June 3, 1969 W. E. ROJECKI 3,447,453

PAPER MACHINERY

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FIG-1

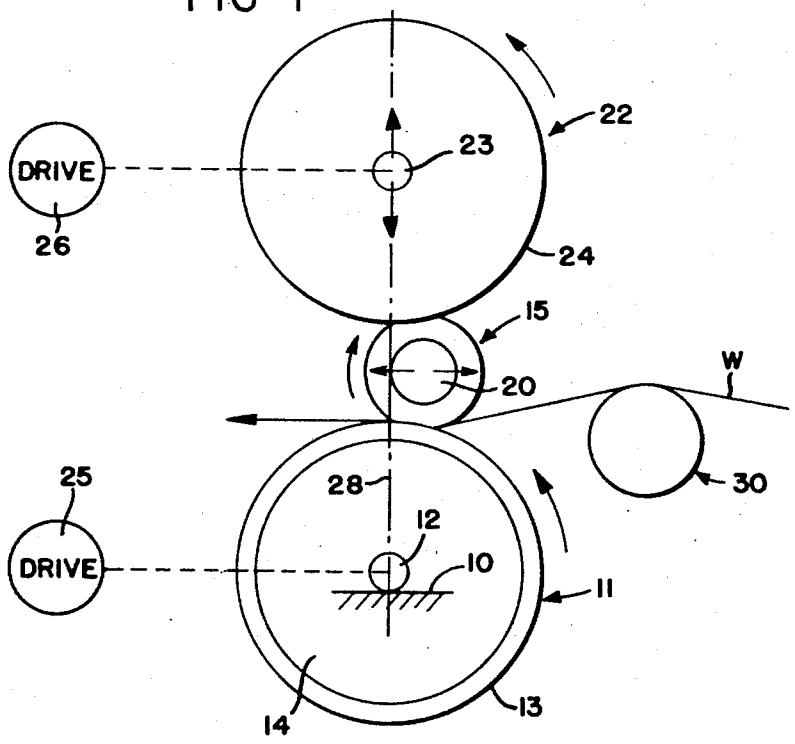
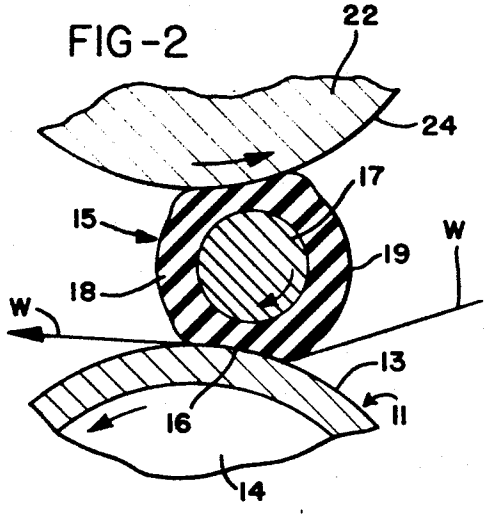



FIG-2




INVENTOR.
WALTER E. ROJECKI

BY

Marshall, Bibel, French & Bugg
ATTORNEYS

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# PAPER MACHINERY

Walter E. Rojecki, Watertown, N.Y., assignor to The Black Clawson Company, Hamilton, Ohio, a corporation of Ohio

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U.S. Cl. 100—162 7 Claims

## ABSTRACT OF THE DISCLOSURE

Extensible paper is produced on a press assembly including a driving press roll, an intermediate roll and a backup roll. The intermediate roll has a diameter substantially smaller than the diameter of the press and backup rolls, is offset in the relation to a plane defined by the axes of the press and backup rolls and has a resilient high friction outer surface which cooperates with the press roll for uniformly contracting a paper web directed between the press and intermediate rolls.

This invention relates to a press assembly for producing extensible paper, and more particularly, to a press assembly of improved, simple and economical construction and adapted to produce a paper of uniform quality and having substantial extension characteristics.

The present invention has special relation to the paper machinery shown in Rojecki Patent No. 3,269,893 and assigned to the same assignee as the present invention. That is, the machinery of the present invention is adapted for use in the production of extensible paper by contracting a web of paper in a longitudinal direction as the web passes through the press.

The principle of operation of the press assembly of the invention is generally similar to that disclosed in Cluett Patent No. 2,624,245, issued Jan. 6, 1953. In general, this principle employs the expansion of a resilient high friction surface and then contracting the surface while a paper web is held in firm contact therewith by a low friction surface so that the web contracts longitudinally with the high friction surface. The present invention is primarily directed to novel machinery which will not only carries out the above principle but also embodies principles for obtaining uniform nip pressure disclosed in Rojecki Patent No. 3,331,734 and assigned to the same assignee as the present invention.

Accordingly, it is a primary object of the present invention to provide an improved and simplified press assembly for use in producing extensible paper and including a press roll having a low friction outer surface in nip forming relationship with an intermediate roll having a high friction resilient surface, and further including means for backing up the intermediate roll in such a manner as to produce uniform nip pressure and thus uniform contraction of a paper web held in contact with the high friction resilient surface.

As another object, the present invention provides a press assembly as outlined in the preceding paragraph wherein the intermediate roll has a small diameter for producing substantial expansion and contraction of the resilient surface for providing substantial shrink or contraction of the web.

Still another object of the invention is to provide a press assembly as outlined above wherein the small diameter intermediate roll is of a lightweight economical construction and thus provides convenience in interchanging or replacing the intermediate roll when the resilient surface becomes worn after extended use.

Still another object of the invention is to provide a compact press assembly which is easy to install and is



especially suited for converting an existing breaker stack into a press for producing extensible paper.

A further object of the invention is to provide a press assembly as outlined above in which the nip pressure can be conveniently adjusted to control the percentage of shrink or contraction of the web while maintaining a uniform nip pressure for providing uniform contraction of the web across its entire width.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawing and the appended claims.

In the drawing:

FIG. 1 is a diagrammatic view illustrating a paper machine press assembly constructed in accordance with the invention; and

FIG. 2 is a fragmentary section view showing the deformation of the intermediate roll for producing contraction of the paper web.

Referring to the drawing, which illustrates a preferred embodiment of the invention, the press assembly includes a frame schematically illustrated by the reference character **10**. A large diameter press roll **11** having journals **12** is rotatably supported by the frame **10** and is formed with a smooth low friction outer surface **13** and defines an internal cylindrical chamber **14** adapted to receive steam for heating the roll.

An intermediate roll **15** having a substantially smaller diameter than that of the press roll **11** forms a nip **16** with the press roll. Preferably, the intermediate roll **15** has a length to diameter ratio of approximately 35 to 1 and includes a solid steel core **17** (FIG. 2) covered by a thick layer **18** of soft rubber which forms a resilient high friction outer surface **19**.

The end portions of the core **15** extend beyond the resilient layer **18** to form journals **20** which are rotatably supported by the frame **10**. The frame also rotatably supports a backup roll **22** having journals **23** so that the roll **22** forms a nip with the intermediate roll **15** generally opposite the nip formed with the press roll **11**. Preferably the backup roll **22** has a smooth outer surface **24**.

As illustrated in FIG. 1, the press roll **11** is driven counterclockwise by a suitable drive **25**, and the backup roll **22** is provided with a helper drive **26** which is especially desirable for starting purposes. The intermediate roll **15** is positioned slightly offset relative to the plane **28** defined by the axes of the rolls **11** and **22** so that the lateral inward force component produced by the torque transmitted to the intermediate roll **15** from the driven press roll **11** is opposed by the lateral outward force component produced by the compression of the intermediate roll **15** between the rolls **11** and **22**.

The intermediate roll **15** and the backup roll **22** are independently adjustable as shown by the arrows in FIG. 1 by suitable means such as that disclosed in the above Patent No. 3,331,734, to provide a predetermined nip pressure and to provide precise balancing of the lateral forces acting on the intermediate roll **15**. This balancing of the lateral forces produces a uniform nip pressure along the entire length of the nip **16** between the intermediate roll **15** and press roll **11** since there are no forces tending to bend or bow the intermediate roll.

A web W of paper is directed from a guide roll **30** through the nip **16** formed between the heated press roll **11** and the intermediate roll **15**. As a result of the compression of the resilient outer rubber layer **18** on the intermediate roll **15**, the layer is deformed within the nip **16** so that a portion of the surface **19** overlaps a portion of the surface **13** of the press **11** causing the outer surface **19** to expand.

The degree of expansion of the paper is determined by several factors including the thickness and durometer

of the outer rubber layer **18** and pressure at the nip **16**. For optimum performance, the radial thickness of the rubber of the outer layer **18** is preferably within a range of 1 to 1.5 inches and the durometer of the rubber within a range of 40–50.

The paper web W is received and compressed between the high friction surface **19** of the intermediate roll **15** and the low friction surface **13** of the press roll **11** after the outer surface **19** has expanded so that the web contracts with the outer surface **19** as the web is carried from the nip **16** while confined between the outer surfaces **13** and **19**. The adherence of the web W to the contracting high friction surface **19** causes the web to slip slightly relative to the smooth low friction surface **13** of the press roll **11**.

As can be seen from the drawing and the above description, several desirable features and advantages are provided by the press assembly of the invention. One primary advantage is provided by the balance of the dynamic lateral forces acting on the intermediate roll **15**. That is, this balance of lateral forces produces uniform pressure between the smooth surface **13** of the press roll **11** and the resilient deformed surface of the intermediate roll **15** across the full width of the web W. This uniform pressure produces a uniform contraction of the web W and thus uniform extension characteristics within the resulting extensible paper.

Another desirable feature is provided by the small size of the intermediate roll **15**. The high length to diameter ratio provides the intermediate roll with comparatively light weight and thus enables the roll to be conveniently interchanged and replaced by a new roll after the outer surface **19** of the intermediate roll has become worn. The small diameter of the intermediate roll **15** also provides for a low cost construction which minimizes the expense of replacing the roll.

It is also an important feature of the press assembly that the small diameter of the intermediate roll **15** and the thickness and durometer of the rubber layer **18** cooperate with the nip pressure to produce substantial shrink or contraction of the paper web W and thus enable an extensible paper to be formed having the ability to be extended substantially before tearing. Furthermore, as a result of the backup support of the intermediate roll **15** along its length and the ability to balance the lateral dynamic forces acting on the intermediate roll, substantial pressure can be exerted at the nip **16** to provide for substantial expansion and contraction of the surface **19** while maintaining the uniformity of the pressure.

What is claimed is:

**1.** A press assembly for use in producing extensible paper comprising a press roll in nip forming relationship with an intermediate roll, said press roll having a smooth low friction outer surface, said intermediate roll having a diameter substantially smaller than the diameter of said press roll and including means forming a resilient high friction outer surface layer adapted to expand and contract as a result of the nip formed with said press roll, means for driving said press roll, a backup roll in nip forming relationship with said intermediate roll and having a diameter substantially greater than the diameter of said intermediate roll, means for supporting said backup roll with said intermediate roll positioned in offset relationship with a plane defined by the axes of said press and backup rolls to balance the dynamic lateral forces acting on said intermediate roll and thereby to produce uniform nip pressure between said press roll and said intermediate roll causing uniform expansion and contraction of said high friction surface layer along the length of said intermediate roll, and guide means for directing a web through the nip formed between said press roll and said intermediate roll so that the web contracts uniformly across its width.

**2.** A press assembly as defined in claim **1** including a drive for said press roll and a helper drive for said backup roll.

**3.** A press assembly as defined in claim **1** wherein said intermediate roll exclusive of said surface layer has a substantial length to diameter ratio to aid in producing a paper web capable of substantial extension.

**4.** A press assembly as defined in claim **3** wherein said length to diameter ratio of said intermediate roll is in the order of 35 to 1.

**5.** A press assembly as defined in claim **1** wherein said intermediate roll is formed by a central metal core covered by a layer of soft rubber-like material to provide said resilient high friction outer surface.

**6.** A press assembly as defined in claim **5** wherein said layer of rubber-like material has a radial thickness generally within a range of 1 to 1.5 inches for contributing to the production of paper having substantial extension characteristics.

**7.** A press assembly as defined in claim **5** wherein said layer of rubber-like material has a durometer generally within a range of 40 to 50 for contributing to the production of paper having substantial extension characteristics.


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PETER FELDMAN, *Primary Examiner.*

U.S. Cl. X.R.

26—18.6; 162—206, 361