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DRIVING MECHANISM FOR PAPER MAKING MACHINES

Filed May 23, 1925 2 Sheets-Sheet 1

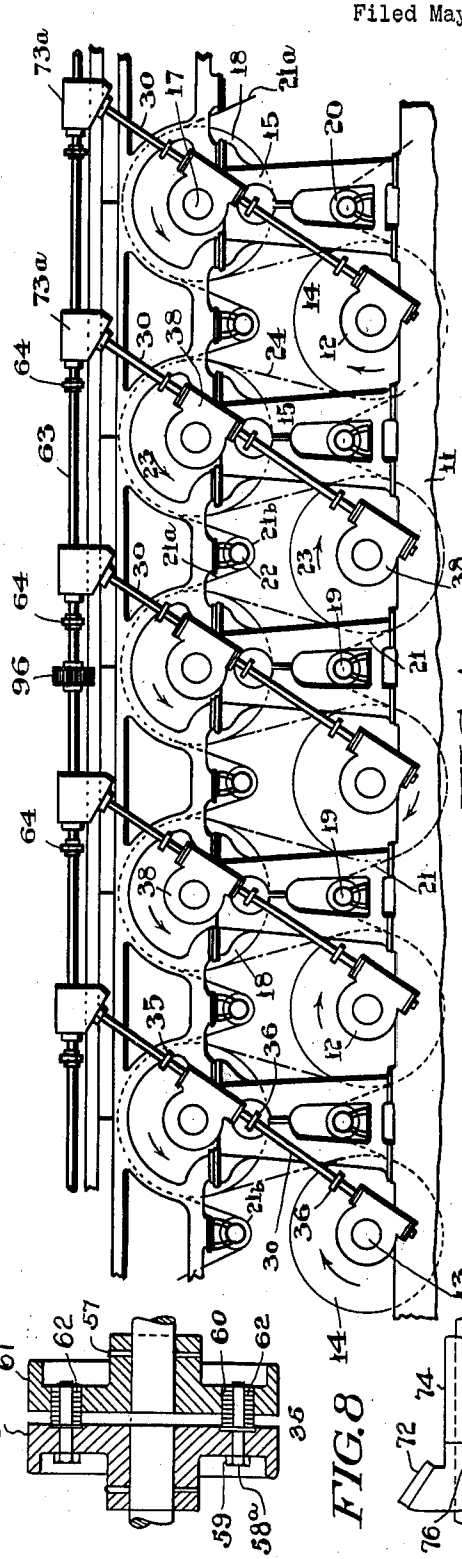


FIG. 1

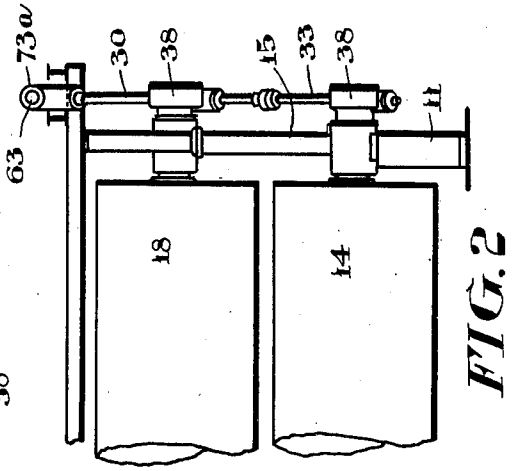


FIG. 2

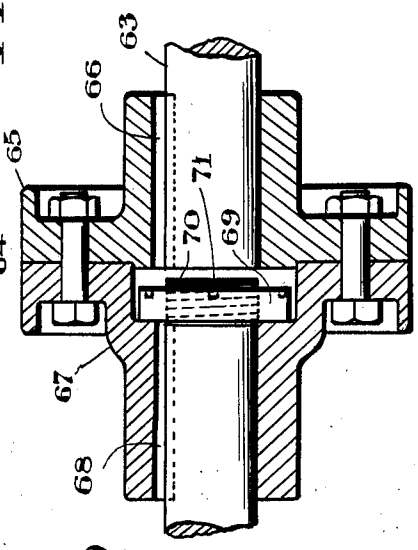


FIG. 7

FIG. 8

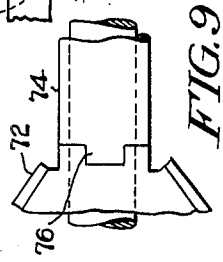


FIG. 9

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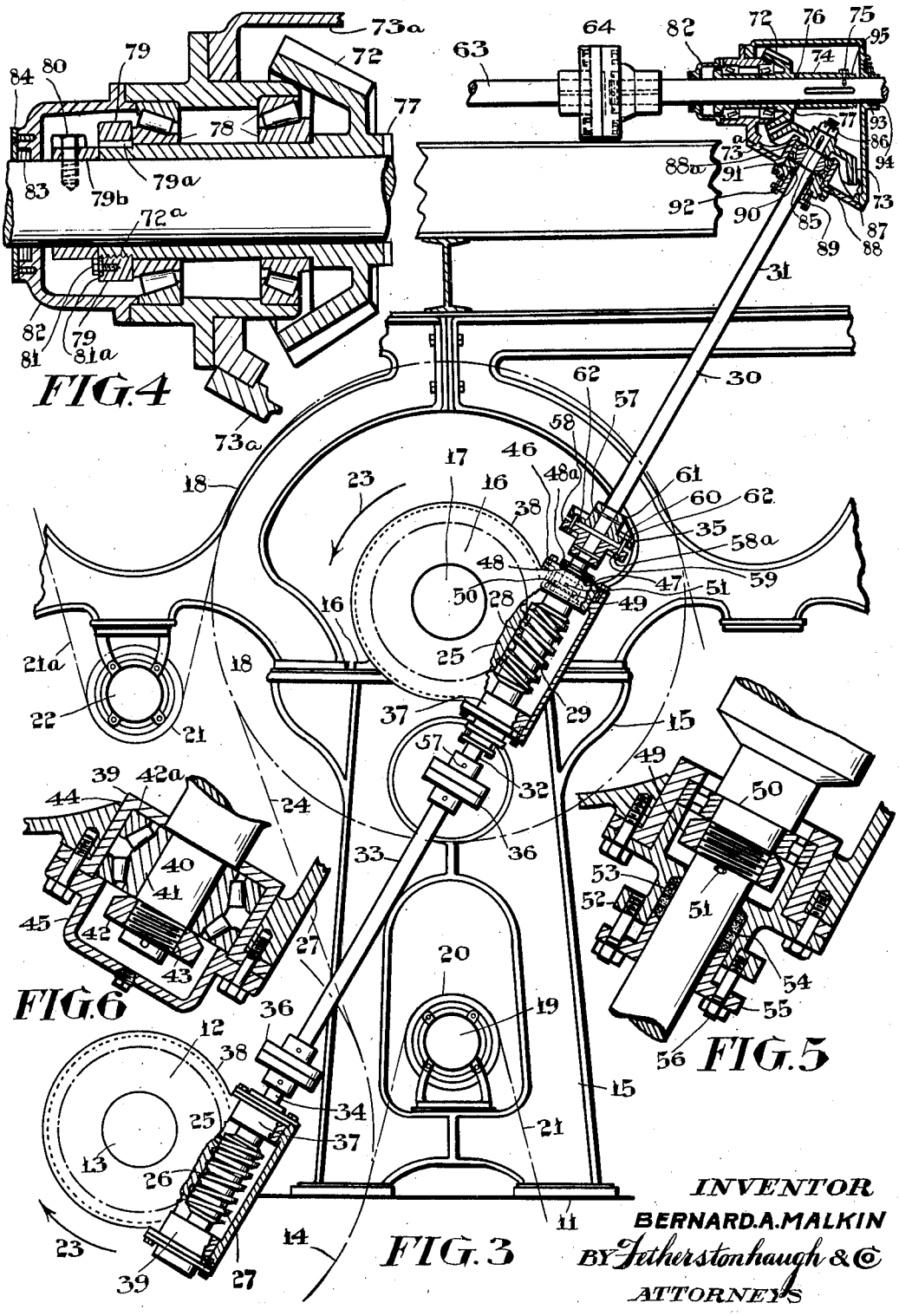


FIG. 4

FIG. 6

FIG. 5

FIG. 3

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UNITED STATES PATENT OFFICE.

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DRIVING MECHANISM FOR PAPER-MAKING MACHINES.

Application filed May 23, 1925. Serial No. 32,404.

This invention relates to new and useful improvements in driving gears for paper making machines and the like and the object of the invention is to provide a simple and efficient driving means of the class stated which will allow easy access to all parts of the machine for repairs, oiling and adjustments.

Another object is to provide a driving gear which will be easily erected and which will ensure an even drive of the machine throughout the entire length of same.

A further object is to provide a device of the class stated in which allowance will be made for the expansion of the working parts of the machine from its starting condition to its working condition.

A still further object is to provide a drive of the class stated in which means will be provided to absorb any end thrust which will be exerted by the gear transmitting the driving power.

A still further object is to provide a totally enclosed gear drive which will allow all running parts of the mechanism to run in a perfect circulation of lubricant.

A still further object is to provide a perfectly balanced drive between the rolls of the machine.

A still further object is to provide a drive of the class stated in which the number of longitudinal driving shafts is reduced to a minimum.

Other advantages will be apparent to persons familiar with this art from the following description.

In my invention I provide a longitudinal sectional main driving shaft which is driven from a source (not shown) but preferably midway between the ends of the shaft. Driven by bevel gearing are the drier roll driving spindles which are provided with worms which engage with worm wheels secured to the ends of the drier roll spindles. Each spindle is adapted to drive two or more drier rolls positioned at different levels and is arranged at an angle to the horizontally disposed main driving shaft. The worm and worm wheel and bevel gearing are enclosed in gear cases which have antifriction bearings or thrust bearings fitted therein to take up any unevenness which may occur in the drive through any inadvertence such as the breaking of the paper sheet, or felts or such like contingencies. All shafting is provided with means to allow for expansion of the parts due to the variations in temperature which occur in machines of this class.

In the drawings:—

Figure 1 is a partial side elevation of a paper machine showing my improved driving means.

Figure 2 is a partial elevation of the device shown in Figure 1.

Figure 3 is an enlarged side elevation of one section of the driving mechanism.

Figure 4 is an enlarged sectional elevation of the bevel gearing and housing on the main driving shaft.

Figure 5 is an enlarged sectional detail of the antifriction bearings mounted in the worm gear casings.

Figure 6 is an enlarged sectional detail of the end thrust bearing in the lowermost worm gear casing.

Figure 7 is an enlarged sectional detail of one of the main driving shaft couplings.

Figure 8 is an enlarged sectional elevation of the expansion couplings on the roll driving spindles.

Figure 9 is a side elevation showing the clutch teeth.

Referring more particularly to the drawings which show a machine having two rows of drier rolls, 11 designates the underframing upon which are secured the bearings 12 for the lower drying roll spindles 13 supporting and rotating with the drier rolls 14. Also mounted on the lower framing or support are the upper drying roll bearing supports 15 upon which are mounted the bearings 16 supporting the spindles 17 to which are secured the upper drying rolls 18. The rolls are arranged in the usual manner that is, the lower rolls are spaced below and midway between the upper drying rolls. Between each pair of lower drying rolls and mounted in suitable bearings 19 secured to the supports 15 are the rotatably mounted guide rolls 20 for the lower drier felt 21 which passes around the underside of the rolls 14 and over the guide rolls 20. The upper drier felt 21^a passes over the drier rolls 18 and under the guide rolls 21^b, spaced between the drier rolls 18 and rotatably mounted in suitable bearings 22, secured to the lower side of the guide roll frame secured to the supports 15.

The movement of the paper through the machine is from right to left and the rotation of the drier rolls is indicated by the

arrows 23. The paper sheet is indicated by the chain dotted line 24, and its location is between the felt and the drier rolls, passing alternately under the lower and over the upper rolls from one end of the machine to the other. Secured to one end of each of the drier roll spindles are the worm wheels 25, the lower ones having teeth 26 adapted to engage with the right handed threaded worms 27 while the upper worm wheels are provided with teeth 28 formed to engage with the left handed threaded worms 29. Both worms of each set are mounted on one side of the worm wheels and may be made integral with or secured to the roll driving spindles 30 which are built in sections to simplify erection, machining and handling and also to allow joints to be made therein for expansion due to the high temperatures used in drying the paper while the machine is working. In the illustration shown the spindles 30 are made in four sections 31, 32, 33 and 34 connected together by means of three couplings 35 and 36, the couplings 35 being of the flexible type to allow for expansion of the spindles. The spindles are mounted in antifriction bearings 37 secured to the casings 38 surrounding the worm wheel and worm. The casings may be secured to the bearings supporting the rolls in any suitable manner and may be supplied with lubricant from said bearing. This is only an erection detail which has been mentioned but not shown in detail as it is common practice to mount casings in any of the aforementioned ways according to the scope, space or any other determining factor known to the designer of a machine of this class. The lowermost bearing 39 may be of the double conical roller type mounted on a reduced portion 40 of the spindle with the smaller race 41 held in place by means of the nut 42 engaging with the threaded portion 43 of the spindle. The upper races 42[a] may be mounted in antifriction bearing housings 44 and held in place by the caps 45 secured to the housings and the casings, and adapted to form a seal to prevent leakage of oil from same.

The uppermost antifriction bearings of each casing may be held in place by means of the glands 46 which may be provided with recesses 47 for sealing rings or asbestos packing 48 which may be held in said recesses by the plates 48[a] secured to the gland. Nuts 49 hold the bearings against shoulders 50 formed in the spindles and cotters 51 may be provided to prevent movement of the nuts. The lower portions of the upper casings may be provided with double glands, one portion 52 of each gland holding the antifriction bearing in position and provided with recesses 53 for a sealing medium such as the asbestos rings 54, which are held in position by the portion 55 which is adjustably secured to the portion 52 by means of the studs 56. The couplings 35 and 36 are secured to the spindles by means of cotters 57. To allow for expansion, one half 58 of each coupling 35 is provided with outwardly projecting studs 58[a] secured thereto by means of the nuts 59. The studs project into apertures 60 formed in the other half 61 of the coupling. Said apertures may be made larger in diameter than the projecting portion of the studs and the space between them may be filled with a number of resilient washers 62 made of leather or such like material. The ends of the sections of the spindles may be spaced from one another and the adjacent faces of the couplings may also be spaced from one another to allow for longitudinal expansion of the spindle sections. The main driving shaft 63 which is mounted above the level of the upper surfaces of the rolls is made up of a plurality of sections joined together by means of suitable couplings 64 such as are shown in Figure 7, each section being provided with means to drive one of the roll driving spindles 30. One half 65 of each of the couplings is secured to one end of each of the sections by means of the key 66 while the other half 67 is secured to the end of the adjacent section by means of the key 68.

To hold the key 68 in position the half 67 of the coupling is recessed to receive a nut 69 which is held in position on a reduced end portion 70 of each section by means of the cotter pin 71.

The driving shaft is horizontally disposed and the roll driving spindles are angularly disposed to the axis of the main driving shaft and project downwardly therefrom. The driving connection between the shafts comprises the bevel gears 72 and 73 secured to the driving shaft 63 and spindles 30 respectively. Both gears are enclosed in the casings 73[a]. Keyed to each of the sections of the main driving shaft and within the casings are the sleeves 74 held in place by means of the screws 75. Each sleeve is provided with clutch teeth 76 at one end adapted to engage with clutch teeth formed in perpendicular faces 77 of the bevel wheels 72. The bevel wheels 72 are mounted on antifriction bearings 78 of the double conical roller type to take up any side thrust which occurs during the working of the machine. The antifriction bearings are held in place by threaded nuts 79 which engage the screw threads formed in the bosses 72[a] of the bevel wheels and the nuts are held from rotation on the bevel wheels by means of the keys 79[a] and locked thereon by means of the screws 81 which hold locking pawls 81[a] in contact with the threads to prevent movement of the nut. At one portion only in the length of the

main driving shaft a collar 79b is provided to centralize the shaft and to allow expansion of same towards both ends of the machine. The collar 79b may be secured to the main driving shaft by means of the screws 80. Sealing caps 82 may be provided at the end of each bearing, said caps being adapted to hold the end roller races in position. The caps are each provided with a recess for sealing rings 83 which are held in place by the plates 84, the said plates being secured to the caps by any suitable means. The bevel wheels 73 are secured by keys 85 and are held in place by means of the nuts 86 on the end of the shaft 30. The faces 87 of the bevel wheels 73 butt against the antifriction bearings 88a, which are also of the double conical roller type, to take up the end thrust which occurs in the bevel drives. The antifriction bearings are held in place by means of the double glands, one portion 88 of each of which holds the adjacent antifriction bearing in position while the other portion 89 is adapted to hold the sealing rings 90 in the recesses 91 formed in the portion 88 and surrounding the shaft 30. The portions 89 are adjustably secured to the portions 88 by means of the studs 92 while the portion 88 is secured by any suitable means to the casing. Packing rings 93 may also be placed in the recesses 94 formed in the casing to seal it. Ridges 95 may be formed in the sleeve to assist in circulating the lubricant in the casings.

In the drawings I have shown a paper making machine with only two rows of drying rolls but it will be readily understood that machines with three or even any amount of rows of drier rolls may be made in such a manner that each roll driving spindle may be adapted to drive one roll of each row by connecting it in the manner shown, that is a bevel gearing connection between the main driving shaft and the spindles, and worm and worm wheel connection between the spindles and the drier rolls. It will also be readily understood that when the drier rolls are positioned one above the other, the roll driving spindles may be placed at right angles to the main driving shaft and the worm and worm wheels may be made right hand or left hand according to the direction of rotation required. When the roll driving spindles are placed at right angles to the main driving shaft in the class of machine illustrated, the spindles may be positioned between the centres of the drier rolls and the worm and worm wheels may all be made right hand or left hand. The modifications herein mentioned but not illustrated are only illustrative of the many such modifications which may be made without departing from the spirit of the invention.

In the drawing and description, the driving spindles 30 are shown as driven from an overhead shaft, but it will be readily understood that the position of this shaft may be modified to suit clearances and any other requirements. The main driving shaft may be driven from a source not shown which will engage with the spur gear 96 positioned preferably between the extreme ends of the shaft. In operation heat is supplied to the drying rolls and the paper sheet is passed through the machine in the well known manner.

To rotate the rolls the longitudinal main driving shaft is rotated, which drives the bevel gearing which operates the inclined spindles each of which drives a pair of the drying rolls or cylinders through the medium of worms and worm wheels. It will be easily understood that there is practically no end thrust due to the horizontal forces exerted by the worm wheels on the worms, as one worm of each spindle is made right hand while the other is made left hand, thus balancing each other and assisting in holding the worms in their desired position that is in mesh with their respective worm wheels. This arrangement also ensures a perfect relationship between the upper and lower rolls and assists in preventing breakages in the paper sheet as it passes through the machine a feature which is very much desired. Another feature in drives such as is herein disclosed is that there is no obstruction which will impede or obstruct inspection of the machine, repairs, oiling, or leading the paper through the machine should a breakage occur.

All parts of the gearing are running in enclosed oil tight casings which ensure perfect lubrication of the working parts of the machine. The shaft and spindles are mounted on antifriction bearings and conical roller bearings absorb the thrust due to the driving forces resultant from the bevel drive and also due to the weight of the spindles. The couplings in spindles also ensure that no binding will occur in the gears as allowance has been made to let the spindles expand in their longitudinal direction when the temperature of the machine rises, due to the excessive heat required to dry the paper. The longitudinal main driving shaft is mounted clear of the drier rolls to allow free access to the machine parts.

The bevel wheels are rotatably mounted on the main driving shaft and are driven through the medium of the sleeves, the clutch teeth of which engage with the clutch teeth formed in the face of the bevel wheels. This construction allows expansion of the main driving shaft in its longitudinal direction without interfering with the position of the bevel wheels.

It will be seen that the construction of

the machine is very simple and easy to erect and everything connected therewith conduces towards increasing the life of the machine parts and reducing the maintenance cost of same.

Having thus described my invention, what I claim is:—

1. In a paper making machine having a frame and rows of drier rolls rotatably mounted in bearing thereon, a main driving shaft, a plurality of roll driving spindles, each spindle being adapted to drive a plurality of drier rolls one on each row bevel gears to transmit motion between the roll driving spindles and the main shaft, and worm and worm gearing to transmit motion between the roll driving spindles and the rolls.

2. In a paper making machine having a frame and drier rolls rotatably mounted thereon, a main driving shaft, a plurality of roll driving spindles, each spindle being adapted to drive a pair of rolls, bevel gearing to transmit motion between the main driving shaft and the spindles and coacting with correspondingly toothed worm wheels to transmit motion between the spindles and the drier rolls.

3. In a paper making machine having a frame and rows of drier rolls rotatably mounted thereon, a main driving shaft, a plurality of rolls driving spindles angularly disposed to the main driving shaft, and each adapted to drive one roll on each row bevel gearing between the ends of said spindles and the main driving shaft and oppositely threaded worms on each of said spindles adapted to gear with correspondingly toothed worm wheels to transmit motion between the spindles and the rolls.

4. In a paper making machine having a frame and drier rolls rotatably mounted in bearings thereon, a main driving shaft mounted on said frame above the level of the uppermost surfaces of the drier rolls, a plurality of roll driving spindles angularly disposed to the main driving shaft, each spindle being adapted to drive a pair of drier rolls, a pair of threaded worms formed in each of said spindles and tooth worm wheels engaging said worms to transmit motion to the drier rolls.

5. A device according to claim 4 having the main driving shaft built in sections, coupled together by couplings adapted to allow expansion of the shaft sections in their longitudinal direction, each section being adapted to drive one of the roll driving spindles.

6. In a paper making machine having a frame and a double row of rolls rotatably mounted in bearings on said frame, a sectional main driving shaft mounted on said frame above the level of the uppermost surfaces of the rolls, couplings connecting each of said sections, a plurality of roll driving spindles angularly disposed to the main driving shaft and adapted to transmit motion to one roll of each row of rolls, bevel gearing between the main driving shaft and said spindles, and a pair of threaded worms secured to said spindles and adapted to engage with toothed gear wheels to transmit motion to the drier rolls.

7. A device according to claim 6 in which each of said spindles is built in sections coupled together with couplings to allow the spindles to expand in their longitudinal direction without interfering with the gear centers.

8. In a paper making machine having a frame, a row of upper drier rolls, a row of lower drier rolls, each set of rolls being attached to roll bearing shafts rotatably mounted in suitable bearings in said frame, a main driving shaft rotatably mounted in said frame above the level of the upper rolls, said main driving shaft being built in sections with couplings to allow each section to expand in its longitudinal direction, a plurality of roll driving spindles angularly disposed to the main driving shaft and adapted to transmit motion to one upper and one lower roll, bevel gears rotatably mounted on the main driving shaft, and provided with clutch teeth, sleeves secured to the main driving shaft and provided with clutch teeth adapted to engage with the bevel clutch teeth, bevel wheels on the end of each of the spindles and meshing with the main shaft bevels, a pair of oppositely threaded worms mounted on said spindles, and worm wheels secured to the roll shaft and gearing with said worms to transmit rotary motion to the rolls.

9. A paper making machine according to claim 8 having all sets of gearing mounted in oil tight casings and means within the casings to absorb shock due to the thrust of said gears during operation of same.

10. A paper making machine according to claim 8 having means to allow expansion of the shaft and spindles in their longitudinal direction, without interfering with the centers of the gears, and means to take up the thrust due to the bevel gears and weight of the spindles.

11. In a machine of the class stated a main driving shaft, bevel wheels rotatably mounted on said shaft, clutch teeth formed in the bevels, a sleeve secured to said shaft, clutch teeth formed in one end of said sleeve, and engaging with the bevel clutch teeth and means to position the bevel wheels on the shaft.

In witness whereof, I have hereunto set my hand.

BERNARD A. MALKIN.