Aug. 21, 1934. R. CARPENTER 1,971,296

PULP AND PAPER MAKING MACHINE

Filed July 18, 1932 6 Sheets-Sheet 1

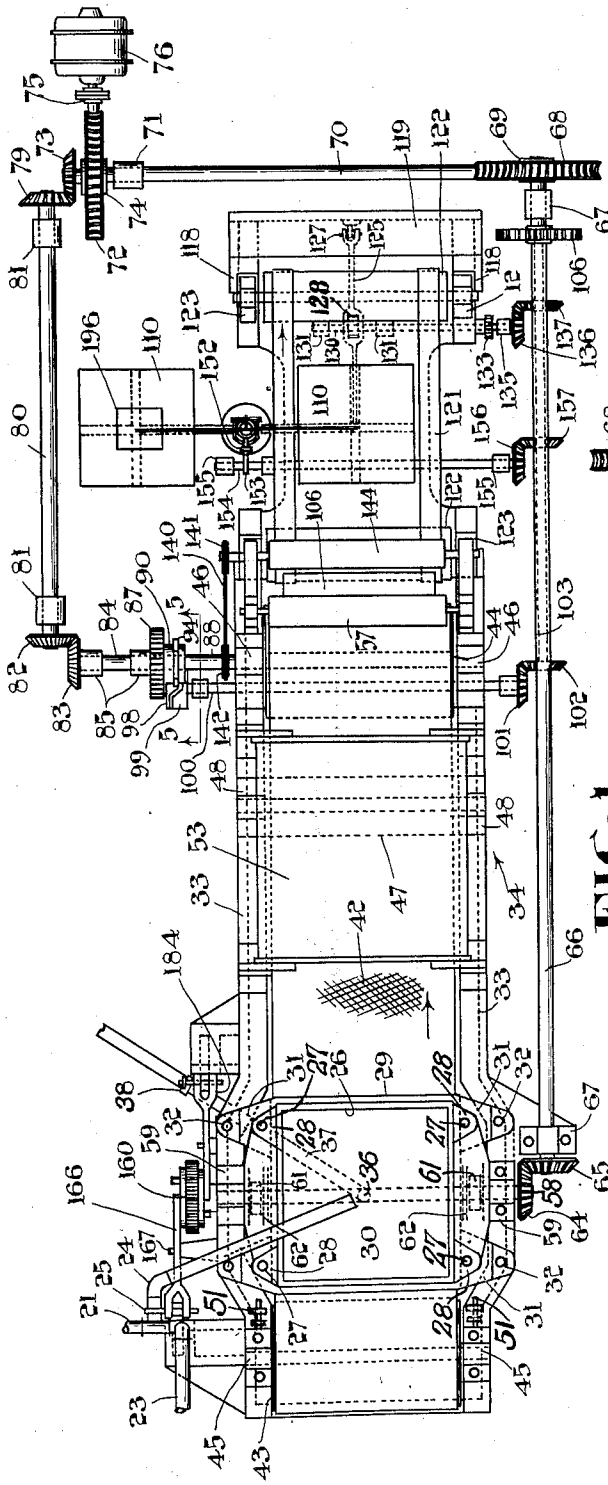


FIG. 1

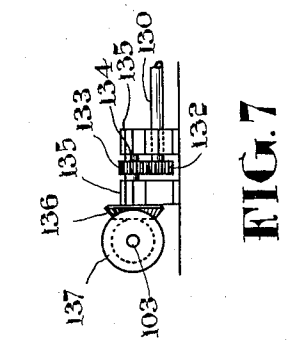


FIG. 7

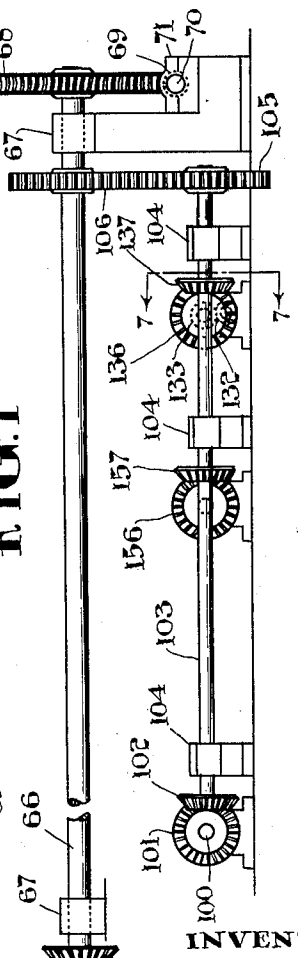


FIG. 6

INVENTOR
RUSSELL CARPENTER
BY J. D. O'Connell
ATTORNEY

Aug. 21, 1934. R. CARPENTER 1,971,296

PULP AND PAPER MAKING MACHINE

Filed July 18, 1932 6 Sheets-Sheet 2

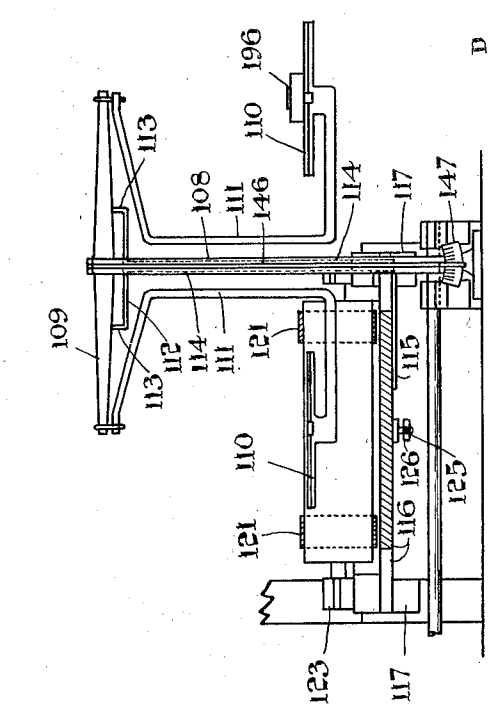


FIG. 4

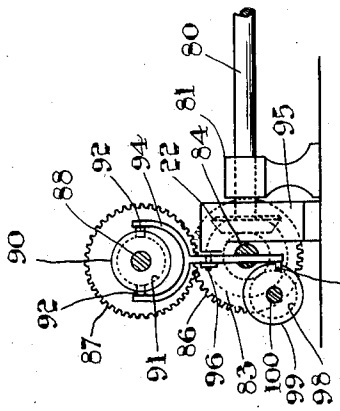


FIG. 5

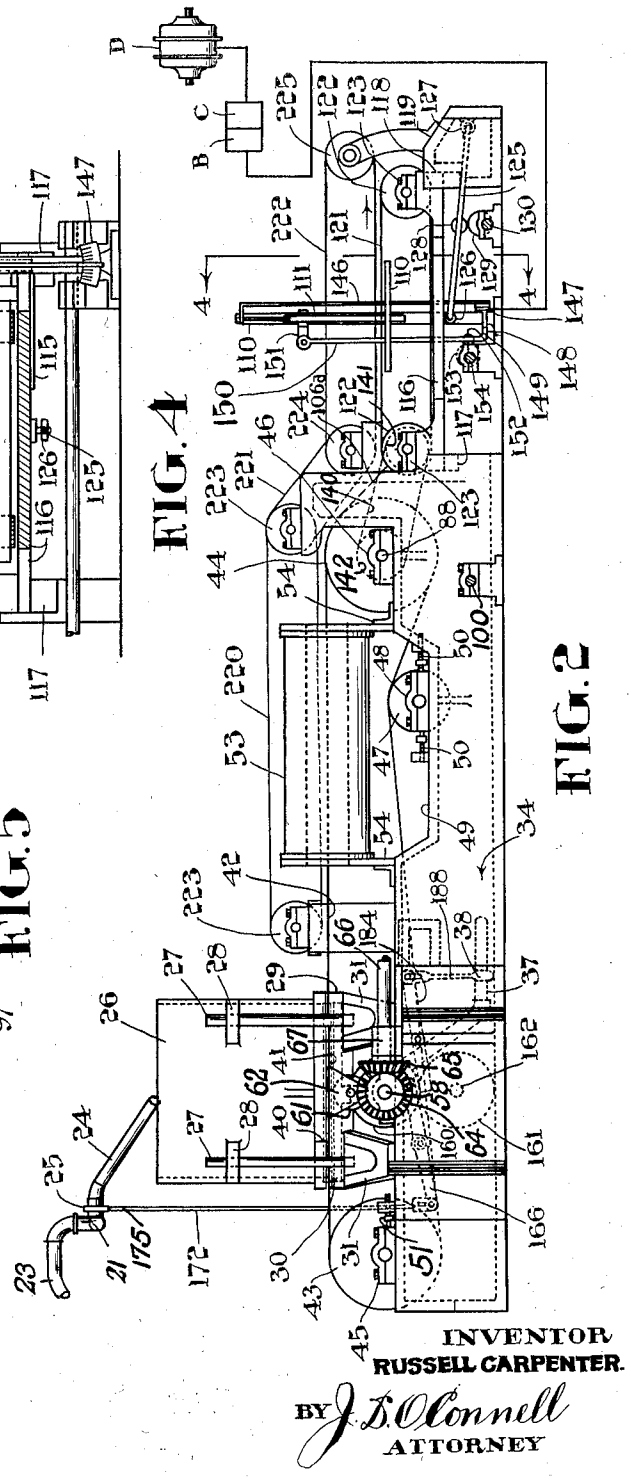


FIG. 2

INVENTOR
RUSSELL CARPENTER.
BY J. S. O'Connell
ATTORNEY

Aug. 21, 1934. R. CARPENTER 1,971,296

PULP AND PAPER MAKING MACHINE

Filed July 18, 1932 6 Sheets-Sheet 3

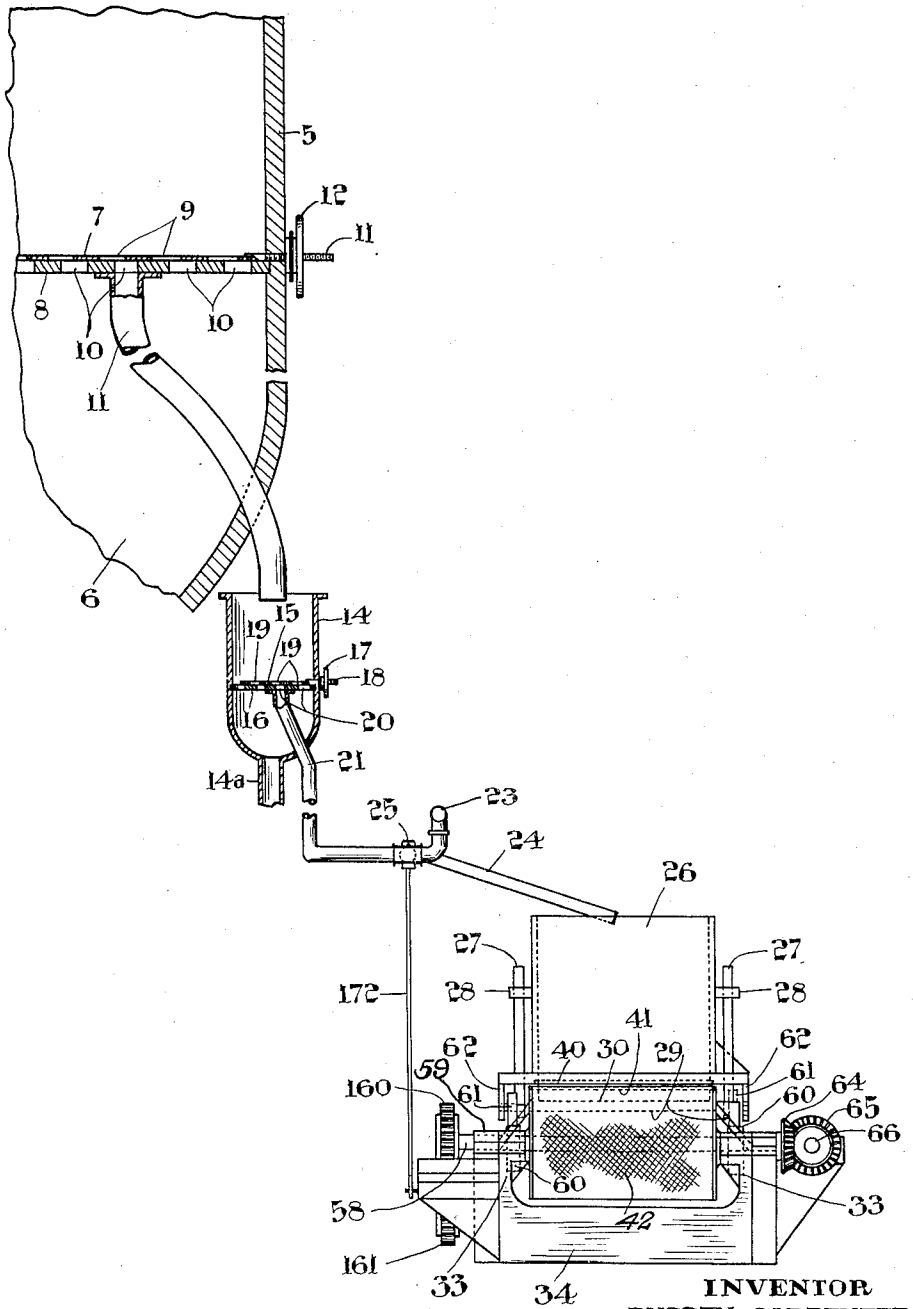


FIG. 3

INVENTOR
RUSSELL CARPENTER
BY J. S. O'Connell
ATTORNEY

Aug. 21, 1934. R. CARPENTER 1,971,296

PULP AND PAPER MAKING MACHINE

Filed July 18, 1932 6 Sheets-Sheet 4

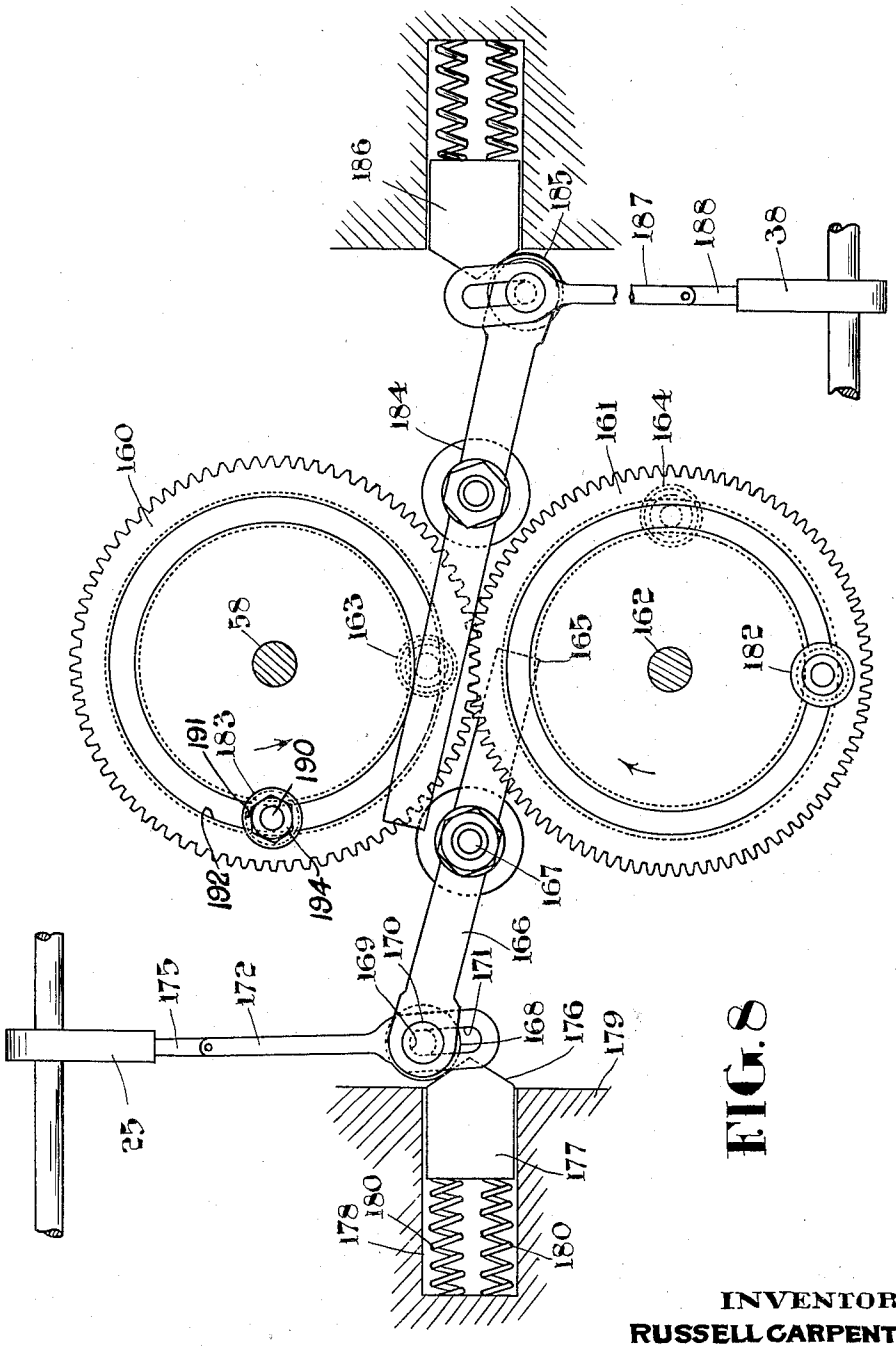


FIG. 8

INVENTOR
RUSSELL CARPENTER
BY J. D. O'Connell
ATTORNEY

Aug. 21, 1934. R. CARPENTER 1,971,296

PULP AND PAPER MAKING MACHINE

Filed July 18, 1932 6 Sheets-Sheet 5

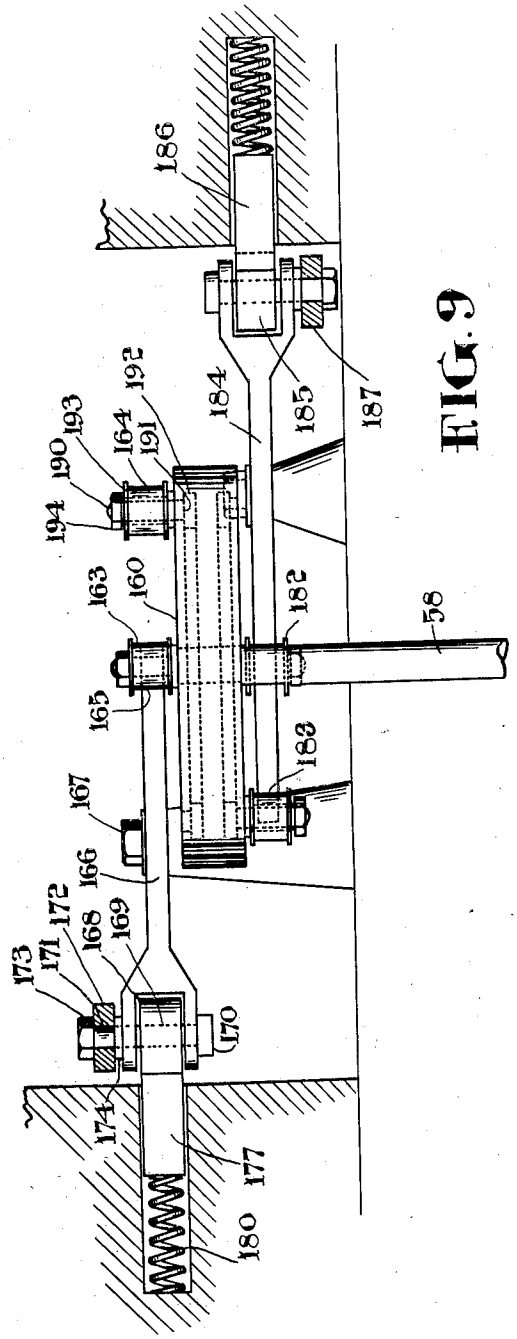


FIG. 9

INVENTOR
RUSSELL CARPENTER
BY J. D. O'Connell
ATTORNEY

Aug. 21, 1934. R. CARPENTER 1,971,296

PULP AND PAPER MAKING MACHINE

Filed July 18, 1932 6 Sheets-Sheet 6

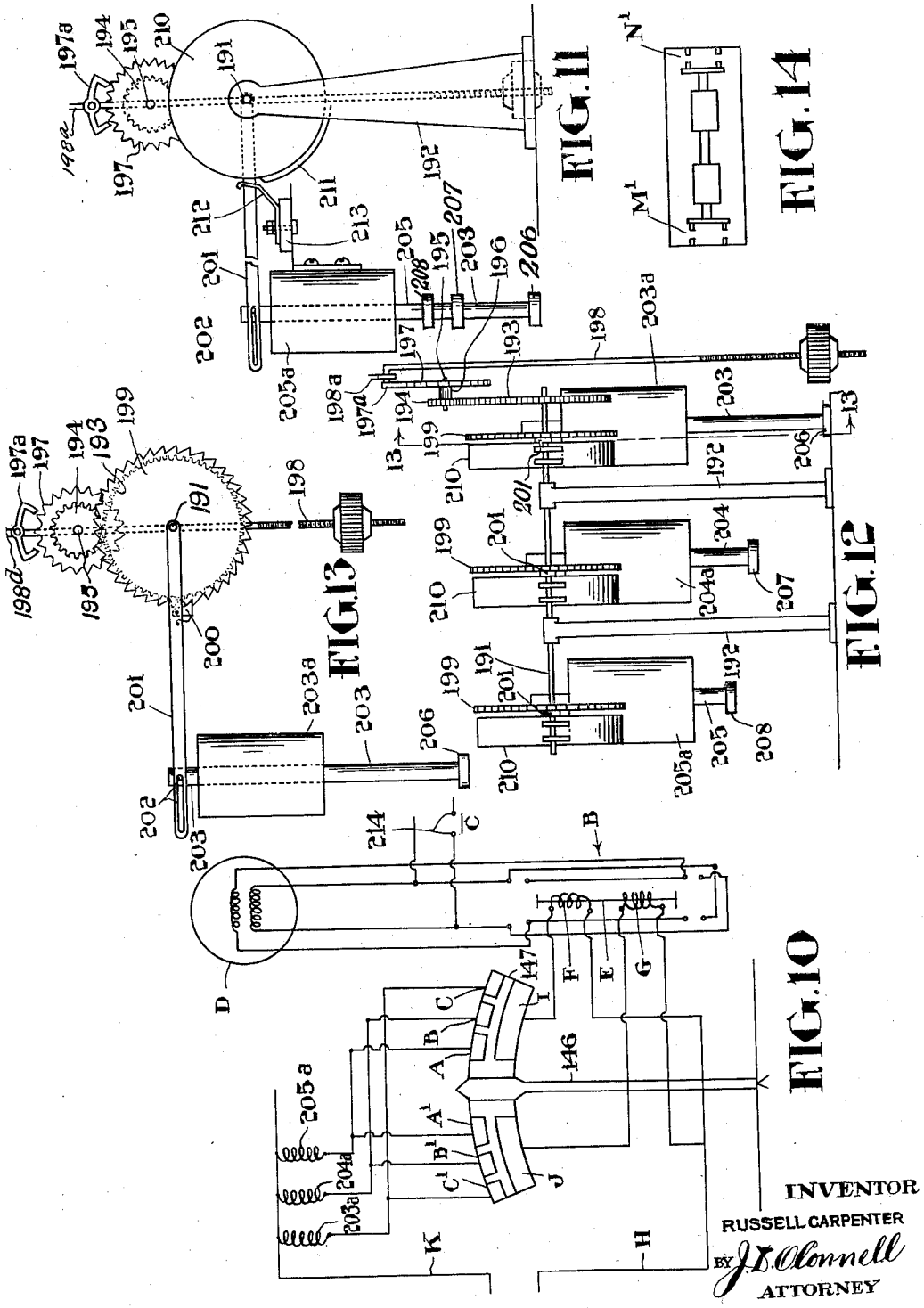


FIG. 11

FIG. 14

FIG. 13

FIG. 12

FIG. 10

INVENTOR
RUSSELL CARPENTER
BY J. F. O'Connell
ATTORNEY

Patented Aug. 21, 1934

1,971,296

UNITED STATES PATENT OFFICE

1,971,296

PULP AND PAPER MAKING MACHINE

Russell Carpenter, Wayagamack Island, Three Rivers, Quebec, Canada

Application July 18, 1932, Serial No. 623,202

12 Claims. (Cl. 92—39)

This invention relates to pulp and paper making machines and comprises improved means for controlling the running weight of the pulp or paper web produced by such machines.

More particularly, the present invention comprises a sample sheet forming; drying; and weighing apparatus operating in conjunction with a pulp or paper making machine and supplied with stock from the same source so that the bone dry weight of the sample sheet will vary in proportion to variations in the bone dry weight of the pulp or paper web forming on the regular machine. The weight of the sample or test sheet thus serves as an accurate indication of the basis weight of the forming web since both are made from the same pulp stock. The mechanism for weighing the sample sheet may also be utilized for automatically regulating the stock valve in response to variations in the weight of the sample sheet and in such manner as to regulate the supply of stock to the web forming apparatus of the pulp or paper machine to correct undesirable variations in the weight of the forming web.

Proceeding now to a more detailed description of the invention, reference will be had to the accompanying drawings, wherein

Fig. 1 is a top plan view of a sample sheet forming and weighing apparatus provided in accordance with this invention.

Fig. 2 is a view in side elevation of the assembly shown in Fig. 1. In this view a portion of the drive gearing is omitted for the sake of clearness, and the stock valve control device associated with the sample sheet weighing mechanism is illustrated diagrammatically.

Fig. 3 is an end view of the sample sheet forming and weighing apparatus. In this view the stock supply tanks for the sample sheet forming and weighing apparatus and for the pulp and paper machine with which it is used are shown in vertical section.

Fig. 4 is a sectional view along the line 4—4 of Fig. 2. In this view the sheet forming and drying means and portions of the drive gearing have been omitted for the sake of clearness.

Fig. 5 is a detail sectional view taken along the line 5—5 of Fig. 1.

Fig. 6 is a view in side elevation of a portion of the drive gearing appearing in Fig. 1.

Fig. 7 is a detail sectional view taken along the line 7—7 of Fig. 6.

Figs. 8 and 9 are enlarged detail views of a portion of a valve operating mechanism controlling the pulp supply and drain valves associated with the sample sheet forming apparatus.

Fig. 10 is a diagrammatic view of the electrical control means associated with the sample sheet weighing mechanism for regulating the supply of stock to the pulp or paper making machine and to the sample sheet forming and weighing apparatus.

Fig. 11 is a view in side elevation of a drum switching mechanism forming part of the electrical control means.

Fig. 12 is a view in front elevation of the drum switch mechanism appearing in Fig. 11.

Fig. 13 is a sectional view along the line 13—13 of Fig. 12.

Fig. 14 is a plan view illustrating a magnetic motor reversing switch forming part of the electrical control mechanism.

Referring more particularly to the drawings, 5 designates a mixed stock tank to which the pulp stock is delivered after being diluted to the desired consistency. From this tank the stock is delivered through the lower half 6 of the tank to the screens or directly to the head box at the wet end of a conventional pulp or paper making machine. The head at which the stock is maintained in the tank 5 is conveniently regulated by a control plate 7 slidably mounted on the bottom wall 8. This plate 7 is provided with a plurality of duplicate flow openings 9 corresponding in size and number with similar openings 10 formed in the bottom wall 8. By moving the plate 7 the position of the openings 9 with reference to the openings 10 may be adjusted to regulate the head of stock in the tank 5. In all positions of the plate the dimensions of the various flow passages provided by the registering openings 9 and 10 will be uniform so that there is no variation in the amount of stock delivered through each of the said passages. Movement of the control plate for regulating the head of the stock in the tank is conveniently accomplished through the agency of the screw 11 and hand wheel 12.

The stream of stock discharged from the tank 5 through one of the flow passages formed by registering openings 9 and 10 is delivered into the receiving end of a conduit 11 which has its delivery end arranged to discharge the stock into an auxiliary supply tank 14 which is a small replica of the main supply tank 5 and serves as the supply tank for the sample sheet forming and weighing mechanism hereinafter described. The streams of stock discharged from the tank 5 through the remaining passages formed by the registering openings 9 and 10 passes to the head box or screens of

the pulp or paper making machine as previously stated. The head at which the stock is maintained in the supplementary supply tank 14 is regulated by means substantially identical with that described in connection with the main supply tank 5. Such means comprises a plate 15 slidably mounted on the bottom wall 16 and adapted to be moved to different positions of adjustment by means of the screw 17 and the hand wheel 18. This plate 15 is provided with a series of openings 19 corresponding in size and number with similar openings 20 in the bottom wall 16, the total number of openings provided being dependent upon the tonnage or capacity of the pulp or paper making machine. In all positions of the plate 15 the effective area of the various flow passages afforded by the registering openings 19 and 20 is such that the same amount and velocity of flow is maintained for each passage. The stream of stock flowing through one of the openings 20 passes into the receiving end of a conduit 21 while the stock flowing through the remaining openings 20 passes into a conduit 14*a* leading to the screens or to the flow box to which the bulk of the stock is delivered from the main supply tank 5.

The conduit 21 is provided with branches 23 and 24 and with a gate valve 25 located in the branch 24. When this valve is closed all of the stock entering the conduit 21 is conducted through the branch 23 to the screens or to the head box of the previously mentioned pulp or paper making machine. When the valve 25 is open the stock supplied to the conduit 21 is delivered via the branch 24 to a rectangular casing 26 in which the pulp stock is initially formed into a sample sheet.

The casing 26 is open at its upper and lower ends and is mounted to slide vertically on suitable guide rods 27. These guide rods 27 slide in suitable guides 28 on the casing 26 and have their lower ends secured to a bottom casting 29 which has its upper surface recessed to provide a drain compartment 30. The casting 29 is herein shown as provided with supporting lugs 31 fastened, as indicated at 32, to the side members 33 of the main supporting frame 34. The drain compartment 30 formed in the casting 29 is provided with a central bottom outlet 36 communicating with one end of a drain pipe 37 leading to the wire suction box header of the paper or pulp machine pipe 37 is provided with a gate valve 38 which, together with the stock supply valve 25, is operated periodically by an automatic valve operating mechanism hereinafter referred to.

The lower end of the vertically movable casing 26 and the upper surface of the bottom casting 29 are provided, respectively, with sealing strips 40 and 41. When the casing 26 is in its lowered position the sealing strips 40 and 41 are respectively engaged with the outer and inner surfaces of an endless sheet forming wire 42 arranged so that its upper reach travels over the casting 29 in contact with the sealing strips 41. As herein shown the wire 42 is trained around suitable rollers 43 and 44 journalled in bearings 45 and 46 mounted at opposite ends of the base frame 34. Adjacent the roll 44 the lower reach of the wire passes over a guide roll 47 journalled in suitable slide bearings 48 mounted to slide in recessed portions 49 of the frame 34, said bearings 48 being movable to different positions of adjustment through the medium of the adjusting bolts appearing at 50. The tension of the wire 42 may be regulated by adjusting the position of the bearings 45 on the frame 34 through the medium of the adjusting bolts 51 shown in Figs. 1 and 2. At a point between the casting 29 and the roll 44 the upper reach of the wire 42 passes through an electrically heated drying chamber 53 which may be of any suitable construction and is mounted on the frame 34, through the medium of suitable supporting brackets 54.

During the open period of the valve 25 the casing 26 rests on the outer surface of the wire 42 so that the fibers of the stock supplied through said valve settle on the wire 42 in the form of a sheet while the water drains into the drain compartment 30 from whence it is discharged through the drain 37 during the open period of the drain valve 28. At suitable instants the valves 25 and 38 are closed and the casing 26 moved upwardly along the guide rods 27 to permit movement of the wire 42 in a direction to carry the wet sheet to the drying chamber 53, from whence it is delivered to the sample sheet weighing mechanism hereinafter referred to.

The raising and lowering of the casing 26 is accomplished automatically through the agency of a cam shaft 58 journalled in suitable bearings 59 and equipped with a pair of cams 60 (see Figs. 1 and 3) co-operating with rollers 61 journalled in brackets 62 depending from the lower end of the casing. One end of shaft 58 is equipped with a bevelled gear 64 meshing with a similar gear 65 fixed to the adjacent end of a shaft 66. Shaft 66 is journalled in bearings 67 at one side of the frame 34 and is equipped, at its opposite end, with a worm wheel 68 in mesh with a worm 69 at one end of a transversely extending shaft 70. Shaft 70 is journalled in suitable bearings 71 and is equipped at the end remote from the worm 69 with a worm wheel 72 and a bevel gear 73. The worm wheel 72 meshes with a worm 74 on a shaft 75 driven by a motor 76 and mounted in suitable bearings 77. The bevel pinion 73 meshes with a similar pinion 79 at one end of a shaft 80 mounted in bearings 81. At its opposite end shaft 80 is equipped with a bevelled gear 82 in mesh with a similar gear 83 at one end of a shaft 84. Shaft 84 is mounted in suitable bearings 85 and is equipped at the end opposite the gear 83 with a spur gear 86 (see Fig. 5) meshing with a similar spur gear 87 rotatably mounted at one end of the shaft 88 which constitutes the power shaft for the wire driving roll 44. A driving connection between the shaft 88 and the gear 87 is periodically established and disrupted by means of any suitable form of clutch the operation of which controls the conveyance of the sample sheet to the dryer and to the weighing scale. As herein shown the movable member 90 of the clutch (see Figs. 1 and 5) is slidably mounted on said shaft and is provided with a groove 91 receiving pins 92 projecting inwardly from the arms 93 of a clutch shifter 94. The clutch shifter 94 is intermediately pivoted to a bracket 95 as indicated at 96 and is provided at its lower end with a pin 97 engaging in a cam groove 98 formed in a cam 99 fixed to one end of a shaft 100. This shaft 100 extends across the frame 34 beneath the wire driving roll 44 and is equipped at its opposite end with a bevel pinion 101 meshing with a bevel pinion 102 fixed to one end of a shaft 103. Shaft 103 is journalled in suitable bearings 104 below the shaft 66 and is provided at its opposite end with a spur pinion 105 meshing with a similar pinion 106 on said shaft 66.

From the foregoing it will be apparent that the motor 76 acts through the shafts 75 and 70 to impart continuous rotation to the shaft 66

so that the casing 26 in which the wet stock is formed into a sample sheet is periodically raised at suitable intervals of time during the resulting rotation of the cam shaft 58. The shaft 88 which serves as the drive shaft for the wire driving roll 44 is intermittently driven by the motor 76, by reason of its clutch and gear connection with the continuously driven shaft 84. The clutch operating shaft 100 is also continuously driven by the motor by reason of its gear connection with the continuously driven shafts 103 and 66. The cam member 99 on the shaft 100 therefore serves to periodically operate the clutch shifter 94 to establish and disrupt a drive connection between the shaft 88 of the wire driving roll 44 and the power driven shaft 84. During the period that the spur pinion 87 is clutched to the shaft 88 the wire 42 is caused to travel in the direction indicated by the arrow so that the wet sample sheet is carried to the drier 53 and from thence onto a carrier associated with the sheet weighing mechanism which will now be described.

As herein shown the sample sheet weighing mechanism comprises a weighing scale including a main standard or post 108 which is of hollow tubular formation. At its upper end this post carries an intermediately pivoted scale beam 109 from which the scale pans 110 are suspended in a well known manner by means of the suspension member appearing at 111. Movement of the scale beam 109 about its pivotal conection with the upper end of the post 108 is normally prevented by means of a horizontal bar 112 having upturned extremities 113 engaging the lower surface of the scale beam at opposite sides of the beam pivot. This bar 112 works in vertical slots (not shown) formed in the upper portion of the standard 108 and is carried at the upper end of a bar 114 mounted to slide vertically in said standard. At its lower end the bar 114 is provided with a laterally extending arm 115 which also works in vertical slots (not shown) formed in the lower portion of the standard. The arm 115 is attached to a vertically movable carrier base 116. One end of said base 116 (Figs. 2 and 4) works in vertical guides 117 formed in the main frame 34, while the other end of said base works in similar guides 118 formed in a suitable casting appearing at 119. The base 116 constitutes the movable support of a carrier by means of which the sample sheet coming from the wire 42 is delivered to the scale pan 110 mounted directly above said base. As herein shown the carrier comprises a number of endless bands 121 trained around rolls 122 journalled in suitable bearing brackets 123 provided at opposite ends of the base. A supporting link appearing at 125 has one end pivotally connected to the base 116 as indicated at 126 and the other end similarly connected to the casting 119 as indicated at 127. This link 125 carries a roller 128 riding a cam 129 fixed to a shaft 130 journalled in suitable bearings 131. One end of shaft 130 carries a spur pinion 132 meshing with a similar pinion 133 carried by a short shaft 134 journalled in suitable bearings 135. Shaft 134 is also equipped at one end with a bevelled pinion 136 meshing with a similar pinion 137 fixed to the previously mentioned shaft 103. During rotation of the continuously driven shaft 130 the carrier mechanism comprising the base 116 and the carrier bands 121 is periodically raised and lowered by reason of the engagement obtaining between the cam 129 on the shaft 130 and the co-operating roller 128 carried by the carrier supporting link 125. During the period that the sheet is being delivered from the wire 42 to the carrier bands 121 the base 116 is supported in the position shown in Fig. 2, wherein it will be noted that the bands 121 are elevated with reference to the scale pan 110 positioned therebetween, said bands 121 being driven (in the direction indicated by the applied arrows) by means of the belt 140 (see Fig. 1) connecting a pulley 141 fixed to one of the rolls 122 with a pulley 142 fixed to the shaft 88. As the sample sheet leaves the wire 142 it passes over the doctor 106a into engagement with the bands 121 which serve to carry the sheet to a position directly above the scale pan 110, at which time the clutch member 70 is thrown out. As the sheet reaches this position the cam 129 is revolved to a position permitting downward movement of the base 116 so that the sheet is thus deposited on the scale pan 110 as the bands 121 drop below said pan. This downward movement of the base 116 also causes downward movement of the attached vertically movable bar 114 mounted in the standard 108 so that the extensions 113 of the horizontal bar 112 are lowered out of engagement with the scale beam 109 so that the latter is free to swing about its pivotal connection with the standard 108. The weight of the sheet deposited on the scale pan 110 is thus indicated by a pointer 146 having its upper end fixed to the scale beam 109. This pointer 146 cooperates with a graduated scale plate 147 carried by the horizontal arm 148 of a vertically disposed L-shaped rod 149. The vertical arm 150 of the rod 149 is pivoted at its upper end to a bracket 151 carried by the standard 108. The arm 150 is provided adjacent its lower end with a shoe 152 engaging a cam 153 fixed to a shaft 154 journalled in suitable bearings 155. This shaft 154 extends transversely beneath the carrier base 116 and is provided at one end with a bevelled pinion 156 meshing with a similar pinion 157 on the shaft 103. The scale plate 147 is thus caused to swing into and out of engagement with the pointer 146 as the cam 153 revolves in contact with the shoe 152. One purpose of this construction is to enable the pointer to swing freely during the weighing of the sample sheet until it has reached the end of its travel and comes to rest at which time it is engaged by the scale plate 147, which is then moved in the direction of the pointer by the cam 153. After a suitable period during which the weight of the sheet deposited on the scale pan 110 is indicated by movement of the pointer 146 over the scale plate 147, the sample sheet is raised from the scale pan 110 by the carrier bands 121 in response to automatic lifting of the carrier base 116 during continued rotation of the cam 129 in contact with the roller 128 carried by the carrier base supporting link 125. The sample sheet is thus lifted from the scale pan 110 by the bands 121 and is carried by said bands to the discharge end of the carrier located adjacent the casting 119 at which point it may be discharged into any suitable receiver.

The valves 25 and 38 associated with the casing 26 may be actuated by any suitable mechanism that will cause these valves to open and close at properly timed intervals. Valve 25 should open and close prior to the opening of valve 38 and should remain open for a period sufficient to supply a predetermined quantity of stock to the casing 26. A sufficient interval

is allowed after closing of valve 25 and before opening of the drain valve 38 to allow the fiber to settle. As herein shown, said valve operating mechanism includes a gear 160 fixed to the cam shaft 58 and meshing with a similar gear 161 carried by a stub shaft 162. Rollers 163 and 164, adjustably fixed to the outer sides of these gears, are arranged to alternately engage with one end 165 of a horizontally pivoted lever 166. Said lever is intermediately pivoted to the frame 34 as indicated at 167 and has its opposite end bifurcated to receive a roller 168 journalled on a pin 169 passing through the branches of the bifurcation. One end of said pin is provided with a head 170 and the opposite end passes through a slot 171 formed in the lower end of a valve operating link 172 and is equipped with a fastening nut 173, a washer 174 being interposed between the link 172 and the opposing portion of the lever 166. The upper end of the valve operating link 172 is pivotally connected to the valve stem 175 of the gate valve 25. The roller 168 is arranged to ride the V-shaped outer end 176 of a spring projected block 177, said block being slidably mounted in a guideway 178 formed in a casting 179 and being normally projected outwardly by means of springs 180 confined between the inner end of the guideway and the inner end of said block. During rotation of the gears 160 and 161 in the direction indicated by the applied arrows, the end 165 of the lever 166 is alternately raised and lowered by its engagement with the rollers 164 and 163. When the lever 166 is in the valve closing position shown in Fig. 9, it remains in this position until the end 163 is engaged and forced upwardly by the roller 164. This movement of the lever causes the roller 168 to travel downwardly over the V-shaped surface 176 of the block 177 until the axis of the roller is slightly below the apex of said V-shaped surface. When the roller reaches this position the pin 169 is at the lower end of the slot 171 and the pressure of the block 177 becomes effective to cause a rapid opening of the valve 25 due to the resulting rapid downward movement of the lever 166 and valve operating link 172. As the gears 160 and 161 continue to rotate the roller 163 engages and depresses the end 165 of the lever until the roller 168 has travelled upwardly over the inclined surface 176 of the block 177 to a point where the pressure of the block becomes effective on the roller and the valve operating link 172 to effect a quick or "snap" closure of the valve in the same manner as described in connection with the valve opening operation.

The opening and closing of the drain valve 38 is effected by means substantially the same as that described in connection with the opening and closing of the stock supply valve 25. Rollers 182 and 183 carried by the inner sides of the gears 160 and 161 are adapted to alternately engage with one end of a lever 184 which is pivoted in the same manner as described in connection with the lever 166 and is equipped at its opposite end with a roller 185 corresponding to the roller 168 and co-operating with a spring pressed block 185 and a valve operating link 187 corresponding to the previously described block 177 and link 172. In this case the link 187 is connected to the valve stem 188 of the drain valve 38 and acts to effect a quick opening and closing of the valve as the roller 185 is caused to travel in opposite directions over the V-shaped outer end of the block 186.

The lever operating rollers carried by the gears 160 and 161 are adjustably mounted so that the instant at which these rollers engage the levers 166 and 184 may be varied to change the timing of the valves 25 and 38. This is preferably accomplished by mounting each roller on a pin 190 having its inner end provided with an enlarged head 191 slidably adjustable in a circular groove 192 formed in the carrying gear, said groove being T-shaped in cross section. A sleeve 193 is interposed between the pin and the roller with one end of the sleeve bearing against the gear and the other end engaged by a clamping nut 194 carried by the outer end of the pin. When the nut 194 is loosened the pin and its roller may be adjusted along the slot 192 and then secured in adjusted position by screwing the nut 194 tightly against the adjacent end of the sleeve 193.

The foregoing sample sheet forming, drying; and weighing apparatus operates concurrently with the pulp or paper making machine with which it is associated and functions to periodically produce sample sheets having a bone dry weight bearing a definite relation to the bone dry weight of the web then forming on the associated paper or pulp making machine. The pulp or paper making machine is regulated in the usual manner until the usual tear-out or test sheets taken at the dry end of the machine indicate that the basis weight of the forming web has been correctly adjusted. The weight of the sample sheet delivered to the scale pan 110 at a time when the basis weight of the forming web is at the desired value is noted and balancing weight 196 is then placed on the scale pan 110 opposite that which receives the sample sheets. If the basis weight of the forming web subsequently varies from the predetermined standard this is reflected by a corresponding variation in the weight of the sample sheet delivered to the scale pan 110 positioned above the carrier base 116. Consequently, when the lowering of the carrier base 116, incident to delivery of the sample sheet to its receiving scale pan, causes the arms 113 of the bar 112 to move downwardly out of engagement with the scale beam 109, the latter is free to tilt to one side or the other depending upon whether or not the weight of the sample sheet exceeds or is less than that of the balancing counterweight 196 on the remaining scale pan. The resulting movement of the scale pointer 146 indicates that the weight of the sample sheet and, consequently, the basis weight of the forming web is above or below the desired standard and immediate steps may then be taken to correct this condition by regulating the stock supply valve serving the pulp or paper making machine or by making other necessary adjustments in the operation of such machine.

The movement of the pointer 146, which occurs when the weight of the forming web and the sample sheet varies from a predetermined standard, may be utilized, in various ways, to automatically correct this condition by regulating the valve through which the pulp or paper stock is supplied to the pulp or paper making machine. One method of accomplishing this result is illustrated in Figs. 10 to 14 inclusive. As illustrated diagrammatically in Fig. 10 the movement of the scale pointer 146 is utilized to control the actuation of a reversing switch B and a motor line switch C which, in turn, control the operation and direction of rotation of a motor

D which actuates the stock supply valve (not shown) in the usual manner. The reversing switch B is of the magnetic type in which the movable contacts are carried by a solenoid core E which is adapted to travel in either direction under the influence of the solenoid coils F and G, each of which has one terminal connected to a supply lead H. The remaining terminals of these coils F and G are respectively connected to contacts I and J carried by the scale plate 147 over which the scale pointer travels.

The motor line switch C is of the multi-drum type as shown in detail in Figs. 11 to 12 inclusive. It includes a shaft 191 rotatably mounted in suitable standards 192 and equipped at one end with an escapement mechanism including a toothed wheel 193 fixed to rotate with the shaft 191 and meshing with a smaller toothed wheel 194 fixed to rotate with an upper shaft 195 mounted in any suitable form of bearing structure generally indicated at 196. Shaft 195 also carries a ratchet wheel 197 co-acting with an escapement ratchet 197*a* fixed to the upper end of a pendulum 198 hung from a suitable support 198*a*.

Shaft 191 also carries a plurality of fixed ratchet wheels indicated at 199. Each ratchet wheel 199 is adapted to be engaged by a spring pressed pawl 200 carried by an associated lever 201. The levers 201 are loosely pivoted at one end on the shaft 191 and have their opposite ends secured by pin and slot connections 202 to the upper extremities of a series of solenoid cores designated 203, 204 and 205, the movements of which are controlled by the associated solenoid coils 203*a*, 204*a* and 205*a*. The solenoid cores 203, 204 and 205 are provided with stops 206, 207 and 208 arranged so that each core has a different length of travel as compared with the companion cores. When any one of the solenoid coils 203*a*, 204*a* and 205*a* is energized, the outer end of the associated lever 201 is raised a definite distance and the pawl carried by said lever engages with a tooth of the associated ratchet wheel 199 when the lever reaches the end of its upward travel. When the solenoid coil is deenergized the lever 201 gradually descends to its original position at a speed controlled by the escapement mechanism associated with the shaft 191. The shaft end of each lever 201 is fixed to a drum 210 which is also loosely mounted on the shaft 191. This drum carries a contact 211 adapted, when the drum is alternately rotated in opposite directions, to move into and out of engagement with a co-operating stationary contact 212 mounted on any suitable form of support indicated at 213. When each drum 210 is rotated by the upward movement of its operating lever 201 the contact 211 engages the contact 212 and closes the gap in the motor supply circuit which appears at 214 in Fig. 10. When the solenoid by which each lever 201 is raised is deenergized the lever falls slowly under the control of the escapement mechanism until the contact 211 moves out of engagement with the contact 212, the length of time which these contacts are engaged being controlled by the stroke of the lever operating solenoid core which is predetermined by the stop associated with said core. As shown to advantage in Fig. 10 one terminal of each of the solenoid coils 203*a*, 204*a* and 205*a* is connected by a lead supply line K to the remaining terminal of the supply source to which the reversing switch coils F and G are connected as previously described. The remaining terminals of the solenoid coils 205*a*, 204*a* and 203*a* are connected, as shown in Fig. 10 to contacts A, A', B, B', C, C' carried by the scale plate 147. As herein shown the contacts A, B and C are grouped directly opposite the contact I at one side of the center of the scale plate 147 and the contacts A', B' and C' are grouped at the opposite side of the transverse center of the scale plate directly opposite the contact J.

Assuming that the pointer 146 is moved to the right a distance merely sufficient to connect the contact I with the contact A this serves to energize the solenoid coil 205*a* of the motor line switch and causes the contacts 211 and 212 controlled by this solenoid to close the gap 214 in the motor supply line for a predetermined period. At the same time the solenoid coil F of the motor reversing switch B is energized to move the solenoid E in one direction so as to determine the direction of rotation of the motor D. Similarly as the pointer 146 is moved to the left only a distance sufficient to connect the contact J with the contact A' the solenoid coil 205*a* of the motor line switch is energized as previously described but in this case the coil G instead of the coil F becomes the energized coil of the motor reversing switch B and causes the motor D to operate in the reverse direction. When the limit of movement of the pointer 146 is such as to connect the contact I with the contact B or with the contact C, or is such as to connect the contacts J with the contacts B' and C', the solenoid coils 204*a* or 203*a* as the case may be are energized in a similar manner to that described in connection with the solenoid coil 205*a* to regulate the length of time which the motor D is caused to operate by closure of the gap 214.

As shown to advantage in Fig. 2, suitable means are provided for preventing cockling of the sample sheet as it passes to the drier and from thence to the weighing mechanism. Such means includes a system of endless carrying bands appearing at 220, 221 and 222. The bands 220 are trained around suitable rollers 223 so that the lower reaches of these bands pass through the drier 53 so as to engage the upper surface of the sample sheet during its passage through the drier, the sheet being thus carried through the drier between the bands 220 and the wire 42. The bands 221 constitute an extension of the bands 220, being trained around one of the rollers 223 and around a further roller 224. These bands serve to carry the sample sheet over the doctor 106*a* and into engagement with the carrying bands 121 of the weighing mechanism. The bands 222 constitute extensions of the bands 221 being trained around the roller 224 and around a further roller 225. It will thus be seen that the sample sheet is carried between the bands 121 and the bands 222 during its travel from the doctor 106*a* to the point at which the sample sheet is discharged after the weighing operation. The bands 220, 221 and 222 may be driven by any suitable form of belt connection (not shown) provided between the rollers 223 and 224 and the shaft 88 of the wire driving roller 44, such belt connection being preferably such that the surface speed of the rollers 223 and 224 is the same as that of the wire driving roller 44.

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

1. The combination with a pulp or paper making machine of a sample sheet forming, drying and weighing apparatus functioning to periodically

produce a sample sheet having a bone dry weight bearing a predetermined relation to the bone dry weight of the pulp or paper web forming on said machine, and means whereby said machine and apparatus are both supplied with pulp or paper stock of the same characteristics so that any variation in the weight of the forming web is indicated by a corresponding variation in the weight of the sample sheet.

2. The combination claimed in claim 1 including means, responsive to variations in weight of the sample sheet from a predetermined standard, for regulating the supply of stock to said machine in such manner as to maintain the basis weight of the forming web at a substantially constant predetermined value.

3. A method of determining the basis weight of the web forming on a pulp or paper making machine which consists in forming, drying and weighing a sample sheet made from pulp stock drawn from the same source as that supplying said machine and having exactly the same characteristics as the stock from which the web is formed.

4. The combination with a pulp or paper making machine of an automatic sample sheet forming drying and weighing apparatus operating concurrently with said machine and receiving stock from the same source of supply, said machine functioning to periodically produce sample sheets whose weight is indicative of the basis weight of the pulp or paper web forming on said machine.

5. A method for determining the basis weight of the web forming on a pulp or paper making machine comprising producing bone dry sample sheets from definitely measured samples periodically extracted from the main body of stock supplied to said machine and noting the weight of the sheets in comparison with a standard weight corresponding to the weight of a sample sheet made from a sample taken at a time when the basis weight of the web forming on said machine is at the desired value.

6. A method for determining the basis weight of the web forming on a pulp or paper making machine comprising periodically extracting a definitely measured sample from the main body of stock supplied to said machine, forming each sample into a wet sheet, drying said sheet and then weighing said sheet.

7. A method for ascertaining and correcting undesirable variations in the basis weight of the pulp or paper web forming on a pulp or paper making machine comprising periodically extracting a definitely measured sample from the main body of stock supplied to said machine, forming each sample into a wet sheet, drying and weighing said sheet, noting the weight of a sheet produced at a time when the basis weight of the web forming on the pulp or paper making machine is at the desired value, comparing the weight of succeeding sample sheets with the standard thus established, and regulating the supply of stock to said machine to correct variations in the basis weight indicated by variations in the weight of the sample sheets from said standard.

8. Apparatus for determining the basis weight of the pulp or paper web being formed on a pulp or paper making machine comprising means for producing wet sheets from definitely measured samples periodically extracted from the main body of stock supplied to said machine and means for drying said sheets.

9. Apparatus for determining the basis weight of the pulp or paper web being produced on a pulp or paper making machine comprising means for periodically segregating a sample from the main body of stock supplied to said machine, means for forming each sample into a wet sheet, means for drying the wet sheets, and means for detecting and indicating variations in the weight of the dried sheets from a predetermined standard.

10. Apparatus for indicating the basis weight of the pulp or paper web being formed on a pulp or paper making machine comprising means for periodically segregating definitely measured samples from the main body of stock supplied to said machine, means for producing a bone dry sample sheet from each sample, and means for indicating variations in the weight of the sample sheets from a standard weight corresponding to the bone dry weight of a sample sheet made from a sample taken at a time when the basis weight of the pulp or paper web forming on said machine is at the desired value.

11. Apparatus for indicating the basis weight of the web forming on a pulp or paper making machine comprising a sample sheet forming wire, means operating periodically to segregate a sample from the main body of stock supplied to said machine and to deposit said sample on the wire to form a wet sample sheet, a drying chamber through which the sample sheet is carried by said wire, a weighing apparatus and means for automatically transferring each sample sheet from the wire to the weighing apparatus after the sample sheet is passed through the drying chamber.

12. Apparatus for indicating the basis weight of the web forming on a pulp or paper making machine comprising an endless sample sheet forming wire, a drying chamber arranged so that the upper flight of the wire extends therethrough, means for periodically segregating a sample from the main body of stock supplied to said machine and depositing said sample on the upper flight of said wire at a point between the drying chamber and one end of the wire, sheet weighing mechanism located adjacent the opposite end of said wire, means for operating the wire so that the sample sheet formed thereon is carried through the drying chamber towards the sheet weighing mechanism, and means for transferring the sample sheets from the wire to the weighing mechanism after the sheets have passed through the drying chamber.

RUSSELL CARPENTER.