July 30, 1974 E. A. NYKOPP 3,826,713

PAPER MACHINE PRESS SECTION AND METHOD FOR USING SAME

Original Filed Aug. 19, 1968 3 Sheets-Sheet 1

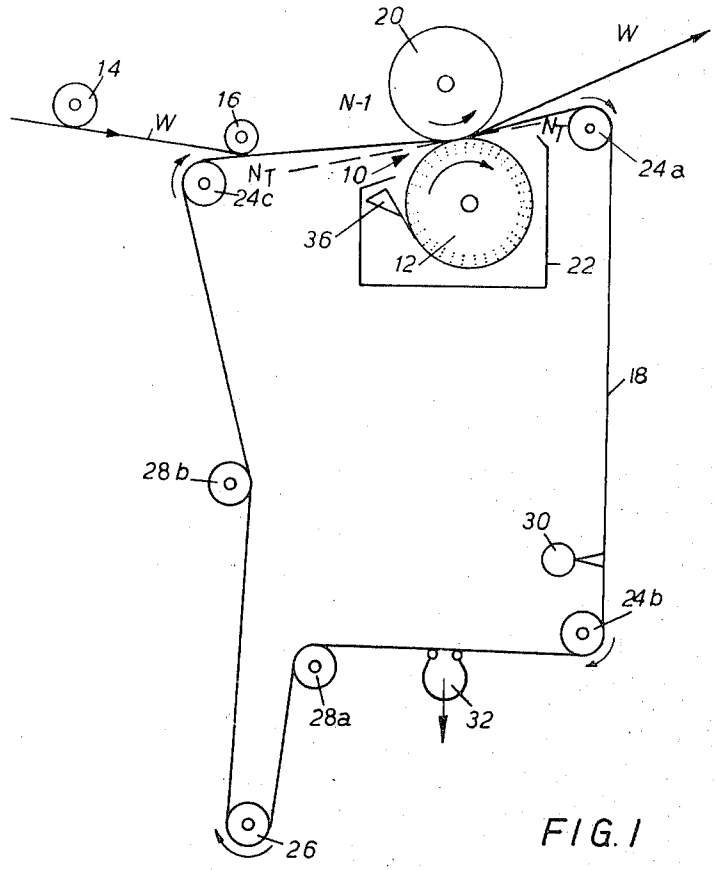


FIG. 1

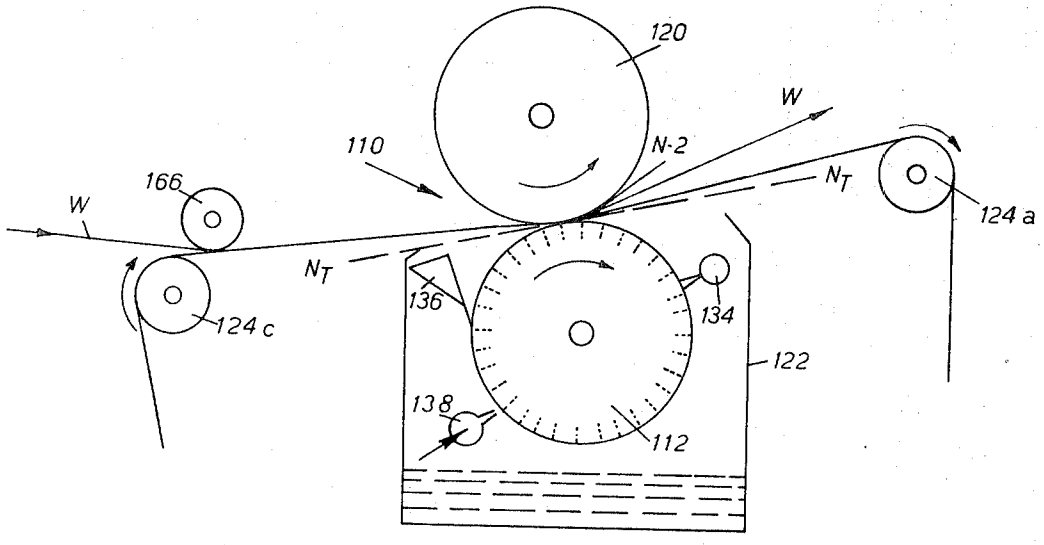


FIG. 2

INVENTOR
ERIK A. NYKOPP
BY Beale and Jones
ATTORNEYS

PAPER MACHINE PRESS SECTION AND METHOD FOR USING SAME

Original Filed Aug. 19, 1968 3 Sheets-Sheet 2

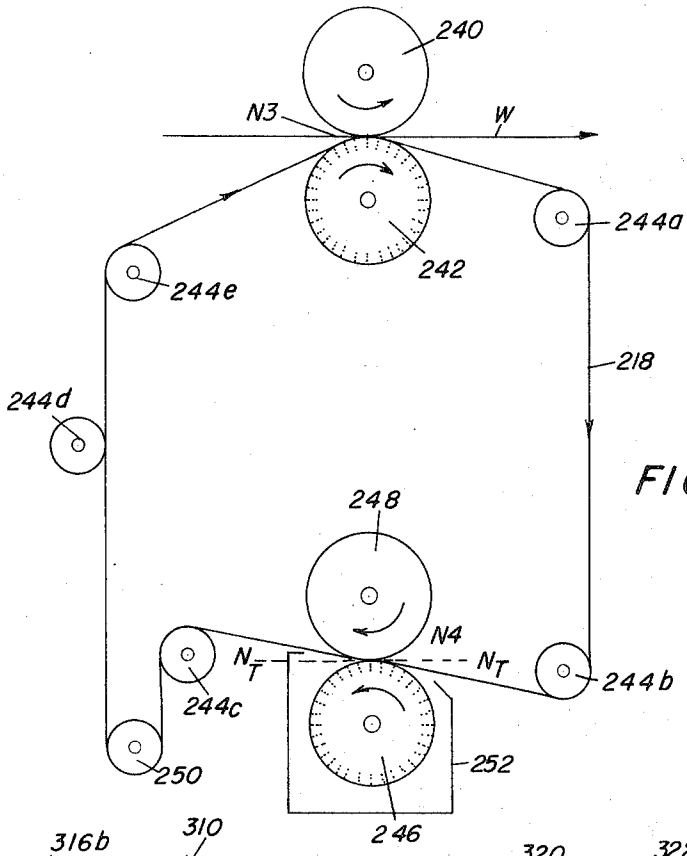


FIG. 3

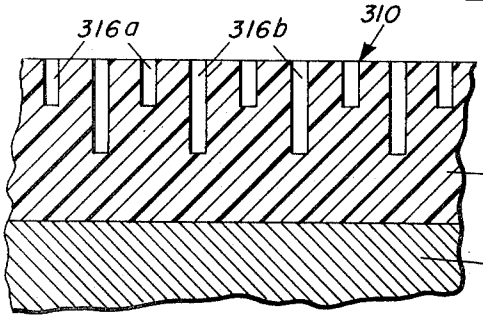


FIG. 4

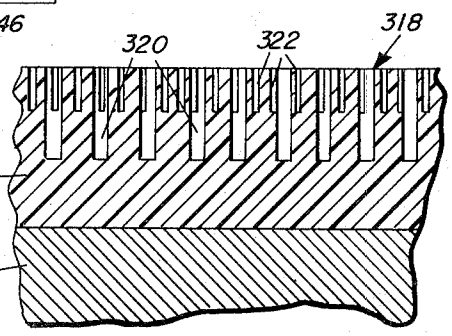


FIG. 6

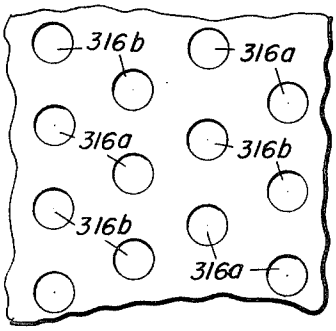


FIG. 5

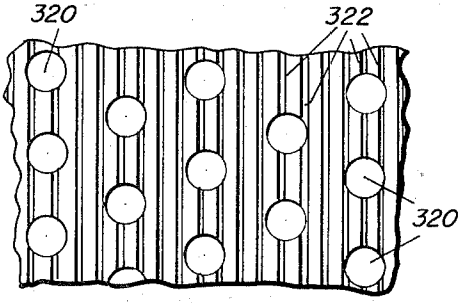


FIG. 7

INVENTOR
ERIK A. NYKOPP
BY Beale and Jones
ATTORNEYS

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PAPER MACHINE PRESS SECTION AND METHOD FOR USING SAME

Original Filed Aug. 19, 1968 3 Sheets-Sheet 3

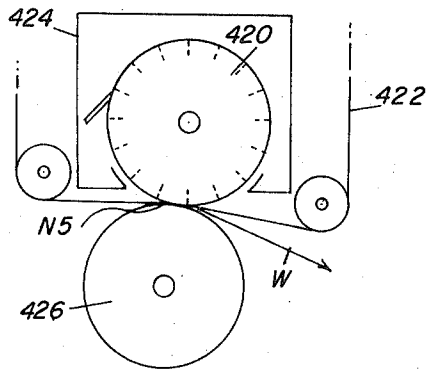


FIG. 8

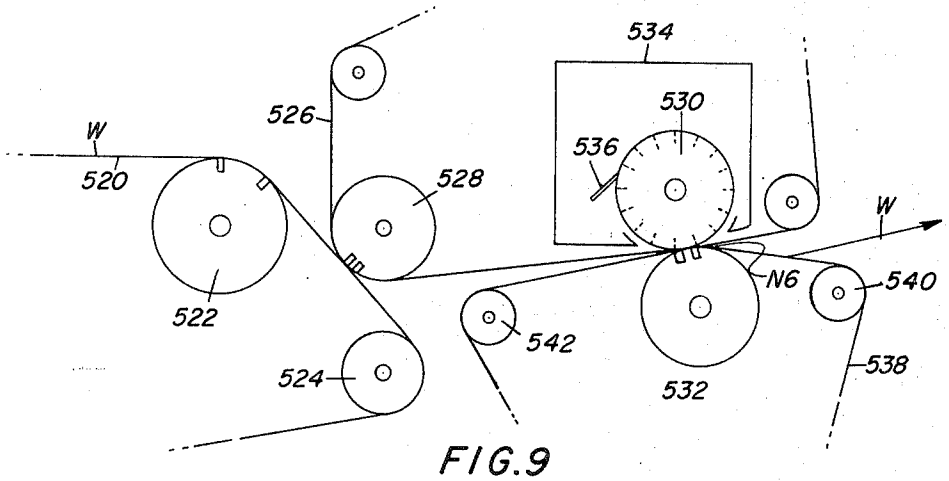


FIG. 9

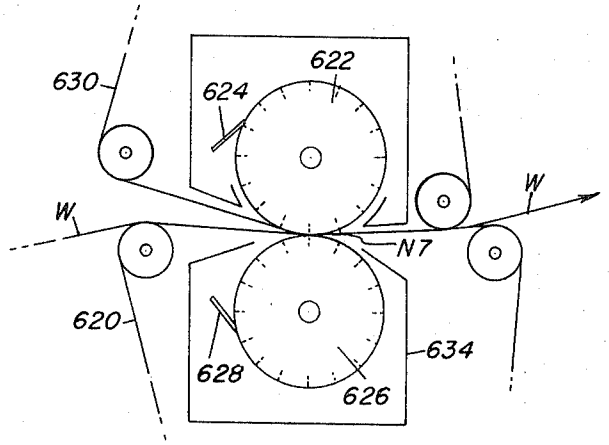


FIG. 10

INVENTOR
ERIK A. NYKOPP
BY Beall and Jones
ATTORNEYS

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PAPER MACHINE PRESS SECTION AND METHOD FOR USING SAME

Erik A. Nykopp, Tampere, Finland, assignor to Oy Tampella AB, Tampere, Finland

Continuation of abandoned application Ser. No. 753,490, Aug. 19, 1968. This application Apr. 28, 1972, Ser. No. 248,593

Int. Cl. B21f 11/00

U.S. Cl. 162—205 19 Claims

ABSTRACT OF THE DISCLOSURE

A paper web and its supporting felt or a felt only is dewatered employing a press assembly comprising a pair of press rolls in nip-defining relation wherein one of the press rolls is a blind drilled roll. On the off-running side of the nip the felt is guided away from the nip on the side of the nip tangent plane opposite the blind drilled roll at an angle defined between the felt and the common tangent plane. The blind drilled roll is disposed in a save-all having a side wall terminating at an upper edge spaced closely adjacent to the common tangent plane and the nip to prevent water from entering the felt on the off-running side of the nip.

This is a continuation of U.S. Patent Application Ser. No. 753,490, filed Aug. 19, 1968, in the name of Erik A. Nykopp, now abandoned.

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to the art of papermaking. More particularly, this invention relates to a paper machine press assembly for mechanically removing water from a paper web and its supporting felt or the felt only, and a method for utilizing said press assembly.

Description of the Prior Art

A transfer press assembly has been proposed which comprises a pair of rolls in nip-defining relation wherein one of the rolls is furnished with a relatively hard elastomeric covering of low yieldability. In the outer diameter of the cover an array of relatively small diameter, radially directed blind drilled holes is provided. A relatively wet felt and a high moisture content web is passed to the press nip for water removal. Upon entry of the felt into the nip, the moisture is received by the blind holes and is held therein during the passage of the felt through the nip. The moisture is released back into the felt upon exit of the felt from the nip.

In such an arrangement, the felt is maintained in contact with the blind drilled press roll, which is normally in the top position, on the off-running side of the nip. The moisture contained in the holes of the roll at the nip is retained in the holes by virtue of the nip pressures. The moisture is then released into the felt at the off-running side of the nip by virtue of the centrifugal force and the air pressure prevailing in the holes of the press roll.

The foregoing press assembly has only been employed as a transfer press and the felt transferring the web from the forming means is maintained in a wet condition in order to hold the web by capillary action on the underside of the felt between the pick-up roll and the transfer press. No provision has been made in such a system to collect the water from the blind holes on the off-running side of the nip and to completely eleminate such water from the system, since the water is intentionally transferred to the felt. In order to prevent the felt from becoming continually wetter, a felt drying means, such as a wringer press, must be provided on the return run for cleaning and drying the felt.

A divided press assembly has been proposed which comprises a looped press felt and a pair of press rolls each having rotary imperforate shells receiving the felt and a paper web in a press nip to receive water from the web, wherein one of the press rolls is within the felt loop and is provided with a myriad of small water-retaining recesses on its surface. As before, the water that is expressed from the web and into the felt at the nip is received by the recesses in the press roll and is retained therein at the nip until its release therefrom to the felt at the off-running side of the nip. This press arrangement has additionally included a suction press roll for removal of a quantity of the transferred water from the felt and moisture detecting means which senses the moisture content of the felt prior to its return to the press assembly.

In such an ararngement, the water that is recovered from the web by the felt at the press nip is received by the water-retaining recesses. However, the water is released to the felt at the off-running side of the nip as before. The press assembly comprising the blind drilled press roll is used as one part of the divided press assembly with the felt being freed from the water in a separate press assembly, which normally includes a suction roll for this purpose. In this arrangement, the felt is led away from the press nip comprising the blind drilled roll in an upward direction when the blind drilled roll is the top roll, and in a downward direction when the blind drilled press roll is the bottom roll. However, in either case, the felt is withdrawn relatively close to the blind drilled roll, so that the water released from the blind drilled roll will be received by the felt. Separate water removal means for the felt are necessary since no means are provided to remove the water retained in the blind drilled roll before the water is released into the felt. Also, no means is provided for removing or collecting any water that may be left on the blind drilled roll. Thus, for the press to be effective, the majority of water retained by the blind drilled roll has to be transferred to the felt.

Still another means of dewatering a wet web at a press nip has been proposed which consists in the employment of a press roll having a plurality of very closely spaced grooves which are very narrow and are relatively shallow. Likewise, very narrow alternating ridges or land areas are provided so that the grooves may be easily bridged by the felt carrying the wet web. The alternating grooves and ridges are continuous and are circumferentially aligned throughout the entire roll periphery. Alternatively, the alternating grooves and ridges may be in the form of a continuous spiral which is generally circumferentially aligned.

Unfortunately, the relatively small groove volume provided by grooved press rolls prevents their satisfactory employment in a pair of press rolls, which is the sole press roll pair in a looped felt, where relatively large quantities of water are to be handled. Thus, when a press roll pair including a grooved roll is employed in the first press position, additional felt drying means are required. Furthermore, even when grooved rolls are employed in press positions handling less amounts of water, the grooves become momentarily full of water in the center of the nip as water from the felt is pressed into them. This reduces the pressing efficiency of the press assembly.

SUMMARY OF THE INVENTION

According to the present invention, a press assembly is provided for use in a press section of a paper machine which comprises a press felt, a pair of press rolls in nip-defining relation for receiving the felt, with one of the rolls being an imperforate roll that is provided with myriads of radially directed blind drilled holes in its surface, means positioned relative to a common tangent

plane for the rolls for guiding the felt away from the nip on the side of the common tangent plane opposite the blind drilled press roll, at an angle defined between said felt and said common tangent plane, and a save-all means interposed between the imperforate blind drilled roll and the press felt. The save-all means has first and second side walls terminating at upper edges extending axially of the blind drilled roll, and one of the side walls is on the off-running side of the nip and terminates at an upper edge that is spaced closely adjacent to the common tangent plane and to the nip to prevent water that is released from the holes of the blind drilled roll from entering the felt on the off-running side of the nip.

Surprisingly, it has been found that the foregoing press arrangement permits the recovery of sufficient amounts of water from the press nip as to obviate the need for employing additional felt drying means, such as suction rolls, or a divided press assembly wherein a felt only assembly is required, for dewatering the felt.

Thus, the press assembly of the present invention comprising a pair of imperforate rolls, wherein one of the rolls is a blind drilled roll and the felt is led along or above (if the blind drilled roll is employed as the bottom roll) the tangential plane between the rolls after exit from the nip, can be successfully employed as the sole press pair for dewatering a wet web and its supporting felt in a felt loop.

The imperforate or blind drilled roll is provided with an arrangement of radially directed blind drilled recesses which may be provided in a hard metal sleeve, or preferably in a relatively soft elastomer or rubber cover for the roll for receiving moisture. The recesses preferably comprise a myriad of small blind drilled holes having a relatively small diameter ranging, for example, between about 1/16 and about 1/4 inch and having a substantial depth of, for example, at least about 1/4 inch so as to provide sufficient water-retaining volume. The holes may be drilled to a uniform depth or the depth may be varied. For example, holes having depths of two or more different values may be employed. The holes may be arranged into a suitable pattern depending upon the different depths, and/or even different hole diameters may be suitably employed.

The blind drilled roll is provided with an open area which is preferably between about 10 and about 40 percent of the roll surface so as to provide distances between holes of between about 1/16 and about 1/4 inch. The small distances between holes enhance the water removal at the press nip, since the water need not travel in the plane of the felt to any degree.

In the press arrangement of the present invention, it is preferred that the blind drilled press roll be provided as the bottom press roll in combination with an upper plain surfaced roll in forming the press nip. The blind drilled roll may be positioned as the upper press roll if desired. However, the blind drilled roll must be positioned within the felt loop when the felt is supporting a paper web. When the blind drilled roll is employed in a felt only press, it may be in either the bottom or upper press roll position, whether inside or outside the felt loop.

According to the present invention, the felt is led on the off-running side of the press nip above the common tangent plane for the press rolls if the blind drilled press roll is employed as the lower roll. The press felt is led away from the press roll around a guide roll and a common tensioning felt roll and guide rolls back to the press nip. Cooperating with the blind drilled press roll is a doctor blade, alone, or both a doctor blade and a shower. It is highly desirable to employ a doctor in the press assembly combination of the present invention. The doctor removes considerable quantities of water in addition to maintaining the blind drilled rolls in a clean condition. The particular doctors and showers employed with the press assemblies of the present invention may be any of those known to the art.

In the case of press roll speeds below about 1000 feet per minute, the centrifugal force is not sufficient to bring the water out of the holes of the blind drilled roll and it is desirable to employ an air doctor in addition to a doctor blade in order to blow the water from the hole. A shower may be additionally employed to keep the roll clean, but its use is not absolutely necessary.

According to one embodiment of the present invention, the imperforate roll having, for example, an elastomer covering containing an array of blind drilled holes may additionally comprise circumferentially aligned grooves that are superimposed on the drilling pattern. These grooves may be, for example, from about 0.005 inch to about 0.050 inch wide and spaced 0.050 inch to 0.200 inch apart. Preferably, the grooves may have a depth ranging from about 0.050 inch to about 0.200 inch. While the grooves alone would not have sufficient volume to remove all of the water extracted in a given press nip they do aid in water removal when employed in conjunction with the blind drilled holes and in this manner the desired quantity of water is removed at the nip. The grooves provide additional open area while reducing the land areas.

The press assembly of the present invention makes it possible to remove water from a relatively wet web and its supporting felt in a single press nip without the need for a special means for drying the felt. Accordingly, means such as a felt only press wherein a suction press roll is employed is rendered unnecessary. The press assembly of the present invention may be employed in a felt only arrangement, as well as for the removal of water from a web and its supporting felt. The volume provided by the holes is more than sufficient to receive the water expelled from the web and felt, or felt only without any danger of crushing. Thus, the perforated blind drilled rolls of the present invention have sufficient capacity to accommodate the water presented to the nip beyond that accommodated by interfiber spaces in the web and felt. This prevents a backward flow of water and resulting interference with the desired fiber formation, as well as inefficient water removal, since the water must travel in the plane of the felt. As an example, the whole volume per unit surface area in a blind drilled roll may be on the order of about 15 times the volume of water extracted in the third press of a modern, high production board machine.

Since the imperforate rolls employed in the press assembly of the present invention are hollow, they may be supplied with anti-deflection devices so as to provide anti-deflection rolls in order to achieve a uniform press nip under different nip loads. Such anti-deflection rolls and devices are well known to the art.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention may be described most readily with reference to the accompanying drawing, in which:

FIG. 1 is a diagrammatic side elevational view of the press assembly of the present invention;

FIG. 2 is an enlarged fragmentary view of a press assembly similar to FIG. 1;

FIG. 3 is a diagrammatic elevational view of a divided press assembly embodying the instant invention;

FIG. 4 is a fragmentary sectional view of a press roll employed in the press section of the present invention having an array of relatively small diameter blind drilled holes therein;

FIG. 5 is an enlarged fragmentary plan diagrammatic view of the press roll shell of FIG. 4;

FIG. 6 is a fragmentary sectional view of a press roll that may be employed in a press assembly of the present invention having a shell provided with both blind drilled holes and narrow grooves;

FIG. 7 is an enlarged fragmentary plan diagrammatic view of the press roll shell shown in FIG. 6;

FIG. 8 is a diagrammatic elevational view of an inverse press assembly embodying the instant invention;

FIG. 9 is a diagrammatic elevational view of a transfer press assembly embodying the present invention; and

FIG. 10 is a diagrammatic elevational view of a double felted press assembly embodying the instant invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, a straight-through press assembly indicated generally by the reference numeral **10** is provided with a blind drilled roll **12** in the bottom roll position. A web W is conducted by means of paper guide rolls **14** and **16** into contact with a felt **18** at the paper guide roll **16** on the oncoming side of the nip N–**1** between an upper plain press roll **20** and the lower blind drilled press roll **12**. The press roll **12** is provided with myriads of small holes in its surface. The press roll **12** may be additionally provided with grooves as well as the holes.

Water is expelled from the web W and the felt **18** in the nip N–**1**. This water is received by the holes in the surface of the lower roll **12** and after exit of the web W and the felt **18** from the nip, the water is released from the holes into the save-all **22**. The release of the water from the holes is caused by centrifugal force at roll speeds above about 1000 feet per minute in combination with the air pressure in the bottom of the holes. A regular blade-type doctor **36** is used for additional removal of water from the blind drilled roll and to keep the roll clean.

After the web W and the felt **18** pass through the nip N–**1** they are led along or above the tangential plane N_t—N_t which is tangent to the nip N–**1**. The web W is preferably separated from the felt **18**, while the felt **18** is led around guide rolls **24***a*, **24***b*, **28***a*, tensioning roll **26**, guide rolls **28***b*, and **24***c* in a loop and back to the nip N–**1**.

Felt cleaning devices such as a shower **30**, a vacuum box **32** and the like may be used for cleaning the felt **18**. Fibers, clay and similar loose solids may collect on the operating side of the felt **18**. Thus, the vacuum is applied on the outside of the felt loop, while the shower **30** is applied from the inside of the loop so that the solids are not drawn through the felt, but are removed outwardly and away from the felt.

Unlike prior press assemblies, the water released from the press roll **20** is not received by the felt **18** after it passes through the nip N–**1**, but is gradually thrown out of the holes into the save-all **22**. As previously mentioned, the felt **18** is led above the nip tangent plane after exit from the nip N–**1**. By guiding the felt in a manner such that it is substantially on the side of the common tagent plane opposite the blind drilled roll, the save-all **22** can be positioned advantageously placed with regard to the off-running side of the nip for collection and removal of the water from the system.

Referring to FIG. 2, another embodiment of the invention is disclosed that is similar to that depicted in FIG. 1. However, the press assembly **110** in FIG. 2 comprises a blind drilled lower roll **112** which is provided with a shower **134**, a regular blade-type doctor **136** and an air doctor **138** in cooperation therewith. The regular doctor is employed to remove the surface water from the roll **112** and to keep the roll clean. The shower **134** assists in maintaining the roll **120** clear and the holes free from fiberous material.

For peripheral speeds in excess of about 1000 feet per minute, sufficient centrifugal force is generated to remove the water from the drilled roll with the assistance of the regular doctor **136**. However, for speeds below about 1000 feet per minute, an air doctor **138** or other similar blowing means is required in addition to the regular doctor **136** in order to remove the water from the holes. At press roll speeds below about 1000 feet per minute, the nozzle air velocity from the air doctor **138** is preferably at least about 500 feet per second so as to empty the holes. A suitable blower for such air doctor includes, for example, one having a capacity of about 40 cubic feet of air per minute per foot of press roll width and a water pressure of 20 inches, which yields a nozzle air velocity of 650 feet per second.

Referring now to FIG. 3, a divided press assembly is disclosed wherein the web W and the felt **218** are led through a nip N–**3** which is provided by the upper press roll **240** which is a plain roll and the lower press roll **242** which may be a plain roll, a blind drilled roll, a grooved roll, etc. The water that is released or expelled from the web into the felt, holes or grooves of the press roll **242** is released into the felt **218** on the off-running side of the nip. The relatively moist felt **218** is conducted by means of the guide rolls **244***a* and **244***b* to the press nip N–**4** between the blind drilled roll **246** and press roll **248**, which may be a blind drilled roll, but is preferably a plain surface roll.

The water is removed from the felt at this felt only press after the nip N–**4** and passes into the recesses of the lower blind drilled roll **246**. After the felt passes through the nip N–**3** it is guided above the tangent plain N_t—N_t by means of the guide roll **244***c* and then is returned to the press nip N–**2** by means of the tensioning roll **250** and guide rolls **244***d* and **244***e*. In this manner, the water released at the nip N–**4** passes into the save-all **252** and is removed from the system.

Referring now to FIG. 4, it will be seen that a sectional view of a blind drilled press roll **310** is shown having a plurality of holes drilled into the cover **312** which is adhered to the hollow metal shell **314** of the press roll **310**. The cover **312** may be metal sleeve, but is preferably rubber or an elastomer-type material. The holes **316** may be of the same depth or of varying depth as illustrated. For example, the holes may be of two different depths, with the shallow holes being on the order of about 9.5 millimeters, while the deeper holes may be on the order of 12.5 millimeters. FIG. 5 discloses an enlargement of the drilled surface shown in FIG. 4. While the holes **316***a* and **316***b* are arranged in a pattern such that they are circumferentially aligned, the holes may also be arranged in a pattern where the holes are not aligned circumferentially, e.g. in random order.

Blind drilled press rolls have distinct advantages over the so-called grooved rolls. For example, blind drilled holes may be produced in a relatively soft, rubber cover, whereas the same is not true of the grooved roll. A grooved cover has to be relatively hard so that the narrow grooves do not close up in operation and so that the land areas do not become rounded. Thus, the felts will not wear out as quickly with the softer blind drilled rolls in the press assembly of the present invention as is the case of the grooved press rolls. The use of a relatively soft cover permits more time in a relatively wider press nip, which enhances water removal from the felt, and the press nip is less sensitive to foreign material or paper wads passing therethrough. Additionally, blind drilled rolls may be reground more easily than grooved rolls. The grooves are quite shallow and the grooved rolls have to be reground and recovered quite often. Still further, the softer elastomeric covers employed in the production of blind drilled rolls give a better bond between the cover and shell, and thereby permit a longer cover life for the press roll.

Other advantages reside in the utilization of a blind drilled cover including the fact that the cover may be reground several times without redrilling, whereas a grooved cover is normally reground every second grinding. Also, it is easier to keep a drilled cover clean due to the large hole diameter as compared to the width of the grooves in a grooved roll. Additionally, the volume provided by drilled holes is about five times the volume provided by grooves in a given area. Thus, the press assembly

of the present invention can handle much greater volumes of water than is possible with press assemblies emploing grooved rolls.

The blind drilled holes **316** in the hard rubber covering are designed in regard to their diameter, depth and the number of holes employed so that they may accommodate a predetermined total volume of water at the nip albeit it a web and its supporting felt nip or a felt only nip.

While the felt is passing through the nip, the nip pressures prevent the release of the retained water in the holes and the water is not released into the save-all until the felt is at the off-running side of the nip and the nip pressures become substantially reduced. At this point, the reduction in nip pressures coupled with the centrifugal force acts to dislodge the water and release it from the holes into the save-all.

An especially preferred embodiment of the present invention is shown in FIG. 6, wherein the press roll **318** is provided with both blind drilled holes **320** and narrow grooves **322**. Thus, as shown in the enlarged top view of roll **318** are circumferentially aligned. The blind drilled holes need not be circumferentially aligned. This embodiment of the present invention provides the necessar large volume for water removal by virtue of the blind drilled holes in combination with the grooves, and the desirable ambient pressure conditions at the nip of the press roll as provided by the narrow grooves **322**. As previously mentioned, this embodiment of the invention is highly beneficial due to the larger open area and smaller land areas between openings.

The felt is positioned on the oncoming side of the nip in any desired position relative to the nip tangent. Thus, the reach of felt on the oncoming side may be below, above or on the nip tangent plane. In some instances, it is desirable to position the felt on the oncoming side of the nip such that it is on the plain surfaced roll side of the nip tangent plane. In this position, the felt will have a minimum contact with the blind drilled roll, viz., only at the nip. Additionally, this mode of operation provides an escape route for the air pressed out of the felt in the nip. Otherwise, this air tends to be between the web and the felt causing web instability and breaks therein.

Referring now to FIG. 8, it will be seen that this embodiment of the invention shows an inverse press wherein the blind drilled press roll **420** is within the felt **422**, which is provided around upper roll **420** and a save-all **424**. The felt **422** is withdrawn from the nip N–5 provided by the roll **420** and the press roll **426** in a downward direction substantially on the side of the nip tangent line opposite the blind drilled roll **420**. As previously mentioned, the blind drilled roll may be employed as the upper press roll (as shown in FIG. 8), so long as it is within the felt loop when the felt is supporting a paper web.

Referring to FIG. 9, it will be seen that a transfer press employing the features of the press assembly of the present invention is provided. Thus, a paper web W is transferred from the Fourdrinier papermaking machine forming wire **520**, which extends over a couch roll **522** and a turning roll **524**, to the transfer felt **526** by means of the suction pick-up roll **528**. The web W is then conveyed by means of the felt **526** to the press nip N–6, which is formed by the upper blinded drilled roll **530** and a lower suction roll **532**. A save-all **534** is positioned relative to the blind drilled roll **530** to collect the water released at the press nip N–6. A doctor blade **536** is employed to remove substantial quantities of water from the blind drilled roll **530** after the blind drilled holes pass through the press nip N–6. The doctor **536** also has the beneficial effect of cleaning the blind drilled roll. The suction press roll **532** is provided within the loop of the press felt **538**, which passes around the guide rolls **540** and **542**, and removes moisture from the felt **538**. The web W is separated from the looped felt **538** at a point between the nip N–6 and the guide roll **540** for further treatment.

Referring to FIG. 10, a double felted press assembly embodying the present invention is shown wherein a paper web W is passed by means of a looped felt **620** to a press nip N–7 defined between an upper blind drilled roll **622** having a doctor blade **624** and a lower blind drilled roll **626** having a doctor blade **628**. A looped felt **630** surrounds upper roll **622** while the looped felt **620** surrounds the roll **626**. Save-alls **632** and **634** are provided for the rolls **622** and **626**, respectively to collect and withdraw the water released by their respective blind drilled rolls, and wiped from the rolls by their respective doctor blades. In this embodiment of the invention, the felts are withdrawn on the off-running side of the nip N–7 on the nip tangent plane.

As previously described, the present invention permits the removal of sufficient volumes of water at a press nip as to completely obviate the need for such equipment as a divided press assembly, suction rolls and the like. Thus, the present invention provides a simple and effective means of mechanically dewatering a relatively moist paper web and its supporting felt or felt only in an effective manner without the need for an elaborate arrangement or expensive equipment.

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

I claim:

1. A press assembly comprising a press felt, a first press roll, a second press roll, said first and second press rolls being in nip-defining relation with said felt, said first press roll being an imperforate roll that is provided with radially directed blind drilled holes in its surface for receiving water, means positioned relative to a common tangent plane between said first and second press rolls for guiding said felt away from the nip on the second roll side of said common tangent plane at an angle defined between said felt and said common tangent plane, said first blind drilled roll being disposed at least partially within a save-all means having first and second side walls terminating at upper edges extending axially of said first blind drilled roll, said first side wall being on the off-running side of said nip and terminating at an upper edge spaced closely adjacent to said common tangent plane and adjacent to said nip to normally prevent water that is released from the holes of said first blind drilled roll from entering said felt on the off-running side of said nip.

2. A press assembly according to claim **1** wherein the felt supports a relatively wet web at the nip.

3. A press assembly according to claim **1** wherein said first and second press rolls are the sole dewatering press rolls in nip-defining relation with said felt.

4. A press assembly according to claim **1** wherein the first press roll is additionally provided with narrow, generally circumferential grooves.

5. A press assembly according to claim **1** wherein the blind drilled holes have a depth in the range of between about ¼ inch and 1 inch.

6. A press assembly according to claim **1** wherein said blind drilled press roll is provided with a doctor blade for additional removal of water from said blind drilled holes.

7. A press assembly according to claim **6** wherein said blind drilled roll is additionally provided with an air doctor means for emptying the recesses of the blind drilled roll at roll speeds below about 1000 feet per minute.

8. A press assembly according to claim **1** wherein said blind drilled holes have a diameter in the range of between about 1/16 and about ¼ of an inch.

9. The press assembly according to claim **1** wherein said first side wall extends across said common tangent plane.

10. A divided press assembly comprising a looped press felt, a first press roll, a second press roll, said first and second press rolls being in nip-defining relation with said

press felt, a third press roll, a fourth press roll, said third and fourth press rolls in nip-defining relation with said felt, said third press roll being an imperforate roll that is provided with radially directed blind drilled holes in its surface receiving water, means positioned relative to a common tangent plane between said third and fourth press rolls for guiding said felt away from the nip on the fourth roll side of said common tangent plane at an angle defined between said felt and said common tangent plane, said third blind drilled roll being disposed at least partially within a save-all means, said save-all means having first and second side walls terminating at upper edges extending axially of said third blind drilled roll, said first side wall being on the off-running side of said nip and terminating at an upper edge spaced closely adjacent to said common tangent plane and adjacent to said nip to normally prevent water that is released from the holes of said first blind drilled roll from entering said felt on the off-running side of said nip.

11. A press assembly according to claim **10** wherein said third press roll is additionally provided with narrow, generally circumferential grooves.

12. A press assembly according to claim **10** wherein said first, second and fourth press rolls comprise plain-surfaced rolls.

13. A press assembly according to claim **10** wherein said blind drilled roll is provided with a doctor blade for additional removal of water from said blind drilled holes.

14. A press assembly according to claim **13** wherein said blind drilled roll is additionally provided with an air doctor means for emptying the recesses of the blind drilled roll at roll speeds below about 1000 feet per minute.

15. A method for dewatering a relatively wet paper web, which comprises advancing said web and a supporting press felt toward a first press roll and a second press roll, said rolls being in nip-defining relation, said first press roll being an imperforate roll that is provided with radially directed blind drilled holes in its surface, said first roll being at least partially within a save-all, passing said paper web and said felt through said nip thereby causing water from said paper web to enter said blind drilled holes, separating said felt and said web on the off-running side of said nip, guiding said felt away from said nip on the second roll side of a common tangent plane between said first and second press rolls at an angle defined between said felt and said common tangent plane, releasing water from said blind drilled holes on the off-running side of said nip into said save-all, said save-all having first and second side walls terminating at upper edges extending axially of said first roll, said first side wall being on the off-running side of said nip and terminating at an upper edge spaced closely adjacent to said common tangent plane so as to normally prevent water that is released from the holes of said first blind drilled roll from entering the felt on the off-running side of said nip.

16. The method of claim **15** wherein the peripheral speed of said first press roll is below about 1000 feet per minute, and a doctor blade and air doctor are employed to assist in the removal of water from said blind drilled holes on the off-running side of said nip.

17. The method of claim **16** wherein the nozzle air velocity from said air doctor is at least about 500 feet per second.

18. A method for dewatering a relatively wet press felt, which comprises advancing said press felt toward a first press roll and a second press roll, said rolls being in nip-defining relation, said first press roll being an imperforate roll that is provided with radially directed blind drilled holes in its surface, said first roll being at least partially within a save-all, passing said felt through said nip thereby causing water from said paper felt to enter said blind drilled holes, guiding said felt away from said nip on the second roll side of a common tangent plane between said first and second press rolls at an angle defined between said felt and said common tangent plane expressing moisture from said blind drilled holes on the off-running side of said nip into said save-all, said save-all having first and second side walls terminating at upper edges extending axially of said first roll, said first side wall being on the off-running side of said nip and terminating at an upper edge spaced closely adjacent to said common tangent plane so as to normally prevent water that is released from the holes of said first blind drilled roll from entering the felt on the off-running side of said nip.

19. The method of claim **18** wherein the peripheral speed of said first press roll is below about 1000 feet per minute, and a doctor blade and air doctor are employed to assist in the removal of water from said blind drilled holes on the off-running side of said nip.

References Cited

UNITED STATES PATENTS

3,477,907	11/1969	Ely, Sr.	162—358
3,215,592	11/1965	Justus et al.	162—358 X
3,198,694	8/1965	Justus	162—358
3,023,805	3/1962	Walker	162—358

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