Sept. 20, 1949. B. W. LANGSTON 2,482,627

MACHINE FOR MAKING CORRUGATED PAPER

Filed Jan. 22, 1946 2 Sheets-Sheet 1

Fig. 1.

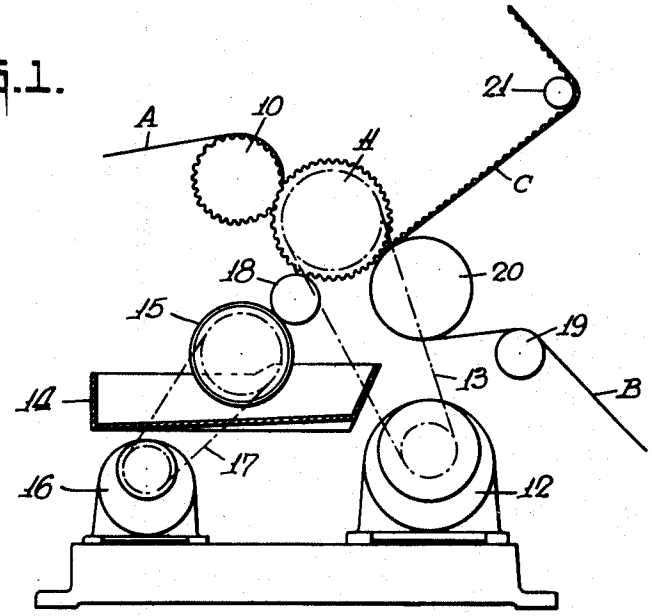
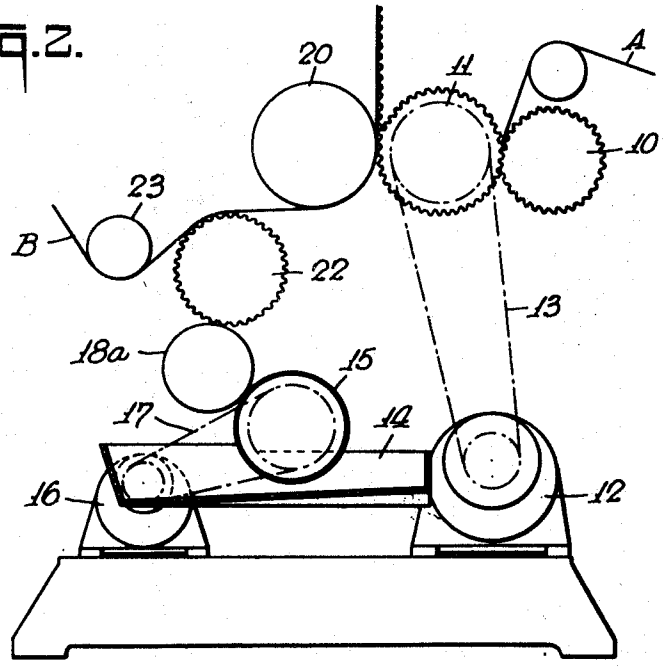


Fig. 2.



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Fig. 3.

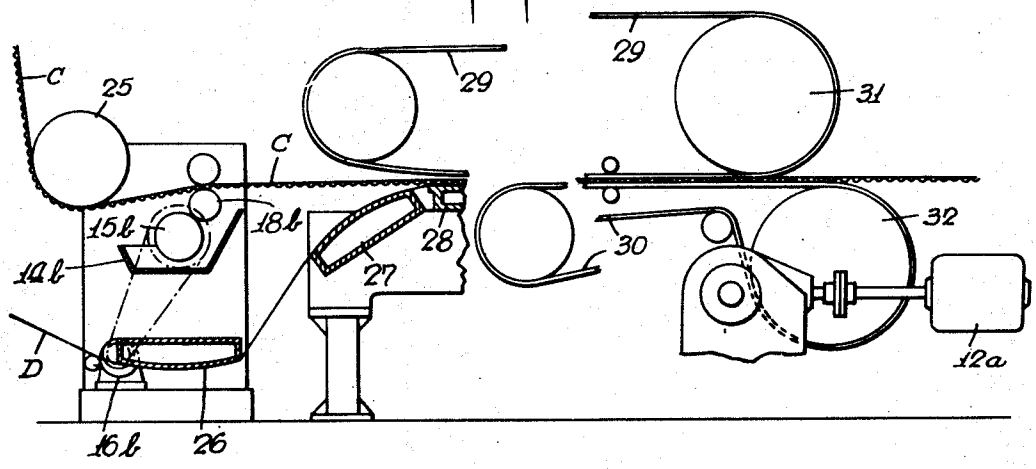
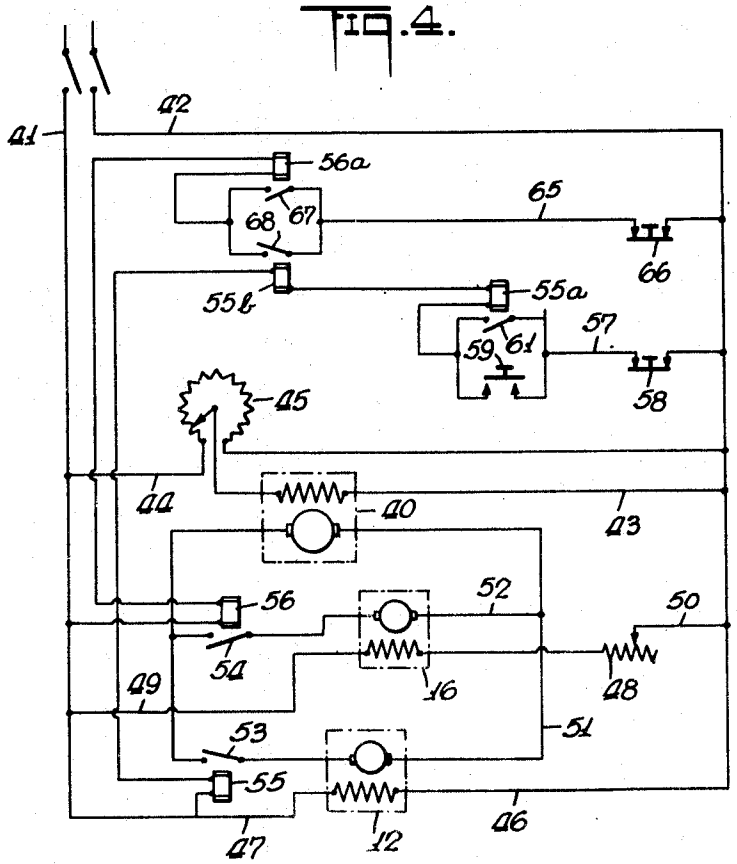


Fig. 4.



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MACHINE FOR MAKING CORRUGATED PAPER

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15 Claims. (Cl. 154—31)

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In the manufacture of both single faced and double faced corrugated board there is usually provided a glue applying roll which may dip into the glue container and deliver the glue to a glue applying roll contacting one of the sheets; or the glue applying roll may dip into the glue and be provided with a doctor roll to control the thickness of the glue film. The glue is applied in transverse stripes so spaced that when the corrugated sheet and the facing sheet are brought together, the facing sheet will be glued to the crowns of the corrugations of the corrugated sheet. The glue applying roll usually rotates with a peripheral speed substantially equal to the rate of travel of the sheet to which it applies the glue.

In commercial operation the machine may be operated at different speeds at different times, and it is important that the glue applying roll have its speed simultaneously and correspondingly changed to avoid any wiping action on the sheet or any dragging of the sheet over the roll. Furthermore it is often necessary, for one reason or another, to shut down the machine for a short period, but if the glue applying roll be likewise stopped, the adhesive may become set or solidified on the surface thereof, and the roll will not function properly when the machine is started up. Therefore the glue roll should be kept rotating during temporary stoppages of the machine.

To take care of these conditions, the machine and the glue roll may be mechanically interconnected so that they operate at the proper relative speeds regardless of the actual speed of operation of the machine, and a clutch connection and an independent low speed motor may be provided for the glue roll so that in normal operation the clutch drives the glue roll from the machine and at the proper speed, but when the machine stops, the clutch can overrun, and low speed rotation of the glue roll is effected from the motor.

Other types of interconnecting mechanisms and drives have been employed, but all add to the expense of the equipment and require some action on the part of the operator to insure the drive of the glue roll at the proper speed, determined by the speed of the machine, and to insure the continued operation of the glue roll at low speed when the machine is stopped.

The main object of the present invention is to provide electric means which operates entirely automatically, and which therefore does not require any attention on the part of the operator and is simple and inexpensive.

In carrying out my invention I provide separate electric motors for the machine and the glue roll, and an electric control for these motors, such that when the machine is running, the glue roll will have its speed directly proportional to the speed of the machine, but when the machine is stopped, the circuit of the glue roll motor is not interrupted, but the glue roll and its motor continue rotating at low speed.

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In the accompanying drawings there are shown, somewhat diagrammatically, the essential portions of the machines for making both the single faced and double faced corrugated board, and to which the present invention may be applied.

In these drawings:

Fig. 1 is a diagrammatic showing of certain parts of a singlefacer, in which the glue is applied in stripes and on the crowns of the corrugated sheet;

Fig. 2 is a similar view of the machine, in which the glue is applied in stripes on the liner and so positioned as to register with the crowns of the corrugations;

Fig. 3 is a section of a doublefacer; and

Fig. 4 is a wiring diagram for the motors and including the new control features.

So far as concerns the mechanisms illustrated in Figs. 1, 2, and 3, they are of conventional type and do not per se involve any novel features of the present invention, except in so far as involves the control of the motor speeds.

In the mechanism shown in Fig. 1, a sheet of paper A is fed between corrugating rollers 10 and 11, and one of them, preferably the corrugating roller 11, is driven by an electric motor 12 in any suitable manner, as for instance by a chain drive 13. The glue is held in a glue pan 14, into which extends a glue roll 15, which is driven by an electric motor 16 in a suitable manner, as for instance through a chain drive 17. A transfer roll 18 takes the glue from the glue roll 15 and delivers it to the crowns of the corrugations of the sheet A, while such sheet is held in the corrugations of the roll 11.

A liner sheet B passes over an idler 19 and then around a pressure roll 20, which is geared to the roller 11 and applies the liner to the adhesive-coated crowns of the corrugations of the sheet A, and the single faced corrugated sheet C is delivered from between the rolls 11 and 20 around an idler 21 and then onto a reel, if the final product is single faced corrugated paper, or it is delivered to a doublefacer, if double faced paper is to be produced. The motors 12 and 16 are so timed that rolls 15 and 18 have the same peripheral

speed as the rollers 10, 11 and 20 during normal operation of the machine.

In Fig. 2 a somewhat similar machine is disclosed, but here the adhesive is applied in stripes to the sheet B rather than to the crowns of the corrugations of the sheet A. The sheet A to be corrugated is delivered between the corrugating rollers 10 and 11 and is then pressed against a liner B, as the two travel between the rollers 11 and 20, all as in the form shown in Fig. 1. In this construction, the glue, picked up by the glue roll 15, passes to a transfer roll 18a, and from the latter goes onto the tips of the corrugations of a roll 22. The liner B passes under an idler 23 into engagement with the glue-tipped corrugations on the roll 22, which latter applies stripes of glue to the liner B.

The liner then passes into engagement with the corrugated sheet as the two are pressed together between the rollers 11 and 20. The motors 12 and 16 are so timed that the peripheral speed of the roll 22 is the same as the linear speed of the liner B so that the stripes of glue applied to the liner B will register with the crowns of the corrugations of the corrugated sheet. A machine of this type is disclosed and claimed in Goettsch Patent 2,051,296, issued August 18, 1936.

In Fig. 3 there are shown some of the essential features of a doublefacer. The single faced corrugated sheet C made in either the machine of Fig. 1 or that of Fig. 2, passes around a preheating roller 25, then over a glue transfer roll 18b engaging a glue roll 15b driven from a motor 16b and dipping in a glue pan 14b. All of these parts may be substantially the same as in Fig. 1. A liner D passes over heated guide chambers 26 and 27 and into engagement with the glue-coated crowns of the corrugations of the sheet C.

The liner and single faced sheet pass over a series of heated plates 28 and are pulled along by a pair of belts 29 and 30, the belt 29 pressing the combined sheet onto the heating plates, and the belt 30 being disposed beyond the heating plates and disposed below the combined sheet. At the delivery end the belts pass over the driving pulleys 31 and 32 driven by a motor 12a. In operation the motors 12a and 16b are operated in timed relation to pull the sheet at the desired speed and to avoid wiping or dragging of the glue where the sheet engages the glue transfer roll 18a.

My invention relates primarily to the control of the motors. For making double faced corrugated board, two independent controls may be provided, one for the motors 12 and 16 of the singlefacer, and the other for the motors 12a and 16b of the doublefacer. Where the invention is applied to a machine for merely making single faced corrugated paper, it will be obvious that only the motors 12 and 16 are employed. For simplicity in the description of the wiring diagram, shown in Fig. 4, reference will be made only to the motors 12 and 16 of the singlefacer.

As shown in Fig. 4, a generator 40 is employed and has its field coil supplied from direct current lines 41 and 42 through wires 43, 44 and a potentiometer rheostat 45, which is preferably motor operated for remote control. The field of motor 12 is connected to the lines 41 and 42 by lines 46 and 47, and the field of the glue roll motor 16 is connected to the lines 41 and 42 by lines 50 and 49 and a vernier rheostat 48. Thus the three fields are in parallel. This vernier rheostat is used to synchronize the speeds of the glue roll and corrugating roll so that their surface speeds will be the same. Once this is set further adjustment is not required unless, of course, new rolls are substituted, or the old ones recut or reground to reduce their diameters. It makes possible the use of separate motors, the speeds of which may be varied at will, but surface speed of one roll kept the same as that of the other.

The current for control of the switch of the motor 12 may be controlled by a main stop switch 58 and a run switch 59 in the line 57 of magnet 55, and the current of the glue roll motor 16 may be controlled by a switch 66.

The armature coil of the generator 40 is connected in series with the armature coil of the motor 12 and with the armature coil of the motor 16 by lines 51 and 52. Thus, the two motors are in parallel, and both armature coils are in series with the armature coil of the generator. The motors may be stopped and started by switches 53 and 54, which may be held in closed position by magnet coils 55 and 56.

These switches, as well as the various other switches hereinafter referred to, are all shown in open position, but the conditions under which they are open or closed will be later pointed out. Those which are operated by an electromagnet, are provided with the usual spring or other means for automatically reversing the position of the switch when the circuit of the magnet is opened.

The control current of the main motor 12 includes a line 57 having therein a stop switch 58, which may be manually opened, and which automatically closes when released, and a run switch 59, which may be closed manually, and which automatically opens when released. A magnet operated switch 61 is in parallel with the run switch 59 and is held closed when the machine is running, but may be opened by the deenergizing of an electromagnet 55a. The magnets 55 and 55a, and a third magnet 55b, the function of which will be later described, are all connected in line 57. For simplicity of illustration and description these are shown as separate magnets, but in practice only one magnet is used to operate a multiple contact relay including the switches.

A second control line 65 includes a switch 66, which is in closed position when the glue roll is running, and also includes two switches 67 and 68 in parallel, and the magnet coils 56a and 56. The switch 67 is normally open, but is closed automatically upon energizing the coil 56a, and the switch 68 is normally open and is closed upon the energizing of the coil 55b, hereinbefore referred to.

The stop switch 58 is normally closed, and when it is desired to start operation of the machine, the run switch 59 is momentarily closed and with the arm of the rheostat in limiting position to give maximum resistance so that the machine will start at low speed. The current may then flow through the line 57 including the stop switch 58, the run switch 59, and the magnet coils 55a, 55b, and 55. By reason of this current flow the switch 53 of the motor 12 is closed by the magnet 55; the switch 68 is closed by the magnet 55b; and the switch 61 is closed by the magnet 55a. Upon the closing of the switch 68, the current of the line 65 may flow through the closed switch 66, the switch 68 and the magnet coils 56a and 56. The energizing of the coil 56a closes the switch 67, and the energizing of the coil 56 closes the switch 54 of the glue roll motor.

All of these operations take place substantially

instantaneously upon the momentary closing of the switch 59 so that this switch may open immediately thereafter and without stopping or interfering with the operation of the machine. Thereafter the speed of the machine is controlled by the operation of the rheostat 45, and increase or decrease of the speed of one motor will be the same as that of the other, and the surface speed of the glue roll will be kept the same as the lineal speed of the paper.

When it is desired to stop the machine for a short period of time, the stop switch 58 is opened. This breaks the circuit through the magnet coils 55, 55a and 55b and thus opens the switches 53, 61 and 68. This stops the motor 12. Previously or immediately thereafter the arm of the potentiometer 45 is moved to its low speed driving position. The current will continue to drive the glue roll motor 16, as the current may continue to flow through the line 65, switch 67, coil 56a and coil 56 to keep the switch 67 and glue roll motor switch 54 in closed position. The stop switch immediately closes, but the current remains broken at the switches 61 and 53. To start up again, it is merely necessary to momentarily close the run switch 59, and the motor 12 will start operation.

If it is desired to stop the glue roll after the motor 12 has been stopped by switch 58, the switch 66 is momentarily opened and then closed. During the open position the circuit through coil 56a and coil 56 is broken, and the switch 67 and the glue roll motor switch 54 open. Thus the immediate reclosing of the switch 66 does not restart the glue roll, because the circuit has been broken by both of the switches 67 and 68. As the switches 66 and 58 automatically close immediately after opening, both motors will start operating upon the closing of the switch 59, and the speed of the motors may be increased or decreased at will by the operation of the rheostat 45.

It will be understood that in practice the switches 58, 59 and 66, as well as the switch of the motor operating the arm of the rheostat will be placed adjacent to each other and on a suitable panel board for convenience in operation.

It will be obvious that other arrangements of switches and controls therefor may be used, and various other changes may be made. It is important that the electric control be such that the speeds of the motors be increased and decreased in the same proportion; that both motors be started simultaneously; and that it be easy to stop the motor 12 without stopping the motor 16. It will also be understood that if the motor 16 be run for any considerable time, while the motor 12 is stopped, the sheet be lifted from the roll 18 or 22, or that the glue pan and the glue applying roll be lowered to break contact of the roll with the sheet.

In many localities the current normally supplied to factories is A. C., and in the use of the present invention D. C. is required for the motors. It will be obvious that where A. C. is supplied, various different means may be utilized for converting the A. C. to D. C., such as a motor generator, electronic tubes, etc.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A corrugating machine including a corrugating roller for continuously advancing and corrugating a sheet, a roller for applying adhesive to said sheet, separate motors, each constituting the sole driving means for its corresponding roller, means for simultaneously varying the speeds of said motors to vary to the same extent the speed of said rollers, and means for stopping the sheet advancing motor without stopping the glue roll motor.

2. A machine having means for continuously advancing a sheet, means for applying adhesive to said sheet, separate electric motors for driving the sheet advancing means and said adhesive applying means, said machine being characterized by an electric circuit including a rheostat for simultaneously varying the speeds of said motors, a switch operative to effect the simultaneous delivery of current to both of said motors, a switch in series with the first mentioned switch and in the circuit of the sheet advancing motor for interrupting the current flow to said motor, and a switch in the circuit of the adhesive applying motor and in parallel with both of the said first mentioned switches for interrupting the flow of current to said last mentioned motor only.

3. A machine for making corrugated paper, having means for corrugating and advancing a sheet, and including a motor, means for applying adhesive to said sheet, and including a motor, a motor generator, said motors having their armature coils in parallel with each other and in series with the armature coil of the motor generator, separate switches for controlling the flow of current through said motor armature coils, magnets acting when energized to close said switches, a switch operative to simultaneously effect the delivery of current to both said magnets, and separate switches, one for interrupting the current to the magnet controlling the sheet advancing motor, and the other operable to interrupt the current to the magnet controlling the glue applying roller after the sheet advancing motor has been stopped.

4. A machine for making corrugated paper, including means for advancing and corrugating the sheet material, a motor for driving said means, an adhesive applying means, a motor for driving it, and three control circuits arranged in parallel, one of said circuits having a rheostat for simultaneously varying the speeds of both motors, the second having a switch operative to effect delivery of current to both motors and a switch for stopping the delivery of current to the first mentioned motor, and the third having a switch operative to stop the delivery of current to the adhesive applying driving motor, but inoperative to effect supplying current to said motor when the circuit of the sheet advancing motor is broken.

5. A machine for making corrugated paper, including a pair of motors, sheet advancing means driven by one of said motors, adhesive applying means driven by the other motor, a rheostat for simultaneously varying the current supply to and speeds of both of said motors, separate magnet controlled switches in the circuits of said motors, a switch for simultaneously energizing said magnets to start both of said motors, a switch for breaking the circuit of a magnet of the sheet advancing motor, but inoperative to break the circuit of the magnet of the adhesive applying motor, and a third switch operative to break the current of the magnet of the last mentioned motor after the circuit of the first mentioned motor has been broken.

6. A machine for making corrugated paper, including sheet corrugating and advancing means, a motor for driving said means, a switch for the

circuit of said motor, an adhesive applying means, a motor for driving said last mentioned means, a switch for the circuit of said last mentioned motor, a control circuit including a magnet for operating the first mentioned switch and a manually operable switch for breaking the circuit of magnet, and a second control circuit having a magnet for controlling the switch of the second mentioned motor and a manually operable switch for breaking the circuit of the second mentioned magnet.

7. A machine for making corrugated paper, including sheet corrugating and advancing means, a motor for driving said means, a switch for the circuit of said motor, an adhesive applying means, a motor for driving said last mentioned means, a switch for the circuit of said last mentioned motor, a rheostat for simultaneously increasing or decreasing the speeds of both motors, two control circuits in parallel, one of said control circuits having a magnet for closing the switch of the first mentioned motor, and a manually operable switch for breaking the circuit of the first mentioned motor, and the other control circuit having a magnet for operating the switch of the second mentioned motor, and a manually operable switch for breaking the circuit of said magnet.

8. A machine for making corrugated paper, including sheet corrugating and advancing means, a motor for driving said means, a switch for the circuit of said motor, an adhesive applying means, a motor for driving said last mentioned means, a switch for the circuit of said last mentioned motor, a rheostat for simultaneously increasing or decreasing the speeds of both motors, two control circuits in parallel, one of said control circuits having a magnet for closing the switch of the first mentioned motor, a manually operable switch for breaking the circuit of the first mentioned motor, and a switch in parallel with said last mentioned switch and controlled by said magnet, and the other control circuit having a magnet for operating the switch of the second mentioned motor, and a manually operable switch for breaking the circuit of said magnet.

9. A machine for making corrugated paper, including sheet corrugating and advancing means, a motor for driving said means, a switch for the circuit of said motor, an adhesive applying means, a motor for driving said last mentioned means, a switch for the circuit of said last mentioned motor, a rheostat for simultaneously increasing or decreasing the speeds of both motors, two control circuits in parallel, one of said control circuits having a magnet for closing the switch of the first mentioned motor, and a manually operable switch for breaking the circuit of the first mentioned motor, and the other control circuit having a magnet for operating the switch of the second mentioned motor, a manually operable switch for breaking the circuit of said magnet, and a pair of magnet operated switches in parallel with each other and in series with said second mentioned manually operated switch, one closing upon the energizing of one of said magnets and the other closing upon the energizing of the other magnet.

10. A machine for making corrugated paper, including sheet corrugating and advancing means, a motor for driving said means, a switch for the circuit of said motor, an adhesive applying means, a motor for driving said last mentioned means, a switch for the circuit of said last mentioned motor. a rheostat for simultaneously increasing or decreasing the speeds of both motors, two control circuits in parallel, one of said control circuits having a magnet for closing the switch of the first mentioned motor, a manually operable switch for breaking the circuit of the first mentioned motor, and a switch in parallel with said last mentioned switch and controlled by said magnet, and the other control circuit having a magnet for operating the switch of the second mentioned motor, a manually operable switch for breaking the circuit of said magnet, and a pair of magnet operated switches in parallel with each other and in series with said second mentioned manually operated switch, one closing upon the energizing of one of said magnets and the other closing upon the energizing of the other magnet.

11. A corrugating machine including a roller for continuously advancing and corrugating a sheet, a roller for applying adhesive to said sheet, separate motors, one for each roller, means for adjusting the speed of one motor in respect to the speed of the other motor to impart the same surface speed to both rollers, means for simultaneously varying the speeds of said motors while maintaining the same peripheral speeds of the rollers, and means for stopping the sheet advancing motor without stopping the glue roll motor.

12. A corrugating machine including a roller for continuously advancing and corrugating a sheet, a roller for applying adhesive to said sheet, separate motors, one for each roller, a vernier rheostat in the circuit of the glue roll motor to change the speed of that motor in respect to the speed of the other motor to impart the same surface speed to both rollers, means for simultaneously varying the speeds of said motors while maintaining the same peripheral speeds of the rollers, and means for stopping the sheet advancing motor without stopping the glue roll motor.

13. A machine for making corrugated paper, including a roller for applying adhesive to the crowns of the corrugations of a corrugated sheet, a motor for driving said roller, a sheet advancing means for applying a surface sheet to said corrugated sheet and advancing said sheets together as a unit, a motor for driving said sheet advancing means, means for simultaneously varying the speeds of said motors and maintaining the peripheral speed of said roller the same as the speed of said advancing means, and thereby varying the speed of said adhesive applying roller and the speed of said sheet advancing means to the same extent, and means for stopping said second mentioned roller without stopping said first mentioned roller.

14. A machine for making single faced corrugated paper, including a roller for corrugating one sheet, a roller for transferring adhesive to the crowns of the corrugations of said sheet, two separate variable speed motors, one for driving said corrugating roller and the other for driving said adhesive transferring roller, means for simultaneously starting said motors, means for simultaneously varying the speeds of said motors, and to the same extent, means for stopping said first mentioned motor, and means for thereafter stopping said second mentioned motor.

15. A machine for making double faced corrugated paper, including a roller for transferring adhesive to the crowns of the corrugations of a corrugated sheet attached to a facing sheet, means for bringing together said single faced

corrugated sheet and a second facing sheet and advancing them at the same time under heat and pressure, a motor for driving said adhesive transferring roller, a motor for driving said sheet advancing means, means for simultaneously starting said motors, means for simultaneously varying the speeds of said motors, and to the same extent, and means for stopping said second mentioned motor without stopping said first mentioned motor.

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