June 28, 1960 E. D. BEACHLER 2,942,661

MULTI-PLY SHEET FORMER

Filed Dec. 18, 1956

Fig. 1

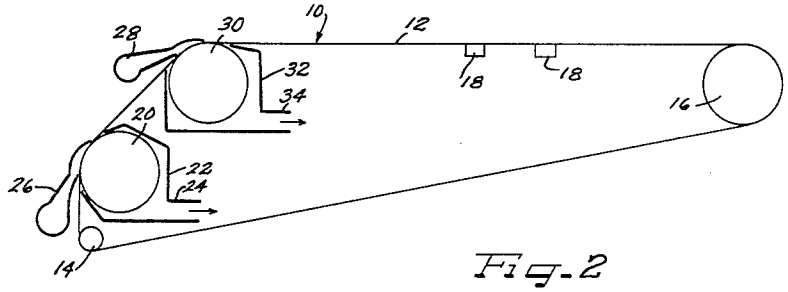


Fig. 2

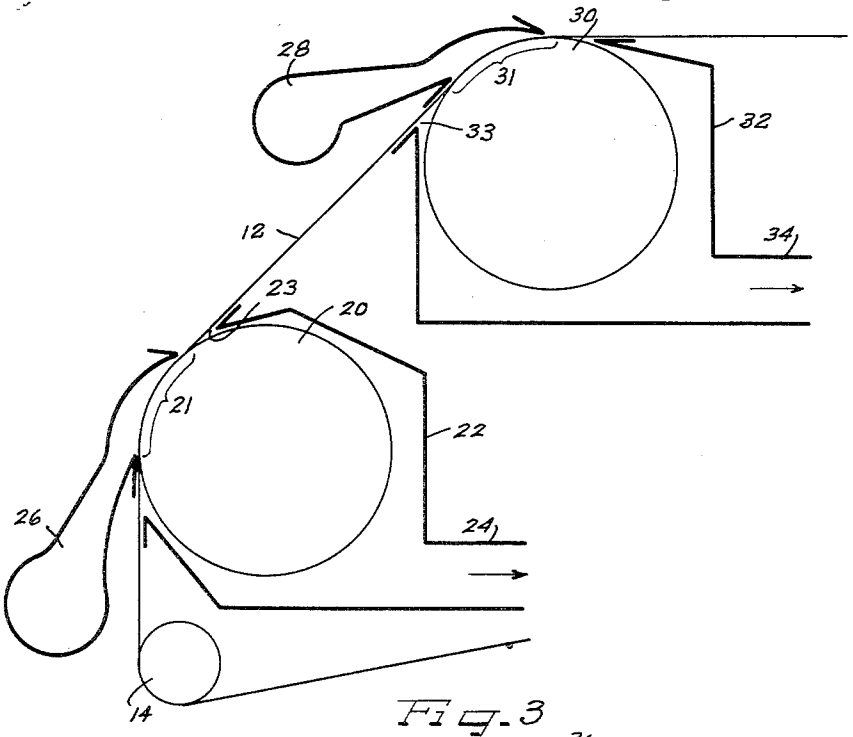
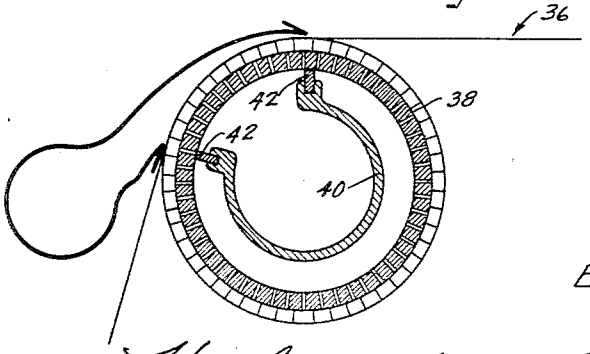


Fig. 3



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United States Patent Office

2,942,661

Patented June 28, 1960

2,942,661

MULTI-PLY SHEET FORMER

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Filed Dec. 18, 1956, Ser. No. 629,070

2 Claims. (Cl. 162—304)

This invention relates to paper making machines and more particularly to an improved apparatus for forming multi-ply sheets of paper, paperboard and the like.

In the conventional endless band or Fourdrinier type paper making machine, water is removed from stock on the upper run of the band or wire by passing the wire over a series of stationary suction boxes. The degree of evacuation of these suction boxes must be varied so that greater suction is available in the box closest to the conventional couch roll. As a result, greater wear is effected on the wire at this point and the life span of the wire is greatly diminished. Because of the limited dewatering potential of such an arrangement it was difficult to form multi-ply sheets on a Fourdrinier type of machine. Furthermore, where multi-ply sheets having plies of varying characteristics, such as color, were formed in machines of this type, the effluent water from the several pulp layers was necessarily intermixed with the result that pulp from the different kinds of stock could not be effectively recovered for reuse.

A primary object of the invention is, therefore, to provide apparatus for forming multi-ply sheets of paper, paperboard and the like wherein a plurality of layers of pulp may be deposited in superimposed relation on a Fourdrinier wire and in which water may be removed from the several pulp layers as deposited so that the water may be segregated for separate recovery of pulp therefrom.

Another object of the invention is to provide paper making apparatus of the Fourdrinier type in which wear on the Fourdrinier wire is substantially reduced by the provision of rotatable foraminous cylinders for dewatering the stock, each of the cylinders being connected to a vacuum source.

A further object of the invention is to provide apparatus for forming a multi-ply sheet of paper, paperboard and the like in which a plurality of foraminous cylinders are rotatably mounted in spaced relation in engagement with the inner surface of an endless Fourdrinier wire, in which each of the cylinders is connected to a vacuum source, and in which successive layers of pulp are deposited on the wire at the several cylinders so that the effluent water from the several layers may be effectively segregated.

A further object of the invention is to provide apparatus for forming a multi-ply sheet of paper, paperboard and the like in which a plurality of stock inlets are arranged in series along the length of an endless Fourdrinier wire for the depositing of successive layers of pulp thereon, and in which a vacuum source is arranged in register with each of the stock inlets so that the layers are formed on the wire in superimposed relation and the effluent water from the several layers may be separately removed for subsequent recovery.

A more particular object of the inventon is to provide apparatus for forming a multi-ply sheet of paper, paperboard and the like in which a plurality of foraminous cylinders are rotatably mounted in spaced relation in

engagement with the inner surface of a Fourdrinier wire, in which a stock inlet is arranged in register with each of the cylinders for depositing stock in successive layers on the upper surface of the wire, and in which each of the cylinders is surrounded by an evacuated enclosure for forming the several plies and for removing water therefrom so that effluent water removed from the several layers may be segregated by the separate evacuated enclosures for subsequent independent recovery of pulp therefrom.

Another object of the invention is to provide apparatus for forming a multi-ply sheet of paper, paperboard and the like in which a plurality of stock inlets are arranged in series along the length of a Fourdrinier wire so that successive layers of pulp are deposited thereon, and in which a suction type forming unit is arranged in register with each of the stock inlets for removal of water from each pulp layer as it is formed so that the water from the several layers may be readily segregated for subsequent separate recovery of pulp therefrom.

These and other objects of the invention will be apparent from time to time as the specification proceeds and with reference to the accompanying drawing wherein:

Figure 1 is an elevational diagrammatic view of the forming end of a Fourdrinier type paper making machine equipped with stock feed and water removal apparatus in accordance with the present invention;

Figure 2 is an enlarged fragmentary elevational view, also diagrammatic in nature, showing in more detail the apparatus of the present invention in operative relation to a Fourdrinier wire of conventional type; and

Figure 3 is a vertical sectional view of a modified form of vacuum source which may be used in lieu of the arrangement shown in Figures 1 and 2.

As shown on the drawing:

In Figure 1 the reference numeral **10** designates generally an endless band or Fourdrinier type paper making machine including a looped forming wire **12** trained between a roll **14** and a couch roll **16**. Stationary suction boxes **18** may be mounted within the loop of the wire **12** in engagement with the undersurface of the upper run of the wire. According to the present invention, a first foraminous roll **20** is rotatably mounted in engagement with the inner surface of the wire **12** in a manner that a continuous wrapped zone **21** is formed about the periphery of the roll **20**. The roll **20** is surrounded by an enclosure **22** which may be connected by means of a conduit **24** to a suitable source of vacuum (not shown). The enclosure **22** has an opening **23** through which a portion of the periphery of the cylinder **20** extends and which provides communication between the interior of the enclosure and the wrapped zone **21** of the wire **12**. A first stock inlet **26** is arranged for depositing stock on the outer surface of the wire **12** within the confines of the zone **21** and in register with the cylinder **20**. As the stock is deposited, water is extracted therefrom by suction within the enclosure **22** and may be carried off for subsequent recovery of the remaining pulp in a conventional manner.

A second stock inlet **28** is arranged in spaced relation to the first stock inlet **26** for depositing stock on the pulp layer from the first stock inlet. The stock inlet **28** is arranged in register with a second foraminous cylinder **30** which is rotatably mounted in spaced relation to the first foraminous cylinder **20** and also engages the undersurface of the wire **12**, thereby forming a continuous wrapped zone **31**. The cylinder **30** may be surrounded by an enclosure **32** connected by a conduit **34** to a source of vacuum (not shown). The enclosure **32** has an opening **33** through which a portion of the periphery of the cylinder **30** extends and which provides communication between

the interior at the enclosure and the wrapped zone **31** of the wire **12** for forming the second pulp layer and removing water therefrom. Since the evacuated enclosure **32** must pull water through both of the pulp layers, the degree of evacuation within the enclosure **32** may be somewhat higher than that of the enclosure **22**. The water thus withdrawn may then be treated for recovery of any pulp remaining.

According to the present invention, a multi-ply sheet having fiber layers of varying characteristics may be formed and the effluent waters from the several layers are immediately separated from the stock as the pulp layer is formed so that intermixing of water from the several pulp layers is prevented. This arrangement is particularly advantageous in the forming of paper and paperboard in which one ply is of a higher fiber quality than the other ply, or where the several plies vary in color. It will be appreciated that the number of forming units employed may be varied at will to obtain a finished product of any desired number of plies. The removal of water from the stock layers as formed by the cylinders **20** and **30** obviates the need for a long series of suction boxes **18**. In the present instance, the suction boxes may be entirely eliminated with a consequent decrease in wear of the forming wire **12**. Where the boxes **18** are utilized, however, they may be operated at a higher pressure or a lower degree of vacuum so that wear on the forming wire **12** is diminished.

In Figure 3 is shown a modified form of suction forming unit that may be employed instead of the foraminous cylinder and evacuated enclosure arrangement of Figs. 1, 2 and 3. This suction forming unit, indicated generally by reference numeral **36**, includes a rotating perforated shell **38**, a stationary suction gland **40** within the shell **38**, and circumferentially spaced seals **42**. The space within the gland **40** may be connected to a suitable source of vacuum (not shown) for removal of water from a pulp layer through the perforations of the shell **38**, as will be understood. Both the cylinder **20** and the cylinder **30** may be replaced by a suction forming unit of the type shown in Figure 3. As in the principal form of the invention, water removed from the several layers as they are formed is immediately segregated for a separate recovery of pulp therefrom.

It will be understood that various modifications and variations of the present invention may be effected without departing from the spirit and scope of the novel concepts thereof.

I claim as my invention:

1. In a paper machine having an endless forming wire wrapping a plurality of rolls and defining therewith a continuous wire loop movable across at least one vacuum box, the improvement which comprises a plurality of spaced forming units each located upstream of the vacuum box to successively deposit a stock slurry upon the forming wire to provide a multi-ply web and to successively and separately remove effluent water from the slurry during deposit upon the wire, each forming unit comprising a foraminous rotatable roll within the wire loop and defining a wrapping zone therewith, an enclosure substantially surrounding the roll and also within the loop and provided with an opening through which a portion of the periphery of the roll extends to establish communication between the wrapping zone and interior of the enclosures, a stock inlet outside the wire loop and shaped to define a tangential flow path for the stock slurry relative to the direction of travel of the forming wire along the wrapping zone, and conduit means within the wire loop and connecting with the enclosure and with a vacuum source to apply a negative pressure to the stock slurry during deposition in the wrapping zone to withdraw effluent water for subsequent recovery, each forming unit being independent of another forming unit to the extent that stock slurries of different characteristics can be deposited upon the wire in the spaced wrapping zones and the effluent water from each slurry separately removed without admixing to permit re-using the same.

2. In a paper machine having an endless forming wire wrapping a plurality of rolls and defining therewith a continuous wire loop movable across at least one vacuum box, the improvement which comprises a plurality of spaced forming units each located upstream of the vacuum box to successively deposit a stock slurry upon the forming wire to provide a multi-ply web and to successively and separately remove effluent water from the slurry during deposit upon the wire, each forming unit comprising a perforated rotatable shell within the wire loop and wrapped thereby and defining a wrapping zone therewith, a stationary suction gland interiorly of the shell connected to a source of vacuum, seal means spaced along the inner diameter of the shell and connecting with the suction gland to define an accurate length along said diameter substantially coextensive with the wrapping zone, and a stock inlet outside the wire loop and shaped to define a tangential flow path for the stock slurry relative to the direction of travel of the forming wire along the wrapping zone, the stock slurry during deposition in the wrapping zone having a negative pressure applied thereto to withdraw effluent water for subsequent recovery, each forming unit being independent of another forming unit to the extent that stock slurries of different characteristics can be deposited upon the wire in the spaced wrapping zones and the effluent water from each slurry separately removed without admixing to permit re-using the same.

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