March 6, 1962 C. W. E. WALKER 3,023,805

TRANSFER PRESS

Filed Feb. 29, 1960

Fig. 1

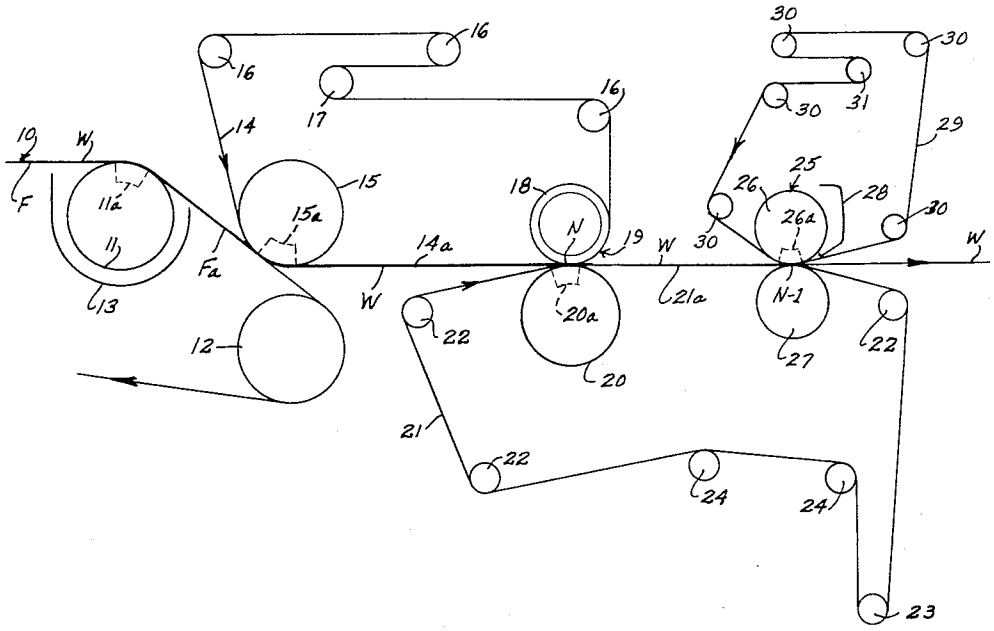
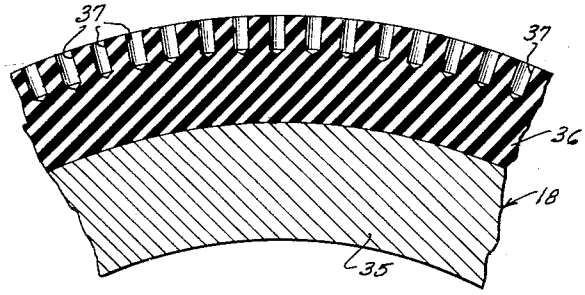


Fig. 2



Inventor

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3,023,805

TRANSFER PRESS

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The present invention relates broadly to the art of paper making, and is more particularly concerned with a new and improved transfer press assembly and method of preventing crushing at a transfer press nip, featuring the provision of a press roll having a pattern of blind drilled holes therein effective as reservoirs to temporarily accommodate the press felt water content and thereby permitting an increase in nip pressures with the consequent important advantage of increased water removal from the paper web.

It is known in the art that at the couch roll end of a Fourdrinier paper machine the web is removed from the forming wire by a transfer or pick-up felt, which carries the web on the underside of the felt lower run to a first or transfer press, whereat the web is received by or transferred to a press felt for water removal action by a subsequent press section. It is further within the knowledge of the art that the paper web at the time of its advancement through the transfer press nip has a high water content and in fact may only contain from 10 to 25% dry fiber, while the pick-up felt is also thoroughly wet with water in order that it may effectively remove the paper web from the forming wire and carry the web to the transfer press.

It can accordingly be readily appreciated that, by reason of the generally saturated condition of the paper web and pick-up felt, the nip pressures at the transfer press must be limited to a relatively low value in order to avoid disturbances in fiber formation arising from what is termed in the art as "crushing." Specifically, when a high water content felt enters the transfer press nip and the pressures at said nip exceed a predetermined amount, there is noted to be at the oncoming side of the nip a backward rush of water in opposition to the direction of travel of the felt and web into and through the nip. This constitutes a highly disturbing influence on proper fiber formation, and nip pressures are therefore limited and little if any water is removed from the web at the transfer press.

In addition, and notwithstanding the crushing problem, if the nip pressures at the transfer press were sufficient to actually drive water from the felt and through the web, any fines or loading materials in the web are washed out with the water and the desired sheet quality is not obtained. For this further reason, in the prior art the transfer press has been limited to the sole function of transferring the web from the pick-up felt to a press felt, with essentially no water removal from the web at the transfer press.

It is accordingly an important aim of the present invention to provide a transfer press assembly of novel construction featuring avoidance of the crushing problem and having the further important advantage of permitting increased nip pressures so that substantial volumes of water can be removed from the web at the transfer press.

Another object of the invention lies in the provision of a method of preventing crushing in a high moisture content web traveling in contact with a relatively wet felt, wherein the web and felt are advanced toward a pair of relatively rotatable rolls one of which is provided with an array of small diameter blind holes along the outer diameter thereof, said rolls rotated in nip-defining relation to advance said web and felt into the nip and force the moisture in the felt into the holes in said one of the rolls, and the felt and web separated at the off-running side of the nip while said rolls are continuously being rotated to release the moisture in said holes for return to the felt.

A further object of the instant invention is to provide an improvement in a press assembly having a pair of rolls in nip-defining relation and receiving a relatively wet felt and a high moisture content web at said nip, the improvement being principally directed to the provision of a roll having on its outer diameter an array of relatively small diameter blind holes receiving moisture from the felt upon entry of said felt into the nip, then holding said moisture therein during passage of the felt through the nip, and next releasing said moisture to the felt upon its exit from the nip.

Other objects and advantages of the invention will become more apparent during the course of the following description, particularly when taken in connection with the accompanying drawings.

In the drawings, wherein like numerals designate like parts throughout the same:

FIGURE 1 is a more or less diagrammatic representation of the couch roll end of a paper machine and embodying therein a transfer press constructed in accordance with the principles of this invention; and

FIGURE 2 is a detail sectional view of a press roll in the transfer press of this invention, to more fully illustrate the array of relatively small diameter blind holes therein.

Referring now to FIGURE 1, there is shown a paper machine generally designated by the numeral **10** and comprising a forming wire F looped over a suction couch roll **11** and a turning roll **12**, the couch roll having a suction area **11***a*, and if desired, a saveall **13** in association therewith. The forming wire F supports a paper web W thereon over the couch roll **11** and along a downwardly inclined wire run F*a*.

The paper web W is removed from the downwardly inclined wire run F*a* by a looped pick-up felt **14** which is urged against the web W by a suction pick-up roll **15** having a suction area **15***a*. The pick-up felt **14** is also trained around a plurality of guide rolls **16**, a tensioning roll **17** and a press roll **18** of a transfer press assembly, generally designated at **19** and to be later described in further detail. By action of the pick-up felt **14** and suction pick-up roll **15** the paper web W is carried along the underside of lower run **14***a* of the pick-up felt to the transfer press assembly **19**.

The transfer press **19** comprises, in addition to the top press roll **18**, a lower suction roll **20** having a suction area **20***a*, which in accordance with this invention performs water removal functions in addition to effecting transfer of the paper web W from the pick-up felt **14** to a press felt **21** at nip N defined by the top press roll **18** and lower suction roll **20**. Within the loop of the press felt **21** is a plurality of guide rolls **22** and a tensioning roll **23**, while outside of the loop are additional guide rolls **24**.

Downstream of the transfer or first press **19** is a second press **25** to which the paper web W is directed and carried by the upper surface of top run **21***a* of the press felt **21**. The second press section **25** is comprised of a top suction roll **26**, having a suction area **26***a*, and a lower press roll **27** within the loop of the press felt **21**. The top suction roll **26** may have in association therewith a saveall **28**, and wrapped by the suction roll **26** is an upper looped press felt **29** trained around a plurality of guide rolls **30**, and if desired, around a tensioning roll **31**. As is appreciated, the paper web W after leaving the second press **25** would normally pass through one or more additional press sections to remove therefrom additional

water prior to movement into a drying section (not shown).

It will of course be further appreciated that the specific arrangement of press felts **21** and **29** may be varied, as for example, the roll **26** may be a plain press roll and the roll **27** a suction press roll. A wide variety of pick-up and press sections are known to the art, and it will therefore be understood that the arrangement of FIGURE 1 is intended to be merely illustrative of an exemplary environment for the transfer press **19** of this invention.

In the conventional transfer press the pick-up felt wraps a press roll having an uninterrupted or solid outer diameter, whether it be provided by a rubber covered roll or a bare metal roll. Under the circumstances, when a substantially saturated pick-up felt and paper web of relatively low dry fiber content enter the nip at the press and suction rolls of the transfer press, crushing in all reasonable likelihood will occur if the nip pressure exceeds a relatively low value. Crushing is of course destructive of good fiber formation, and it is therefore the customary practice to apply at the transfer press only minimum nip pressure, and accordingly, there is essentially no water removal accomplished from the paper web at the transfer press. Further, and as was noted, the presence of large volumes of water in the pick-up felt and the application of nip pressures sufficient to drive through the paper web washes out fines or loading materials therein. This is of course additional to the problem of crushing, and the prior art has accordingly resorted to use of the transfer press for the sole function of transferring the paper web from the pick-up felt to the press felt, and has accomplished essentially no water removal at the transfer or first press. This necessitates the provision of a plurality of downstream press sections and a lengthening of the press end of the paper machine, in order to effect the desired amount of water removal by the more economical mechanical expedient of pressing, prior to transfer of the web or sheet to heated drying sections.

In accordance with the novel concepts of this invention, the liquid or water expelled from the pick-up felt by action of the nip is retained in the press roll **18** of the transfer press during passage of the felt through the transfer press nip, so that at the nip a substantial amount of the water present in the paper web and in the lower press felt can be expelled by the nip pressure and withdrawn through action of the suction roll of the transfer press, since the excess pick-up felt water is essentially entirely and temporarily removed. Substantially higher nip pressures can therefore be employed. By this invention crushing and washing are essentially entirely eliminated, and by accomplishing web water removal functions at the transfer nip, the efficiency of the paper making process is markedly increased. As is known, at the nip N the paper web W is "transferred" away from the wet felt **14** as they leave said nip. Accordingly, rewetting of the felt **14** from the press roll **18** as it leaves the nip N does not also rewet the paper web.

Apparatus effective to eliminate crushing and to produce the new results stated comprises the transfer press **19** and particularly a press roll **18** constructed substantially in the manner shown in FIGURE 2. The press roll **18**, which is normally in the top position shown, is provided with an inner metal cylinder or shell **35** to which is bonded or otherwise secured along the outer diameter thereof an elastomeric covering **36** having on its outer diameter a plurality of generally equally spaced and radially inwardly extending blind holes or pockets **37** of relatively short depth and relatively small diameter. In the exemplary embodiment of the invention illustrated in FIGURE 2, the covering **36** is formed of rubber to prevent or reduce slippage of the pick-up felt **14** thereon, although the desired degree of water retention could be accomplished if the blind holes **17** were provided in a bare metal roll. However, a rubber covering **36** has the further advantage of weight savings and ready replacement, and in accordance with this invention the covering **36** is of relatively low deformability, having a hardness of about 30 P&J, so that the covering does not compress substantially at the nip to entrap substantial amounts of air therein, which would upon release of the deforming or compressing force at the nip cause water in the holes **37** to be spewed out by the entrapped air to create a possible disturbance to proper fiber formation in the web traveling therebeneath.

The blind drilled holes **37** in the hard rubber covering **36** are calculated as to number, depth and diameter so as to accommodate at the nip N an appreciable amount of the total volume of water in the area of the pick-up felt **14** compacted at said nip. Illustratively stated, the holes or pockets **37** may have a depth ranging from ¼ to about 1 inch, diameters ranging from approximately 1/16 to ¼ inch, and at a spacing to provide about 10% to about 50% open area.

It will now be appreciated that when the top press roll rotates in counter-rotating relation with the lower suction roll **20**, and the lower run **14***a* of the pick-up felt **14** in a highly wet condition advances and carries the relatively low fiber content paper web W into the nip N, the water or liquid in the pick-up felt is forced therefrom by the nip pressure radially inwardly into the reservoirs provided by the blind holes **37** in the covering **36** on the top press roll **18**. While the felt is passing through the nip, the nip pressures prevent release of the retained water in said holes **37**, and the water is not released for return to the pick-up felt **14** until the felt is at the off-running side of the nip and the nip pressures substantially reduced. The water reservoirs provided by the holes **37** are thus effective to temporarily remove from the nip N the water in the pick-up felt **14** to prevent the earlier noted crushing and washing conditions, and yet, since essentially the entire water volume retained in the holes **37** is released or returned to the felt at the off-running side of the nip, the pick-up felt **14** is maintained at the desired degree of wetness for effective web pickup on the downwardly inclined wire run F*a*. In other words, the pick-up felt **14** is returned to the web pick-up point generally defined by the suction area **15***a* of the suction pick-up roll **15** at generally the same moisture content as when the felt leaves the top press roll **18**, although the normal water losses encountered in the absence of the top press roll structure of this invention may necessitate replenishment and as well, conventional felt washing and wringing devices may be used on the pick-up felt **14** in the manner well known to the art.

Since by this invention there is temporarily removed from the pick-up felt at the nip N the major volume of water in said felt, and accordingly there is eliminated the problems of crushing and washing through the web at the nip N, the nip pressure at the transfer press nip can be markedly increased so that the transfer press can now perform water removal functions on the paper web W. The nip pressure employed and the degree of water removal effected by the press felt **21** and suction gland **20***a* of the lower suction roll **20** is of course calculated to avoid any disruptions in fiber formation in the relatively wet paper web at the nip N, although by the novel transfer press **19** of this invention a substantial volume of web water is effectively removed without damage to the web, with the result that it is now possible to eliminate one or more downstream press sections and still provide a paper web which upon entry to the drying section is not in an abnormally wet condition. Accordingly, this invention has the important advantages of eliminating crushing and washing which occurs when water is driven through the web, and now permitting water removal functions to be performed at a transfer press, with the further advantageous results noted.

An exemplary form of the invention has been herein described and illustrated in connection with a particular arrangement of pick-up and press sections, although the invention is not so restricted and various changes and

modifications may well be practiced without departing from the novel concepts of the instant invention.

I claim as my invention:

1. In a transfer press assembly having a pair of rolls in nip-defining relation and receiving a relatively wet felt and a high moisture content web at said nip, the improvement which comprises a relatively hard elastomeric covering of low yieldability on one of said rolls and having in its outer diameter an array of relatively small diameter radially directed blind holes receiving moisture from said left upon entry of the felt into the nip, holding said moisture therein during passage of the felt through the nip, and releasing said moisture to the felt upon its exit from the nip.

2. A transfer press assembly, comprising a pick-up roll, a press roll, a pick-up felt trained around said pick-up and press rolls, a suction roll in nip-defining relation with said press roll, and a press felt movable through said nip in contact with said suction roll, said press roll being provided with a relatively hard elastomeric covering of low yieldability having on its outer diameter an array of relatively small diameter radially directed blind holes receiving moisture from the pick-up felt upon entry of the felt into the nip, holding said moisture therein during passage of the felt through the nip, and releasing said moisture to the felt upon its exit from the nip, the suction roll and press felt being effective to remove water from a traveling paper web during passage through said nip and while the water from the pick-up felt is retained in the blind holes in the press roll.

3. A press roll for use in a paper machine transfer press assembly and located in said assembly to be wrapped by a high water content felt, said roll comprising a generally cylindrical shell and a covering thereon of relatively low deformability provided with an array of blind holes of a diameter and depth calculated to retain therein a substantial volume of the water in said felt during application of nip pressure to said felt and to later release said water volume directly to the felt, whereby crushing at the oncoming side of the nip is avoided, the holes having depth ranging from one-quarter to about one inch, diameters from one-sixteenth to one-quarter inch, and being spaced to provide from 10% to 50% open area.

4. A method of preventing crushing in a high moisture content web traveling in contact with a relatively wet felt in a transfer press assembly, which comprises advancing said web and felt toward a pair of relatively rotatable rolls one of which is provided with a relatively hard elastomeric covering of low yieldability having an array of small diameter radially directed blind holes along the outer diameter thereof, rotating said rolls in nip-defining relation to advance said web and felt into the nip and force the moisture in the felt into the holes in the covering on said one of the rolls without substantially deforming said holes, and separating the felt and web at the off-running side of the nip while continuously rotating said rolls to release the moisture in said holes for return to the felt.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,023,805 March 6, 1962

Charles W. E. Walker

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, line 11, for "left" read -- felt --.

Signed and sealed this 19th day of February 1963.

(SEAL)
Attest:

ESTON G. JOHNSON
Attesting Officer

DAVID L. LADD
Commissioner of Patents