine without danger of injury to himself and without danger of injury to the soft rubber roll by feeding large masses or wads of paper into it.

What is claimed is:

1. The combination with the final press rolls and the initial drier roll of a paper-making machine, of a pair of smoothing rolls interposed between the said press and drier rolls and having their peripheral parts formed respectively of soft resilient rubber and of hard unyielding material, and a mechanism for pressing the rolls together when in operation to cause the last said roll to indent the first said roll and for separating them when not in operation to prevent injury to the rubber.

2. The combination with the final press rolls and the initial drier roll of a paper-making machine, of a pair of smoothing rolls interposed between the said press and drier rolls and having their peripheral parts formed respectively of soft resilient rubber and of hard unyielding material, means for pressing the rolls together to cause the last said roll to indent the first said roll, and means for rotating the rolls at the nip toward the press rolls, the said rolls being so positioned that the paper passes from the press rolls part way around one smoothing roll to the nip and from the nip part way around the other smoothing roll to the drier roll.

3. The combination with the final press rolls and the initial drier roll of a paper-making machine, of a pair of smoothing rolls interposed between the said press and drier rolls and normally engaging each other and means for rotating at the nip toward the press rolls, the peripheral part of the first smoothing roll around which the paper passes to the nip being formed of soft

resilient rubber and the peripheral part of the second smoothing roll around which the paper passes from the nip being formed of hard unyielding material whereby the second roll is enabled to indent the first.

4. The combination with the final press rolls and the initial drier roll of a paper-making machine, of a pair of smoothing rolls interposed between the said pressing and drier rolls and normally engaging each other and means for rotating the smoothing rolls at the nip toward the press rolls, the peripheral part of the upper smoothing roll over and around which the paper passes to the nip being formed of soft resilient rubber and the peripheral part of the lower smoothing roll around and under which the paper passes from the nip being formed of hard unyielding material whereby the second roll is enabled to indent the first.

5. The combination with the final press rolls and the initial drier roll of a paper-making machine, of a pair of smoothing rolls interposed between the said press and drier rolls and normally engaging each other and means for rotating the smoothing rolls at the nip toward the press rolls, the peripheral part of the first smoothing roll around which the paper passes to the nip being formed of soft resilient rubber and the peripheral part of the second smoothing roll around which the paper passes from the nip being formed of hard unyielding material whereby the second roll is enabled to indent the first, the said smoothing rolls being arranged with the first said roll engaging the wire side of the paper and with the second said roll engaging the felt side of the paper.

6. The combination with the final press rolls and the initial drier roll of a paper-making machine, of a pair of smoothing rolls interposed between the said press and drier rolls, one smoothing roll having its peripheral part formed of soft resilient rubber and the other smoothing roll having its peripheral part formed of hard unyielding material whereby the second said roll is enabled to indent the first, the smoothing roll around which the paper first passes being crowned.

7. The combination with the final press rolls and the initial drier roll of a paper-making machine, of a pair of smoothing rolls interposed between the said press and drier rolls, one smoothing roll around which the paper first passes being crowned and having its peripheral part formed of soft resilient rubber and the other smoothing roll around which the paper last passes having its peripheral part formed of hard unyielding material whereby the second roll is enabled to indent the first.

8. The combination with the final press rolls and the initial drier roll of a paper-making machine, of a pair of smoothing rolls

interposed between the said press and drier rolls, one smoothing roll around which the paper first passes being crowned and having its peripheral part formed of soft resilient rubber and the other smoothing roll around which the paper last passes having its peripheral part formed of hard unyielding material whereby the second roll is enabled to indent the first, the said smoothing rolls being arranged with the first said roll engaging the wire side of the paper and with the second said roll engaging the felt side of the paper.

9. The combination in a paper smoothing press, of a rotatable roll, fixed horizontal bearings for the roll, a second rotatable roll parallel to the first roll, horizontal bearings for the second roll movable toward and from the first said bearings, rods having connections with the movable bearings, automatically acting means for moving the rods in one direction to force the second roll against the first, and manually operable means for moving the rods in the other direction to move the second roll away from the first.

10. The combination in a paper smoothing press, of a rotatable roll, fixed horizontal bearings for the roll, a second rotatable roll parallel to the first roll, horizontal bearings for the second roll movable toward and from the first said bearings, rods having connections with the movable bearings, automatically acting means for moving the rods in one direction to force the second roll against the first, nuts threaded on the rods, and abutments adapted to be engaged by the nuts when turned, whereby the rods can be moved in the other direction to move the second roll away from the first roll.

11. The combination in a paper smoothing press, of a main frame, a roll rotatable in fixed horizontal bearings in the frame, a supplemental frame pivoted to the main frame at a horizontal axis parallel to the axis of the first said roll, a second roll parallel to the first roll and rotatable in horizontal bearings in the supplemental frame, and means tending to swing the supplemental frame and thereby force the second roll against the first roll.

12. The combination in a paper smoothing press, of a main frame, a lower roll rotatable in fixed horizontal bearings in the frame, a supplemental frame pivoted to the main frame at a horizontal axis parallel to the axis of the first said roll, an upper roll above and parallel to the lower roll and rotatable in horizontal bearings in the supplemental frame, rods connected to the supplemental frame and normally extending downward therefrom, automatically acting means for tensioning the rods to force the upper roll against the lower roll, and manually oper-

able means for pushing upward on the said rods to lift the supplemental frame and the upper roll away from the lower roll.

13. The combination in a paper smoothing press, of a main frame, a lower roll rotatable in fixed horizontal bearings in the frame, a supplemental frame pivoted to the main frame at a horizontal axis parallel to the axis of the first said roll, an upper roll above and parallel to the lower roll and rotatable in horizontal bearings in the supplemental frame, rods connected to the supplemental frame and normally extending downward therefrom but movable out of normal position, automatically acting means for tensioning the rods to force the upper roll against the lower roll, manually operable means for pushing upward on the said rods to lift the supplemental frame and the upper roll away from the lower roll, and a lock for holding the supplemental frame in elevated position to permit the removal of the lower roll.

14. The combination in a paper smoothing press, of two opposed rotatable rolls, and a threading belt adjacent one end of the rolls.

15. The combination in a paper smoothing press, of two opposed rotatable rolls, a pulley on one of the rolls, a threading belt extending over the said pulley, and an idler pulley for the said belt.

16. The combination with the final press

rolls and the initial drier roll of a paper-making machine, of a pair of smoothing rolls interposed between the said press and drier rolls; means for pressing the rolls together, means for rotating the rolls at the nip toward the press rolls, the rolls being so positioned that the paper passes from the press rolls part way around the upper smoothing roll to the nip and from the nip part way around the lower smoothing roll to the drier roll, and a threading belt adjacent one end of the lower roll and having its paper engaging surface moving toward the nip in the general direction of paper movement.

17. The combination in a smoothing press, of two opposed rotatable rolls around the upper of which the paper passes to the nip and around the lower of which the paper passes from the nip, a spring pressed doctor acting on the lower roll above the paper, and a crumb catcher carried by the doctor for preventing loose particles from falling onto the paper.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

HERMAN R. HARRIGAN.

Witnesses:

ARCHER G. DEAN,
C. STEWART LEE.