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DRIVE FOR PRESS ROLLS OR THE LIKE

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3 Sheets-Sheet 1

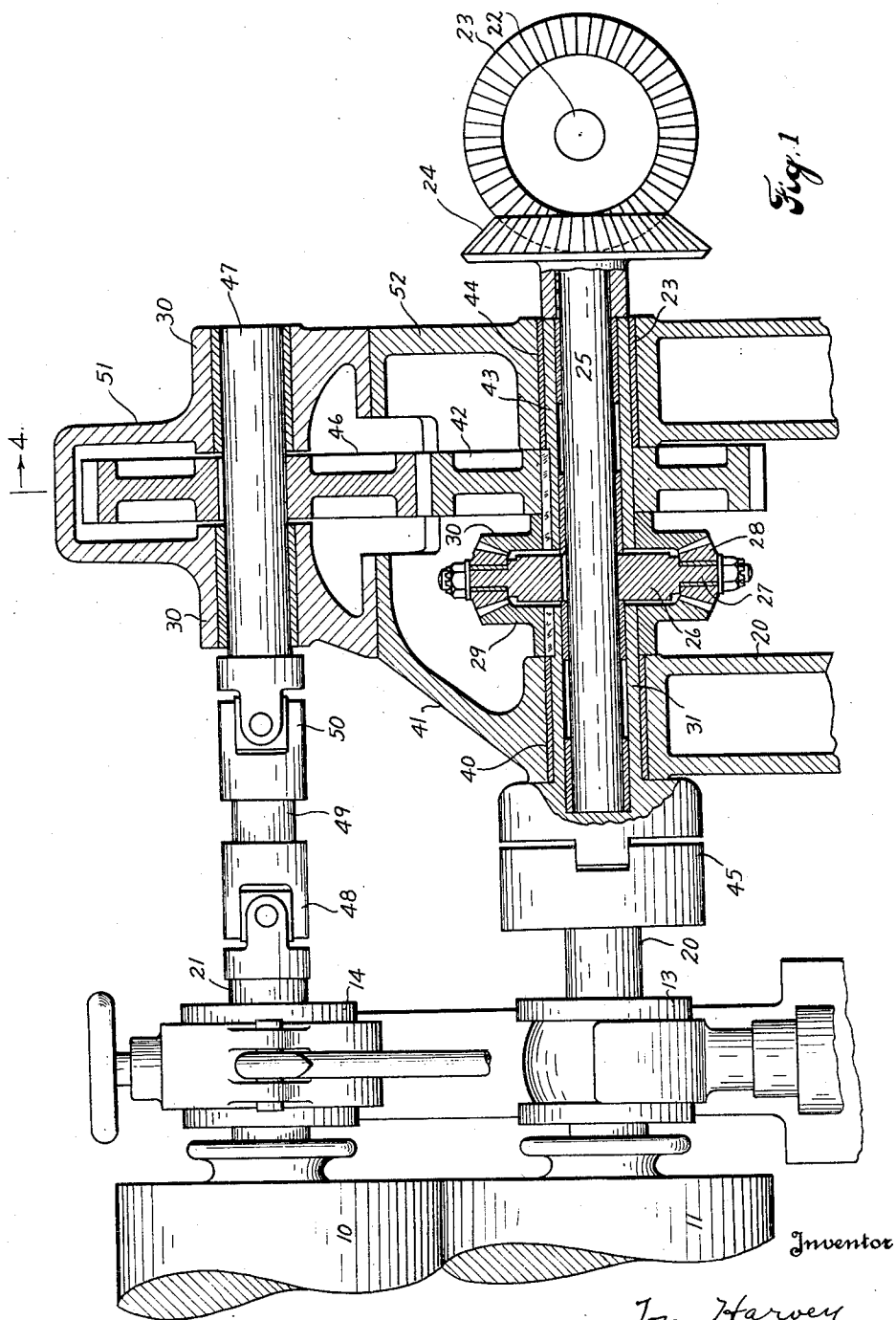


Fig. 1

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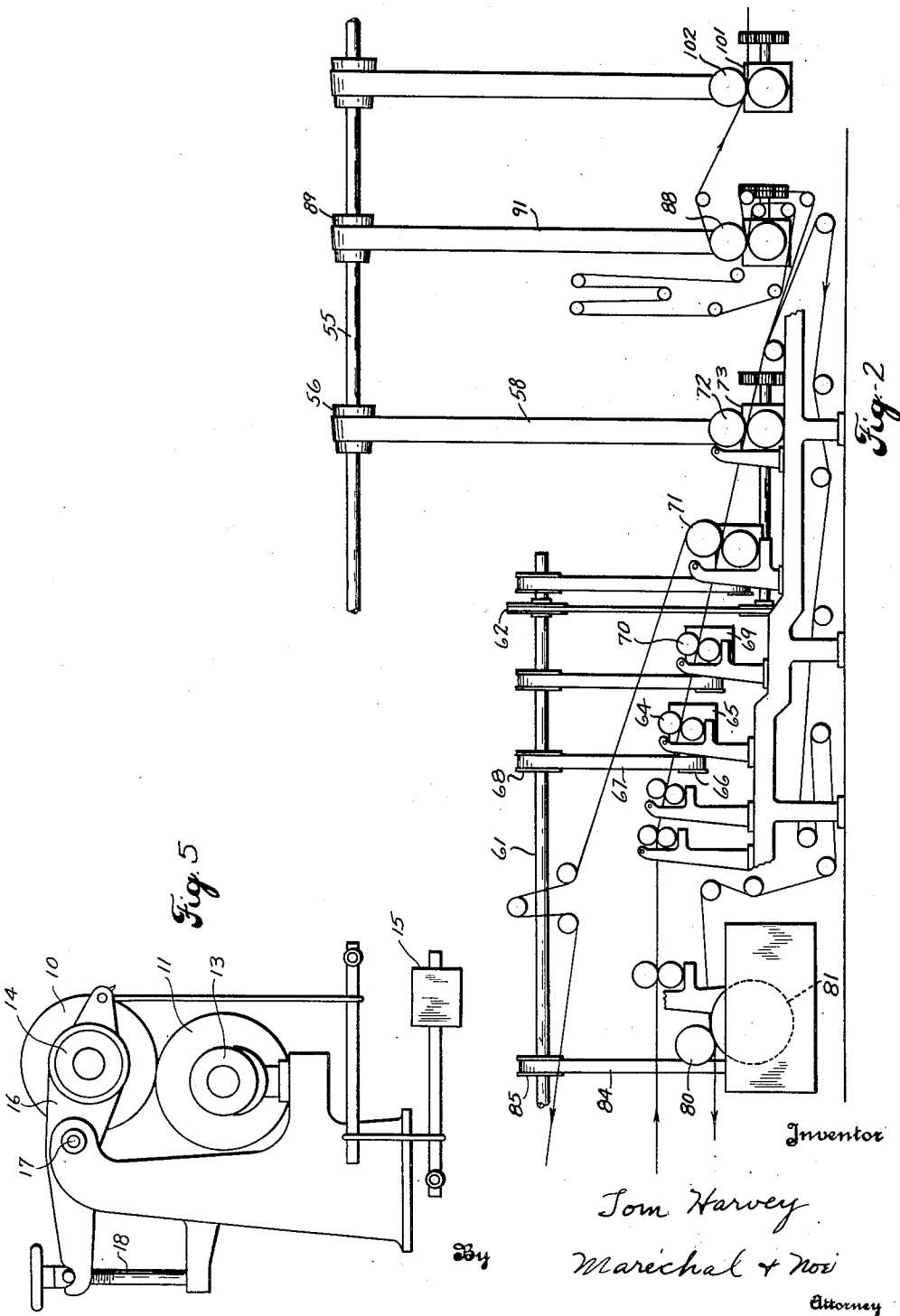
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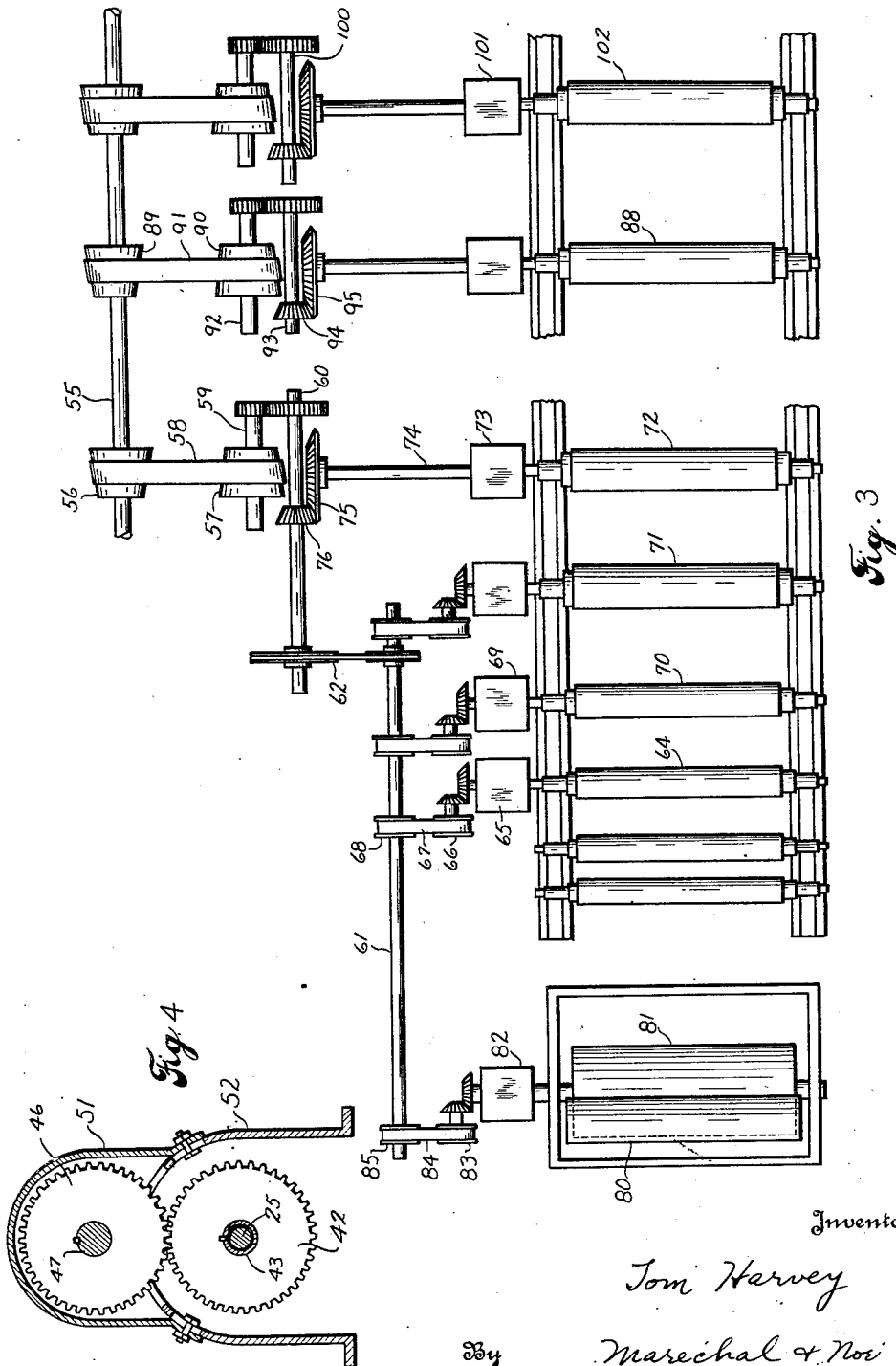
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UNITED STATES PATENT OFFICE

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DRIVE FOR PRESS ROLLS OR THE LIKE

Application filed April 17, 1931. Serial No. 530,793.

This invention relates to paper making machinery and the like, employing a pair of cooperating rolls which feed a web of material between them.

One object of the invention is the provision, in a paper making machine or the like, of a pair of cooperating rolls which feed a web of material between them, having differential driving means for supplying power equally to both rolls and driving them at the same peripheral speed, provision being made for supporting one of the rolls for bodily movement without affecting the drive for the rolls.

Another object of the invention is the provision of cooperating rolls of the character mentioned having a flexibly jointed connection between one of the rolls and differential driving gearing, the parts of the differential driving gearing being supported in a novel manner to provide constant mesh of the gears.

Another object of the invention is the provision of a paper making machine having a number of pairs of cooperating rolls which feed and squeeze a web of material between them, differential means being provided for driving the rolls of a pair at the same peripheral speed, the system incorporating means for varying the speed of one pair of rolls with respect to another pair for the proper coordination of the speed of the various pairs of rolls.

Other objects and advantages of the invention will be apparent from the following description, the appended claims and the accompanying drawings, in which—

Fig. 1 is a vertical section of a roll drive embodying the present invention;

Fig. 2 is a diagrammatic view of a paper making machine having differential driving means for a number of pairs of cooperating rolls all feeding a common paper web;

Fig. 3 is a plan view corresponding to Fig. 2;

Fig. 4 is a vertical section on the line 4—4 of Fig. 1; and

Fig. 5 is a detail view of one form of roll mounting.

Referring more particularly to the drawings, like numerals designating similar parts

in the various views, 10 and 11 designate a pair of rolls adapted to squeeze and feed a web of material between them. The invention as herein described is applied to a paper making machine although it is adapted to other uses. The roll 10 as shown in Fig. 1 is the upper roll and 11 is the lower roll of a baby press or main press. The rolls may also be smoothing rolls or the couch roll and cylinder mold, or other similar rolls of a paper making machine. Such rolls are adapted to feed and squeeze a web of material, such as a paper web guided between upper and lower felts, or carried on one side of a single felt. The material fed between the rolls might be merely a single layer of paper such as passes through the nip of the smoothing rolls.

In accordance with the present invention upper and lower rolls of the character referred to are driven through a differential device which supplies power equally to the two rolls and rotates them at the same peripheral speed. Heretofore, it has been the custom to drive the lower roll of a press while the upper roll acts as an idler, or the upper and lower rolls have been geared together so as to drive them both positively but at a speed which is dependent upon the pitch diameters of the gears. While the pitch diameters of the gears might agree approximately with the roll diameters, in practice exact correspondence of the roll diameters with the pitch diameters of the gears is almost unobtainable as the rolls wear down constantly and need to be resurfaced. Even when new, the deflection of a roll during operation renders the exact computation of the pitch diameters necessary to obtain equal peripheral speeds practically impossible. Two cooperating rolls operating at different peripheral speeds produces wear and pulling on the felts and produce a rubbing action between the felts and the paper, which is in a moist or partly formed condition and therefore more easily affected by any movement of it on the felt or by any rubbing movement or friction that obtains between the paper and the surface of a roll that it might be in direct contact with. An attempt has also been made to drive the two rolls of a paper making ma-

chine through a differential drive but this attempt has not proved practical as no provision was made for relative movements of the two rolls.

5 In accordance with the present invention the two rolls are relatively movable, the upper roll being preferably the one that is capable of movement so that it can move
10 bodily away from the lower roll when an unusually large mass of material must be passed between the rolls or when different thick-
15 nesses of paper web must be provided for. A differential driving means supplies power equally to the two rolls, the parts of the differential drive being held so as to provide for
constant mesh of the gears, while a flexible jointed connection is provided for driving
the upper or movable roll.

20 The provision of means for driving the two rolls at the same peripheral speed makes it possible to resurface the rolls if they should become worn without requiring any change
25 at all in the drive means. Deflection or bending of the rolls during operation need not be carefully calculated, and the differential
30 drive is adapted for operating pairs of rolls of various sizes at exactly the same peripheral speed. The rotation of the cooperating rolls at the same peripheral speed due to the supply
35 of power equally to them provides for long life of the felts as there is practically no friction or rubbing action between the surfaces of the felts and rolls. Neither roll furnishes all of the driving power which is supplied
40 equally to two rolls, so whatever small slip might be present between the felts and the rolls would be exactly equalized. Thus no rubbing action or slippage whatever obtains
45 between the felts and the paper web carried between them. The quality of the paper is therefore improved. When used on smoothing rolls, where the paper comes in direct contact
50 with the rolls between which it passes, the exact equalization of the driving power on both surfaces of the paper insures a minimum
of rubbing action or friction between the paper and the rolls and greatly improves the quality of the finished product. Heretofore the smoothing rolls would not operate
55 always at the same peripheral speed and therefore the upper or the lower surface of the paper was rubbed by the roll rendering the paper of unequal thickness and marring its finish. The moist paper fibres instead of being
pressed down firmly without rubbing action, as they should be, were roughened and
"up-ended" by the rubbing action.

A very important and quickly apparent advantage of the invention is the increase of life
60 given to the felts, as the invention has proved to very materially increase the life of the felts due to the fact that the slippage between the felts of the rolls is minimized and rendered practically negligible.

65 As shown in Fig. 1 the lower roll 11 is sup-

ported in a suitable bearing 13, a similar bearing being provided at the opposite end of the roll so as to mount the roll axis in definite position. The upper roll 10 is supported at
70 each end in a bearing 14 which is capable of movement to permit increase or decrease of distance between the roll axis and thus provide for the passage of an unusually large
75 quantity of material that often obtains at intervals in the operation of paper machines. The upper bearing 14 is controlled preferably by means of weights 15, see Fig. 5, adjustable
80 so that the proper predetermined normal amount of pressure can be obtained between the two rolls. These weights hold the bearing 14 down toward the bearing 13. The bearing 13 is mounted in the frame of the paper making machine, while bearing 14 at
85 each end of the upper roll is mounted in an arm 16 pivotally supported at 17 in the frame, an adjusting screw 18 or similar device being provided for raising the roll for felt replacement, repair, etc.

The roll shaft 20 which supports the lower roll 11 and the shaft 21 of the upper roll
90 10 are both driven from a suitable driving shaft such as shaft 22 through the differential gearing referred to. Shaft 22 carries a bevel gear 23 meshing with bevel gear 24 fixed on a shaft 25. Keyed to shaft 25 is an
95 arbor 26 in which are a plurality of studs 27 each rotatably supporting a bevel pinion 28. The bevel pinions mesh with two oppositely facing bevel gears 29 and 30, gear 29 being fixed on a sleeve 31, rotatably mounted
100 in a bearing 40 in housing 41 and serving as a support for the bearing in which the left-hand end of shaft 25 is mounted. Bevel gear 30 is fixed to a spur gear 42 rigid with sleeve 43 that turns in a bearing 44 in the housing
105 41 and that rotatably supports the right-hand end of shaft 25.

The supply of power from shaft 22 to the two bevel gears 29 and 30 is divided by the
110 bevel pinions 28 which may drive the bevel gears at equal speeds or which may rotate on their studs 27 and drive the bevel gears at different speeds. Gear 29 is connected positively through sleeve 31 and jaw clutch
115 45 to the roll shaft 20, while gear 30 is connected positively through gear 42, gear 46 meshing therewith and shaft 47 to the upper roll shaft 21.

When the pitch diameters of gears 42 and 46 correspond to the roll diameters of rolls
120 11 and 10 respectively, the pinions 28 do not rotate on the pinion studs, but if the diameters of the rolls 10 and 11 are not in accordance with the pitch diameters of the gears the bevel pinions rotate on their axes
125 as they move bodily about the axis of the shaft 25, the result being that the power is supplied equally to the two rolls. Equal supply of power, of course, causes the two
130 rolls to be driven at the same peripheral

speed as they both operate similarly on the moving web of paper or paper and felt. The rotation of the two rolls at the same peripheral speed feeds and squeezes the web of paper or the felts and paper so that whatever friction or relative slipping action between the rolls and the web of material is present is equalized on the upper and lower surfaces of the material passing between the rolls. A web of paper carried between two felts is therefore not affected at all as there would be no rubbing or slipping between the paper web and the inner felt surfaces. The wear on the outer surfaces of the felt is minimized because whatever slippage is present is exactly divided between the upper surface of the upper felt and the lower surface of the lower felt and neither felt is required to assume all of the wear.

The upper roll shaft 21 is connected to the shaft 47 of gear 46 in a flexibly jointed manner, being connected by universal joint 48 to a short shaft 49 which in turn is connected by universal joint 50 to the end of shaft 47. This permits vertical movement of the roll 10 while the axis of the shaft 47 remains fixed during operation so that meshing engagement of the gearing is not affected when the upper roll moves.

The enclosing housing 41 for the differential driving means preferably encloses the gears 46, 42, 29, 30 and 28 which may therefore operate in oil. The upper part of this housing is preferably a support 51 mounted adjustably on the lower housing portion 52, the upper surface of housing portion 52 being cylindrically curved and the lower side of support 51 being curved correspondingly. The center of curvature coincides with the axis of shaft 25 so that the support 51 may be swung to the right or left as viewed in Fig. 4 while maintaining constant mesh between the gears 42 and 46. The bearings for shaft 47 and bearings 40 and 44 for the lower shafts are therefore always fixed a definite distance apart so that the gears mesh constantly, although the upper gear 46 may be moved to the right or left to accommodate a pair of rolls that may not be arranged exactly vertically one over the other. The couch roll and cylinder mold for example are ordinarily arranged so that their centers do not lie vertically one over the other, and the adjustment provided in the support 51 permits the axis of the shaft 46 to be approximately arranged in alignment with the axis of the upper roll.

The differential roll drive can be applied to a single pair of rolls of a paper making machine, but is preferably applied to several pairs of rolls. Figs. 2 and 3 show a preferred arrangement for driving the felts and paper web of a paper forming machine having one or more cylinder molds, baby press rolls, first and second main presses, and smoothing rolls,

other rolls such as calender rolls and additional presses being provided if desired. The several rolls of the machine are preferably driven from a common line shaft 55. Power is supplied to the first section of the paper forming machine including the cylinder mold, baby press rolls and first main press, by means of tapered pulleys 56 and 57 and a belt 58 which drives jack shaft 61 through shafts 59 and 60 at a speed which is determined by the adjustable belt and the tapered pulleys. Jack shaft 61 operates the several driven roll pairs of this machine section at relatively variable speeds so that the speed of one pair of rolls can be coordinated with shrinkage or stretching as the web of material moves from one pair of rolls to an adjacent pair of rolls. Thus as shown the shaft 60 and jack shaft 61 are connected through a suitable sprocket and chain connection 62 or the like. The jack shaft 61 is connected to the several driven rolls by means of belts and pulleys, each belt being so arranged that the belt slippage can be adjusted by movement of an idler pulley or the like under the control of the operator. The third baby press roll 64, as shown, is driven through a differential driving connection corresponding to the construction shown in Fig. 1 and designated generally 65, power being supplied to the differential drive by means of the pulley 66 operated by belt 67 from pulley 68, belt 67 being controllable to regulate slippage, as previously mentioned. A similar drive is provided through the differential drive device 69 for the fourth baby press roll 70. The fifth baby press roll 71 is similarly driven. The first main press 72 is operated through the differential drive 73, power being supplied from shaft 74 (corresponding to shaft 25 of Fig. 1), bevel gear 75, bevel pinion 76 and shaft 60. The speed of operation of the first main press 72 is controllable, as all of the rolls may be speeded up or slowed down by the control of the tapered pulleys and the belt which operates from the line shaft so as to coordinate this section of the machine with adjacent sections, and the speeds of the other rolls may be governed to properly coordinate all of them with the speed of the first main press. The couch roll 80 and cylinder mold 81 are driven by another similar differential drive designated generally 82 from pulley 83, belt 84, pulley 85 and jack shaft 61. A second and third cylinder mold and couch roll could also be provided, operated by similar differential driving devices from the jack shaft 61.

The second section of the machine, embodying the second main press 88, and any additional associated rolls, is driven from the line shaft 55 by means of the tapered pulleys 89 and 90 and the adjustable belt 91. These devices drive shaft 92 geared to shaft 93 which is connected directly by bevel gears 94

and 95 to the shaft of the differential driving device similar to the construction heretofore described. This differential drive operates the upper and lower rolls of the second press and of course supplies power equally to the two rolls. It will be apparent that the speed of operation of the second press may be properly coordinated with the speed of the first section of the paper making machine.

The line shaft 55 also operates a jack shaft 100 which is connected in a manner previously described to the differential driving device 101 which operates the smoothing rolls 102. These smoothing rolls press and feed the paper web only between them. As the smoothing rolls are driven at exactly the same peripheral speed any slippage of the paper with relation to the rolls is minimized and divided equally on both sides of the paper so that the paper will not be roughened or rendered uneven in thickness. However, when drives of this character are supplied to the couch rolls, baby presses, main presses, etc., there will be practically no slippage between any of the rolls and the felts or between the paper web and any of the rolls, as each pair of cooperating driven rolls supplies only a comparatively small amount of power to the entire drive, the result being the practically complete elimination of any slippage anywhere with respect to the felts and the paper web. The life of the felts is therefore very substantially increased and the quality of the product materially improved. As the rolls become worn they can be resurfaced and their diameters changed, without affecting the differential drives and without requiring any changes in the gears of the various differential drives.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In a paper making machine of the class described, in combination, two rotary rolls adapted to squeeze and feed a web of material between them, differential driving means for applying power equally to both said rolls and positively drive them at the same peripheral speed, fixed bearings for the parts of the differential driving means maintaining the axes thereof in definite predetermined positions, movable bearings for at least one of said rolls, means for adjusting said movable bearings to effect the maintaining of a predetermined pressure between the said rolls in operation, and a flexibly jointed driving connection from said differential driving means to the roll having mov-

able bearings and extending between said movable roll bearing and one of the fixed bearings of the driving means.

2. In a paper making machine of the class described, in combination, two rotary rolls adapted to squeeze and feed webs of paper and felt between them, a driving shaft, a driven gear positively driving one of said rolls, a driving gear meshing with said driven gear, bearings for said driving and driven gears holding them in constant mesh with their axes fixed a definite predetermined distance apart, movable bearings for said one roll and fixed bearings for the other roll, means for pivotally supporting said movable bearings and means for adjusting the pivotal support to effect the maintaining of a predetermined pressure between the said rolls in operation, a flexibly jointed driving connection between said driven gear and said one roll and extending between the bearing of said driven gear and a movable bearing of said one roll and providing for motion of the roll axis while the axis of the driven gear remains fixed, and a differential gear drive for positively rotating said driving gear and one of said rolls from said driving shaft and applying power equally to both said rolls so they rotate at the same peripheral speed.

3. In a paper making machine of the class described, in combination, two rotary rolls adapted to squeeze and feed a web of material between them, differential driving means for applying power equally to both said rolls and positively drive them at the same peripheral speed, fixed bearings for the parts of the differential driving means maintaining the axes thereof in definite predetermined positions, movable bearings for at least one of said rolls, a support for said movable bearings that is pivotally mounted about an axis laterally spaced from the roll axis with means for adjusting said support to effect the maintaining of a predetermined pressure between the said rolls in operation, and a flexibly jointed driving connection from said differential driving means to the roll having movable bearings and extending between said movable roll bearing and one of the fixed bearings of the driving means.

4. In a paper making machine of the class described, in combination, two rotary rolls adapted to squeeze and feed a web of material between them, differential driving means for applying power equally to both said rolls and positively drive them at the same peripheral speed, fixed bearings for the parts of the differential driving means maintaining the axes thereof in definite predetermined positions, movable bearings for at least one of said rolls, means for adjusting said movable bearings to effect the maintaining of a predetermined pressure between the said rolls in operation, a stationary housing entirely enclosing said differential driving means and sup-

porting its said bearings, and a flexibly jointed driving connection from said differential driving means to the roll having movable bearings and extending between said movable roll bearing and one of the fixed bearings of the driving means.

5. In a paper making machine of the class described, in combination, two rotary rolls adapted to squeeze and feed webs of paper and felt between them, a driving shaft, a driven gear positively driving one of said rolls, a driving gear meshing with said driven gear, bearings for said driving and driven gears, a first bearing supporting section fixedly supporting the bearing for said driving gear, a second bearing supporting section fixedly supporting the bearing for said driven gear, means for adjustably fixing one of said sections on the other but always holding the driving and driven gears in constant mesh with their axes fixed a definite predetermined distance apart, movable bearings for said one roll and fixed bearings for the other roll, means for pivotally supporting said movable bearings and means for adjusting the pivotal support to effect the maintaining of a predetermined pressure between the said rolls in operation, a flexibly jointed driving connection between said driven gear and said one roll and extending between the bearing of said driven gear and a movable bearing of said one roll and providing for motion of the roll axis while the axis of the driven gear remains fixed, and a differential gear drive for positively rotating said driving gear and one of said rolls from said driving shaft and applying power equally to both said rolls so they rotate at the same peripheral speed.

In testimony whereof I hereto affix my signature.

TOM HARVEY.