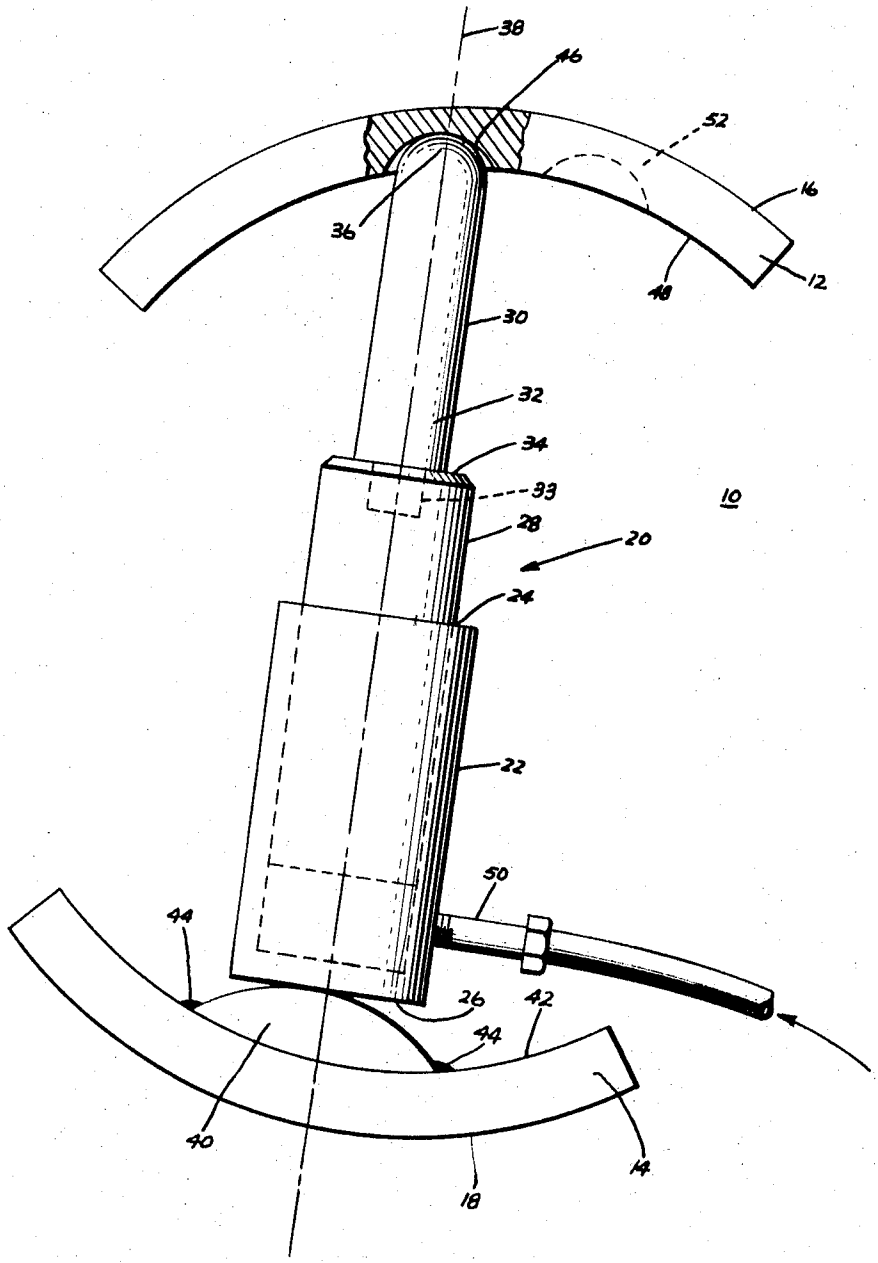
Dec. 7, 1971 J. J. VAN GOMPEL 3,625,046

APPARATUS AND METHOD FOR STRAIGHTENING DEFORMED ROLLS OF SHEET STOCK

Filed Oct. 29, 1969 5 Sheets-Sheet 1

Fig. 1



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APPARATUS AND METHOD FOR STRAIGHTENING DEFORMED ROLLS OF SHEET STOCK
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FIG. 2

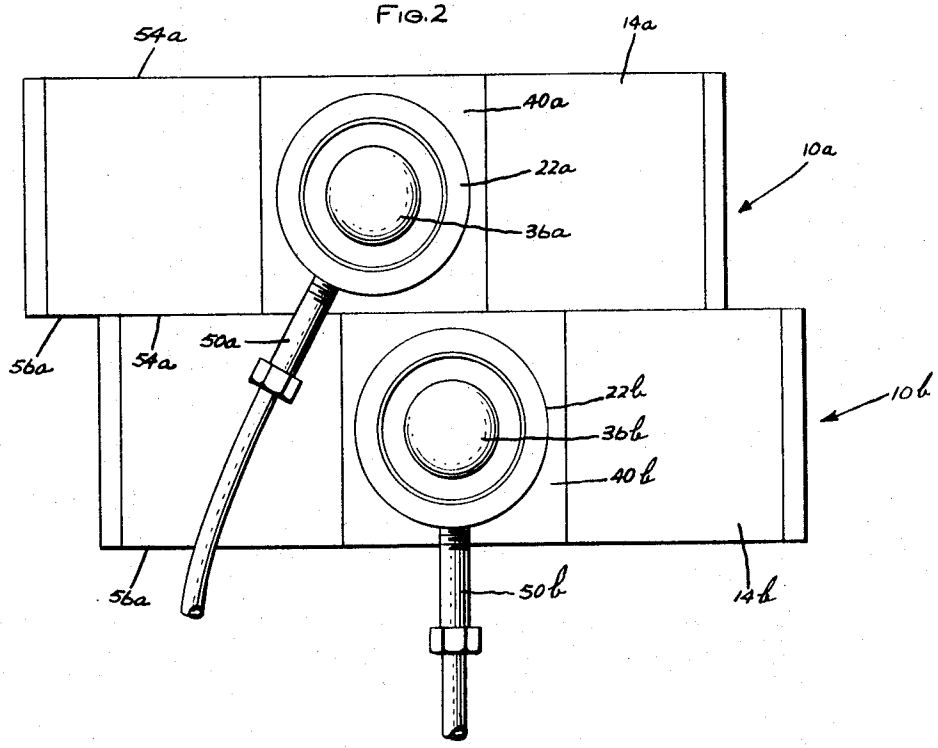


FIG. 3

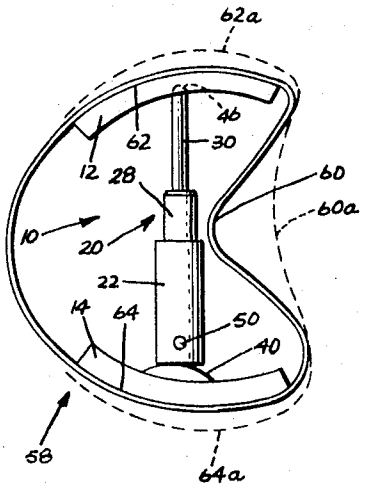
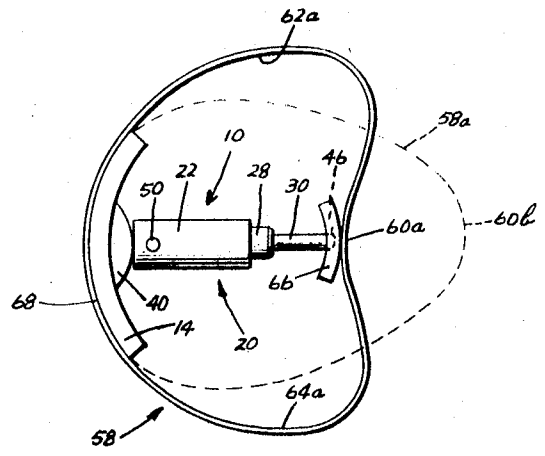


FIG. 4



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APPARATUS AND METHOD FOR STRAIGHTENING DEFORMED ROLLS OF SHEET STOCK

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FIG. 5

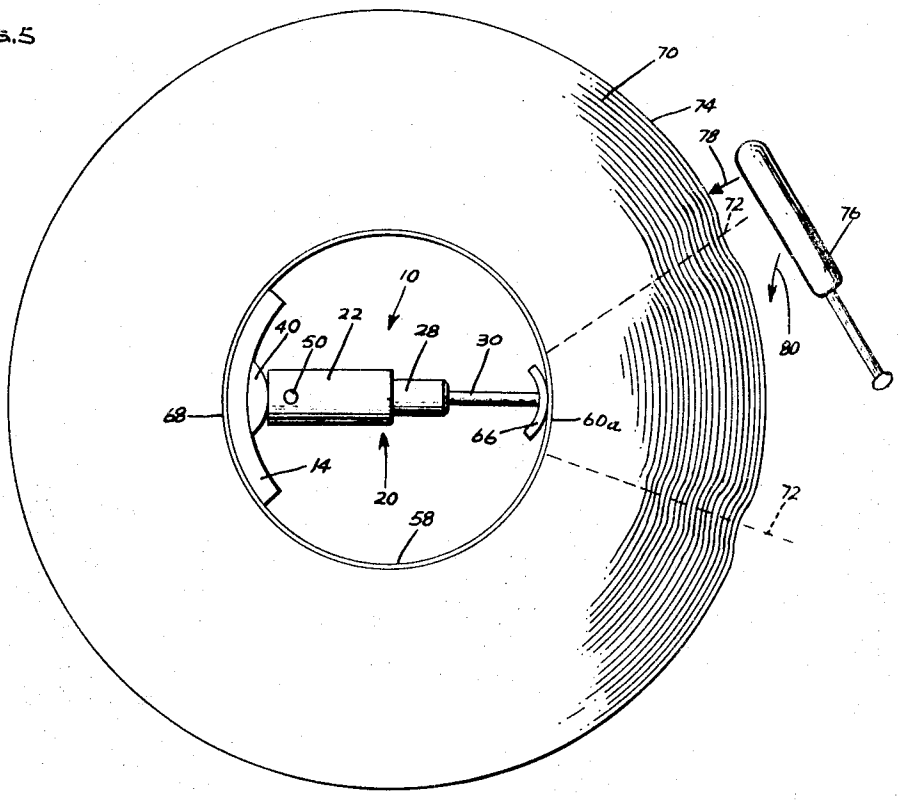


FIG. 6

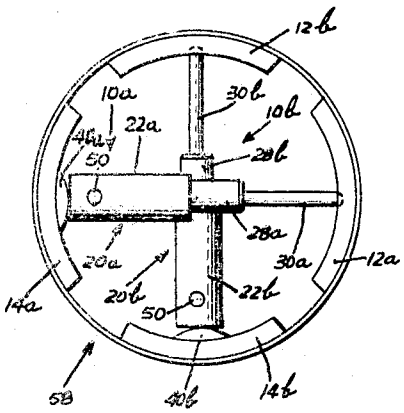
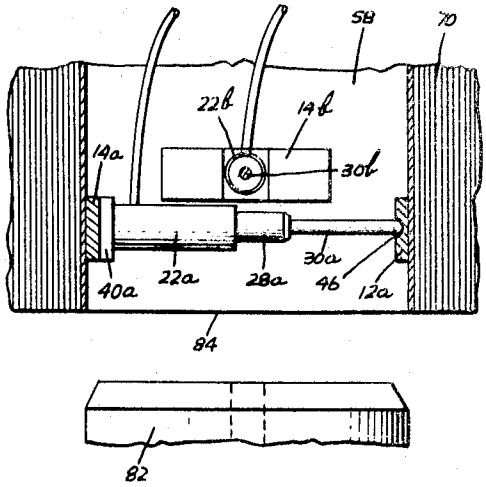


FIG. 7



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APPARATUS AND METHOD FOR STRAIGHTENING DEFORMED ROLLS OF SHEET STOCK
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FIG. 8

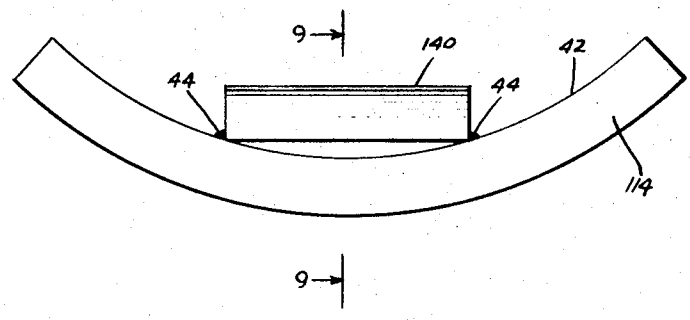


FIG. 9

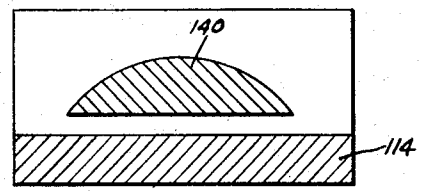


FIG. 10

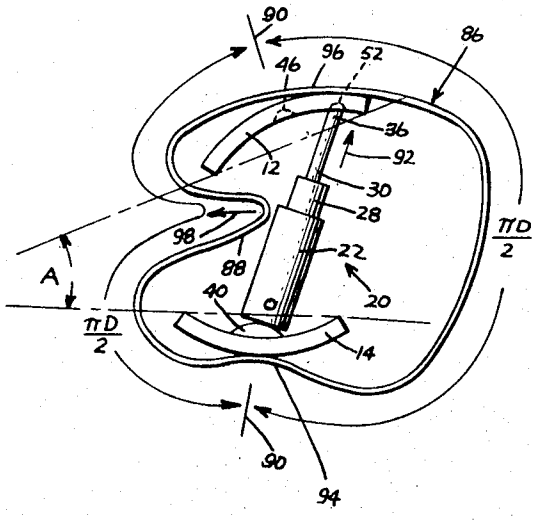
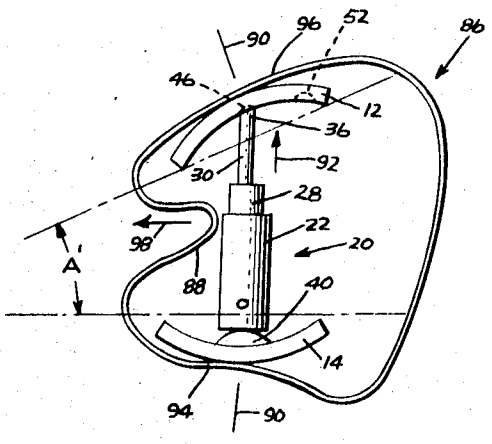


FIG. 11



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Dec. 7, 1971 J. J. VAN GOMPEL 3,625,046

APPARATUS AND METHOD FOR STRAIGHTENING DEFORMED ROLLS OF SHEET STOCK

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FIG. 12

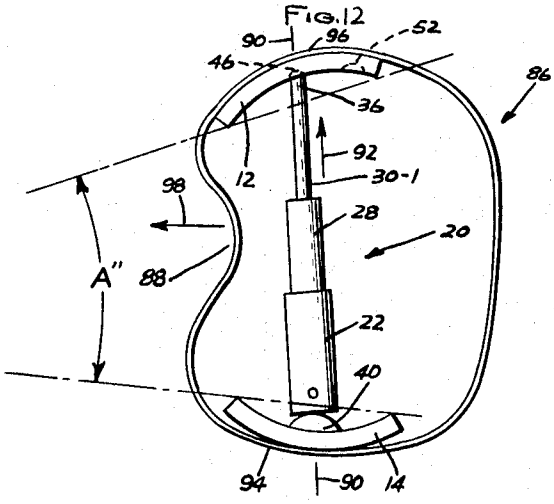


FIG. 13

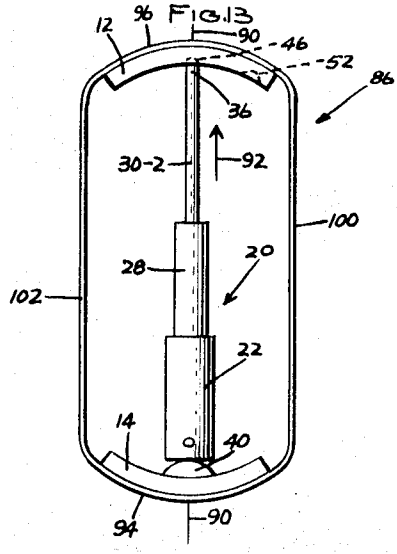


FIG. 14

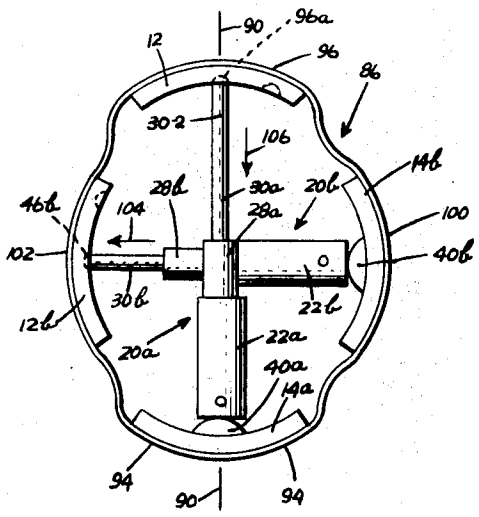


FIG. 15

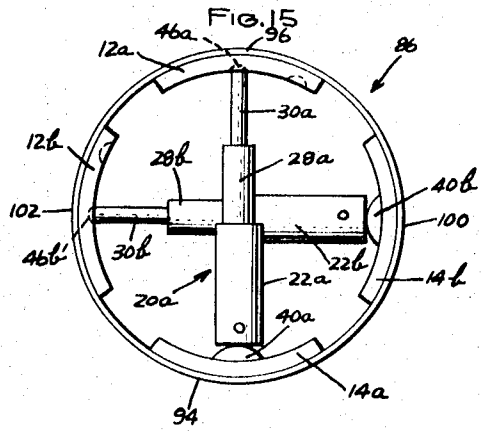


FIG. 16

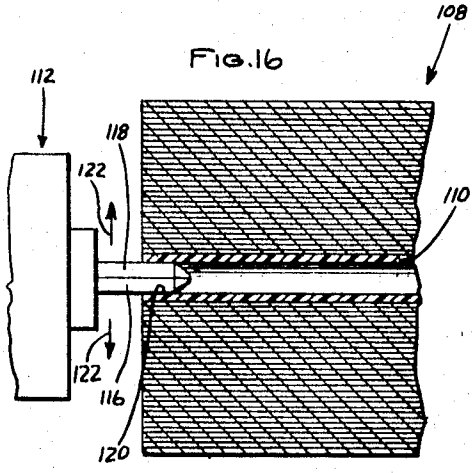
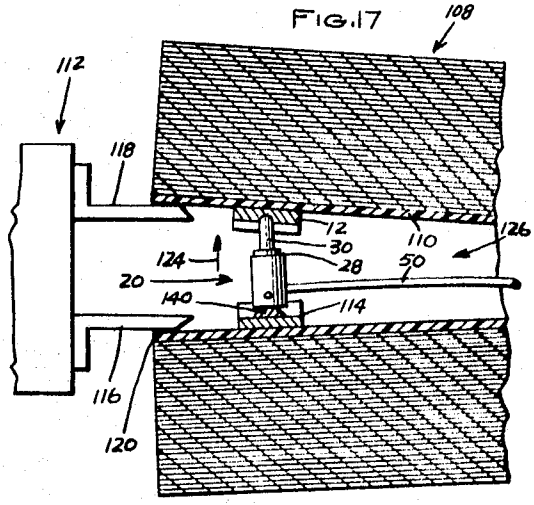


FIG. 17



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United States Patent Office 3,625,046 Patented Dec. 7, 1971

3,625,046

APPARATUS AND METHOD FOR STRAIGHTENING DEFORMED ROLLS OF SHEET STOCK

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Filed Oct. 29, 1969, Ser. No. 872,093
Int. Cl. B21j 9/12
U.S. Cl. 72—392 21 Claims

ABSTRACT OF THE DISCLOSURE

A pair of spaced-apart, outwardly curved shoes are provided for respectively engaging generally opposite internal surface areas of the core of a deformed roll. A hydraulic ram is provided extending on an axis between the shoes and having a cylinder and an extensible piston rod which terminates in a pin coaxial with the axis and having a rounded distal end. One of the shoes has a raised, part-cylindrical portion thereon having rolling engagement with the end of the cylinder remote from the piston rod, and the other shoe has an opening therein which removably receives the rounded distal end of the piston rod thereby providing for pivotal motion of both shoes with respect to the axis, whereby the shoes generally conform to an out-of-round configuration of the core without exerting side loading on the ram when the piston rod thereof is extended.

BACKGROUND OF THE INVENTION

Field of the invention

This invention generally relates to an apparatus and method for straightening deformed rolls of sheet stock.

DESCRIPTION OF THE PRIOR ART

Large rolls of sheet stock, such as printing paper and paper used in the paper-conversion industry, are conventionally supported on cylindrical cores formed of relatively thin-walled material, such as cardboard or metal. During the transportation of such rolls and/or handling of the rolls at the printing or conversion plant, there are times when a roll is dropped or otherwise jostled resulting in deformation or depression of the roll with resultant deformation of the core. Such deformed rolls cannot be employed on modern, high-speed printing presses or conversion equipment due, among other things, to vibration.

The scrap value of a deformed roll of paper is a small fraction of the original cost of the paper and thus, a substantial loss is incurred unless the paper can be salvaged. The web of paper on the roll can, of course, be salvaged by rewinding the paper from the deformed roll onto a new, cylindrical core. However, this is a time-consuming operation requiring rewinding apparatus which is not commonly available in printing and conversion plants.

Pat. No. 3,292,903, granted Dec. 20, 1966, discloses apparatus for straightening deformed paper rolls which comprises a pair of shoes inserted in an end of a deformed core and a ram-actuated mechanism for separating the shoes which is located exteriorly of the core. By reason of the arrangement and configuration of the actuating linkage, the shoes of such apparatus cannot be located in the deformed core at points therein spaced from the ends, and thus, such apparatus is not suitable for straightening certain severely deformed cores.

U.S. patent application Ser. No. 689,158, filed Dec. 8, 1967, and now abandoned, and U.S. application Ser. No. 848,507 filed Aug. 8, 1969, and now abandoned in favor of continuation-in-part application Ser. No. 37,225, filed May 14, 1970, disclose spreaders for damaged cores, these devices generally comprising elongated bodies

adapted to be inserted into a deformed core with a ram-actuated shoe carried by the body for outwardly forcing depressed areas of the core, thereby to restore the roll to its original round configuration. It has been found that the irregular configuration of the interior surface of deformed cores results in the application of side loading on the hydraulic ram of such spreaders with consequent damage to the ram, in turn necessitating frequent and costly repair or replacement of the ram.

It is therefore desirable to provide an apparatus and method for straightening deformed rolls of sheet stock, the apparatus being of the type employing a hydraulic ram, wherein the apparatus may be inserted into the interior regions of the deformed core, and wherein side loading of the ram is substantially eliminated, thus reducing the cost of maintenance of the apparatus.

SUMMARY OF THE INVENTION

In accordance with the broader aspects of the apparatus of the invention, a pair of spaced-apart, outwardly curved shoes are provided for respectively engaging generally opposite internal surface areas of the core of a deformed roll, and a hydraulic ram is provided extending on an axis between the shoes and having first and second parts which are relatively movable in the direction of the axis, the parts respectively engaging the shoes. Each of the shoes has means thereon for permittiing pivotal motion thereof with respect to the axis of the ram so that the shoes may generally self-adjust and conform to an out-of-round configuration of the core without exerting side loading on the ram as the same is extended.

In accordance with the broader aspects of the method of the invention, there is inserted in the core of a deformed roll an apparatus which comprises a pair of spaced-apart, outwardly curved shoes, and a hydraulic ram which extends on an axis between the the shoes and which has first and second parts relatively movable in the direction of the axis, the shoes respectively having means permitting pivotal motion thereof with respect to the axis. Hydraulic pressure is applied to the ram thereby to extend the same so that the shoes respectively engage two generally opposite internal surface areas of the core and force the same relatively outwardly. The ram is then retracted and the apparatus rotated in the core to a different position. Hydraulic pressure is then again applied to the ram to extend the same so that the shoes now respectively engage another two generally opposite internal surface areas of the core and force the same relatively outwardly.

It is accordingly an object of the present invention to provide improved apparatus for straightening deformed rolls of sheet stock.

Another object of the invention is to provide improved apparatus for straightening deformed rolls of sheet stock wherein the apparatus may be inserted into the interior regions of a deformed core.

A further object of the invention is to provide improved apparatus of the type employing a hydraulic ram for straightening deformed rolls of sheet stock wherein side loading of the ram is substantially eliminated.

Yet another object of the invention is to provide an improved method for straightening deformed rolls of sheet stock.

The above-mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view, partly in cross section, illustrating the apparatus of the invention;

FIG. 2 is a top view of two devices in accordance with the invention disposed in back-to-back relationship, with the top shoes removed;

FIG. 3 is a side view showing an initial step in a first embodiment of the method of the invention;

FIG. 4 is a side view showing another step in the first embodiment of the method of the invention;

FIG. 5 is a side view showing a further step in the first embodiment of the method of the invention;

FIG. 6 is a side view showing the final step in the first embodiment of the method of the invention;

FIG. 7 is a fragmentary cross-sectional view further illustrating the method step of FIG. 6;

FIG. 8 is a side view showing a modified form of the bottom shoe of the apparatus of the invention in which the part-cylindrical portion is rotated by 90° from the position of the embodiment of FIG. 1;

FIG. 9 is a cross-sectional view taken along the line 9—9 of FIG. 8;

FIG. 10 is a side view showing an initial step in a second embodiment of the method of the invention;

FIG. 11 is a side view showing another step in the second embodiment of the method of the invention;

FIG. 12 is a side view showing yet another step in the second embodiment of the method of the invention;

FIG. 13 is a side view showing a further step in the second embodiment of the method of the inenvtion;

FIG. 14 is a side view showing the final step in the second embodiment of the method of the invention;

FIG. 15 shows the cylindrical core resulting from the method of FIGS. 10 through 14;

FIG. 16 is a longitudinal cross-sectional view showing the initial step in a third embodiment of the invention; and

FIG. 17 is a longitudinal cross-sectional view showing a further step in the third embodiment of the method of the invention employing the apparatus of the invention with a bottom shoe of the type shown in FIGS. 8 and 9.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1, the apparatus of the invention, generally indicated at **10** comprises top and bottom curved, metal shoes **12** and **14**. As illustrated, shoes **12**, **14** respectively have arcuate outer surfaces **16** and **18** which generally conform to the desired curvature of the core of a roll to be straightened.

A hydraulic ram **20** is provided having a cylinder **22** with an open end **24** and a flat, closed end **26**. Piston rod **28** is positioned in cylinder **22** extending outwardly from open end **24**. An elongated pin **30** is provided having a proximal end **32** removably secured to the outer end **34** of piston rod **28**, as by a threaded stud shown in dashed lines at **33**, and having a rounded or crowned distal end **36**. It will be observed that the cylinder **22**, piston rod **28** and pin **30** are disposed on an axis **38** which extends between shoes **12**, **14**.

Bottom shoe **14** has a raised, part-cylindrical portion **40** secured to its inner surface **42** intermediate its ends in any suitable fashion, as by welding at **44**. It will be seen that portion **40** extends transversely across the width dimension of bottom shoe **14**. Part-cylindrical portion **40** is disposed in rolling engagement with flat end **26** of cylinder **22** thereby to permit pivotal or rocking motion of bottom shoe **14** with respect to axis **38**.

Top shoe **12** has a radiused socket **46** formed in its inner surface **48** intermediate its ends which removably receives rounded distal end **38** of pin **30**, thus permitting pivotal movement of top shoe **12** with respect to axis **38**.

It will be seen that by providing for pivotal movement of the top and bottom shoes **12**, **14** with respect to the axis **38** of the ram **20**, the shoes may generally conform to an out-of-round configuration of a deformed roll core without exerting side loading on the ram as the ram is extended by the application of hydraulic pressure to fluid inlet **50**, which communicates with cylinder **22** in conventional fashion.

Another radiused socket, shown in dashed lines at **52** may be formed in the inner surface **48** of the top shoe **12** offset from the center socket **46** in order to permit the expansive force to be exerted at a more advantageous location, depending upon the configuration of the deformed core, as shown in FIG. 17.

Referring now to FIG. 2, two apparatuses of the type shown in FIG. 1, identified as **10***a* and **10***b* are shown disposed in back-to-back abutting relationship. It will be observed that bottom shoes **14***a*, **14***b* are relatively elongated and have planar, opposite longitudinal sides **54**, **56** which permit the shoes to be disposed in coplanar, abutting relationship, the diameters of the cylinders **22***a*, **22***b* being slightly less than the width of the shoes. It will be understood that the top shoes **12** (not shown in FIG. 2) preferably have the same configuration as the bottom shoes **14** so that they, likewise, may be disposed in coplanar abutting relationship. The capability of locating two or more apparatuses **10** in such back-to-back relationship permits the application of greater straightening force at desired locations. While in FIG. 2, the two apparatuses **10***a* and **10***b* are shown as being slightly displaced radially, it will be understood that they may be arranged in alignment parallel with the axis of the core, or that they may be further radially displaced from the position shown in FIG. 2.

Referring now to FIG. 3, a typical deformed roll core **58** is shown, it being understood that a roll of sheet stock, such as paper (not shown) is supported on core **58** and is likewise deformed. Deformed core **58**, which may be formed of relatively thin-walled cardboard or metal, is shown as having a typical depression **60** formed therein as a result of deformation of the roll supported thereon, as by dropping or inpingement upon some obstacle. In accordance with the method of the invention, apparatus **10** is positioned in the interior of the deformed core **58**, as shown, and hydraulic pressure is applied to inlet **50** of cylinder **22** thereby to extend piston rod **28** and pin **30** so that shoes **12**, **14** respectively engage generally opposite internal surface areas **62** and **64** of the deformed core **58**, areas **62** and **64** being respectively on opposite sides of the depressed portion **60**. It will immediately be observed that by virtue of the pivotal engagement of shoes **12** and **14** with pin **30** and part-cylindrical portion **44**, respectively, shoes **12**, **14** conform to the configuration of the internal surface areas **62**, **64** without applying side loading to the ram.

The application of hydraulic pressure to the ram **20** is continued with extension of piston rod **28** and pin **30** thus causing shoes **12**, **14** to force areas **62**, **64** of the deformed core **58** relatively outwardly, as shown in dashed lines at **62***a*, **64***a*, resulting in reduction of the depressed portion **60**, as shown in dashed lines at **60***a*.

Referring now to FIG. 4, following outward expansion of areas **62**, **64** of the deformed roll **58**, as above described, ram **20** is retracted and rotated to the position shown in FIG. 4. Now, a relatively short top shoe **66** may be substituted for the longer shoe **12** initially employed, shoe **66** however, also having the tapered socket **46** formed in its inner surface which receives rounded distal end **36** of piston rod **30**. Hydraulic pressure is then again applied to extend piston rod **28** and pin **30** until shoe **66** engages the reduced, depressed area **60***a* and the bottom shoe **14** engages the opposite internal surface area **68**. Application of hydraulic pressure is then continued to force areas **60***a*, **68** relatively outwardly so as to form core **58** into a generally ovoidal form, as shown in dashed lines at **58***a*, with the shorter shoe **66** forming the smaller end **60***b*.

Referring now to FIG. 5, core **58** is shown in a configuration intermediate that shown in solid lines and that shown in dashed lines in FIG. 4, i.e. during extension of ram **20** from its retracted to its extended position, and roll **70** of sheet stock, such as paper, is shown on the core **58**. It will be understood that roll **70**, in its

initial deformed condition, had a depressed portion aligned with and causing formation of depressed portion **60** of core **58**. As the opposite areas **60***a*, **68** of core **58** are forced outwardly toward the ovoidal configuration shown in dashed lines at **58***a* in FIG. 4, the depressed portion of roll **70** is likewise forced outwardly however, creases or indentations **72** tend to remain generally radially aligned with the boundries of depressed portion **60** of roll **58**, a roll having such indentations being commonly referred to as a "starred" roll. Such creases or indentations may be removed by striking the outer peripheral surface **74** of roll **70** in the area of indentation **72** with a bat or pompom **76** with a motion shown by the arrows **78**, **80** such striking being performed simultaneously with extension of ram **20** to form the core and roll into the ovoidal configuration shown in FIG. 4. By delivering blows to the outer peripheral surface **74** of roll **70** with pompom **76** simultaneously with expansion of the roll as above-described, the high portions of the "star" are pulled and distributed into the remainder of the roll.

Referring now to FIGS. 6 and 7, following the steps described above in connection with FIGS. 3, 4 and 5, ram **20**, now identified as ram **20***a* is retracted sufficiently so as to substitute a longer top shoe **12***a* for the shorter top shoe **66**. A second ram **20***b* is then positioned interiorly of core **58** with the axes of rams **20***a*, **20***b* being generally perpendicular, as shown. Fluid pressure is then selectively and/or simultaneously applied to rams **20***a*, **20***b*, which may be disposed in back-to-back relationship as shown in FIG. 7, so that the respective pairs of shoes **12***a*, **14***a* and **12***b*, **14***b* form the core **58** into the desired generally cylindrical configuration.

Rams **20***a*, **20***b* are then removed and conventional cylindrical plugs **82** are inserted in the open ends **84** of the straightened core **58**. Final touches may be given to the roll after it has been so plugged by rolling it over a flat surface and striking high or uneven points on its outer periphery **74** with the pompom **76**.

In a specific embodiment of the apparatus shown in FIG. 1, cylinder **22** had an overall axial length of 4½ inches and an outside diameter of 2¼ inches, and piston rod **28** had an outside diameter of 1½ inches and a maximum axial extension of 2½ inches. Pins **30** had an outside diameter of 1¼ inches and varied in axial length from 1 inch to 7 inches.

Referring now to FIGS. 8 and 9, a modified form of bottom shoe **114** is shown in which the raised, part-cylindrical portion **140** is rotated by 90° from the position of the portion **140** shown in the embodiment of FIG. 1, portion **140** in this embodiment extending parallel with the length dimension of bottom shoe **114**. The bottom shoe **114** may be employed in conjunction with the cylinder **22** and top shoe **12** of FIG. 1 in applications where the top and bottom shoes cannot be in alignment, such as that shown in FIG. 17.

Referring now to FIG. 10 another typical deformed roll core **86** is shown having a typical deep depression **88** formed therein. It is desirable in straightening the deformed core **86** to apply the initial and intermediate expanding force at points on the interior surface of the core **86** which would be diametrically opposite if the core were cylindrical, i.e. at points spaced apart by a distance equal to one-half the circumference of the core when in its cylindrical form but following the deformed periphery of the core, as shown by the lines **90** in FIG. 10. Thus, top and bottom shoes **12**, **14** are preferably positioned as closely as possible to such points **90**.

In the particular deformed core **86** shown in FIG. 10 by reason of the depth of the depression **88**, it is initially impossible to seat distal end **36** of pin **30** in the central socket **46** of top shoe **12**, and thus distal end **36** is initially seated in the offset socket **52**, as shown. It will be observed that in the initial position of the apparatus as shown in FIG. 10, the edges of the top and bottom shoes **12**, **14** define an angle A, which is approximately 30° in the case of the particular deformed core shown.

Following initial positioning of ram **20** and the top and bottom shoes **12**, **14** as shown in FIG. 10, cylinder **22** is actuated thereby to extend piston rod **28** and pin **30** in the direction shown by the arrow **92**, thereby forcing opposite portions **94**, **96** of core **86** outwardly so as to reduce the depressed portion **88** outwardly, as shown by the arrow **98**.

Referring now to FIG. 11, as soon as the depressed portion **88** has been moved outwardly in direction **98** sufficiently to permit distal end **36** of pin **30** to be seated in the central socket **46** of top shoe **12**, cylinder **22** is actuated to retract piston rod **28** and pin **30** sufficiently to permit distal end **36** to be moved from socket **52** to socket **46**, as shown, and cylinder **22** is then again actuated to extend piston rod **28** and pin **30** in direction **92** thereby further to force opposite portions **94**, **96** of core **86** outwardly so as further to reduce the depth of depressed portion **88**, as shown by the arrow **98**.

It will now be observed that in the position shown in FIG. 11, the expansive force exerted by ram **20** by engagement of the top and bottom shoes **12**, **14** with the opposite internal surfaces of core **86** is applied in general alignment with points **90** which are spaced apart by one-half the circumference of the normal cylindrical core. It will further be observed that the angle A' defined between the edges of the respective top and bottom shoes **12**, **14** has been somewhat reduced from that shown in FIG. 10.

Referring now to FIG. 12, as a result of the outward extension of piston rod **28** and pin **30** in direction **92**, thereby outwardly to expand opposite portions **94**, **96** of core **86**, piston rod **28** will reach its fully extended position so that no further outward expansion of core **86** would be possible. Thus, when portions **94**, **96** of core **86** have been expanded outwardly to the extent possible with the length of the particular pin **30** employed in the steps shown in FIGS. 10 and 11, cylinder **22** is actuated to retract piston rod **28** and a longer pin **30–1** is substituted for the shorter pin **30**. Distal end **36** of the longer pin **30–1** is again seated in the central socket **46**, and cylinder **22** is again actuated to extend piston rod **28** and pin **30–1** in direction **92** thereby further to expand portions **94**, **96** of core **86** outwardly, and further to reduce depressed portion **88** in direction **98**.

Referring now to FIG. 13, as the outward expansion of opposite portions **94**, **96** of core **86** continues in direction **92**, depressed portion **88** will eventually disappear completely and the portions **100**, **102** intermediate end portions **94**, **96** will tend to define parallel planes, as shown. In the process of expanding core **86** to the configuration shown in FIG. 13, it may be necessary to substitute a still longer pin **30–2** for the shorter pin **30–1** employed during the step shown in FIG. 12. It will now be observed that the diametrically opposite portions **94**, **96** now conform to the arcuate configuration of the top and bottom shoes **12**, **14** which, in turn, conform to the inside diameter of desired cylindrical core, as shown in FIG. 15.

Referring now to FIG. 14, a second ram **20***b* (the ram and its components employed in the previous steps being identified with the suffix *a*) is introduced disposed at 90° with respect to ram **20***a* with its top and bottom shoes **12***b*, **14***b* respectively engaging the opposite portions **102**, **100** of core **86**, a relatively short pin **30***b* being employed with ram **20***b*. Then, cylinder **22***b* is actuated to extend piston rod **28***b* and pin **30***b* in direction **104**, while cylinder **22***a* of ram **20***a* is simultaneously actuated to retract piston rod **28***a* and pin **30–2** in direction **106**, thereby causing the core **86** to begin to assume its desired cylindrical configuration. As this process continues, it will be necessary progressively to substitute shorter pins **30***a* on ram **22***a*. The extension of cylinder **28***b* and pin **30***b* together with the simultaneous retraction of piston rod **28***a* and pin **30***a* then continues until the core **86** has been re-

stored to its cylindrical configuration, as shown in FIG. 15.

Referring now to FIG. 16, a paper roll **108** is shown having a core **110** which is sufficiently collapsed to prevent initial insertion of the apparatus of the invention. Here, core expanding apparatus **112** is provided having a pair of elongated, pointed, expansible elements **116, 118**. Elements **116, 118**, in their collapsed position, are inserted or driven into end **120** of the collapsed core **110**, as shown. Elements **116, 118** are adapted for outward separating movement, in the direction shown by the arrows **122**, by a suitable fluid power cylinder (not shown). Expanding apparatus **112** may be of the type illustrated and described in the aforesaid Pat. No. 3,292,903, or other similar apparatus for end-insertion into a collapsed core, as is well known to those skilled in the art.

Referring now to FIG. 17, expanding apparatus **112** is then actuated to separate elements **116, 118** so as to widen end opening **120** of core **110** sufficiently to introduce ram **20** therein. It will be observed that in this initial widening of end opening **120** of the collapsed core **110**, the opposite wall portions of the core become inclined inwardly away from opening **120** toward the opposite end **126** of the core, as shown in FIG. 17. Here, a bottom shoe **114** of the type shown in FIGS. 8 and 9 and described above is employed with its part-cylindrical portion **140** thus being disposed at right angles to the longitudinal axis of core **110**. This permits top and bottom shoes **112, 114** to accommodate themselves to the inclined relationship of the opposite walls of core **110**, as shown.

With ram **20** thus positioned in the widened opening **120** of the collapsed core **110**, cylinder **22** is actuated thereby to extend piston rod **28** and pin **30** in the direction shown by the arrow **124** thereby further to widen the opening **120**. Ram **20** may then be moved toward the smaller end **126** of core **110** and the operation repeated until the collapsed core **110** has been expanded in at least one dimension sufficiently to perform the method steps of the type described above for restoring the core to its original cylindrical configuration.

While employment of a single ram **20** has been shown in FIGS. 3–5 and 10–13, and two back-to-back rams **20*a***, **20*b***, in FIGS. 6 and 7, and 14 and 15 it will be readily understood that in the case of an elongated roll having an elongated deformed core, a number of rams **20** may be employed at spaced intervals along the interior of the core, each ram being positioned in accordance with the location and configuration of the depressed portion **60** at that particular point, thus providing flexibility in straightening which is not afforded by the prior art devices above-described.

While there have been described above the principles of this invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of the invention.

What is claimed is:

1. Apparatus for straightening deformed rolls of sheet stock comprising a pair of spaced-apart, outwardly curved shoes for respectively engaging generally opposite internal surface areas of the core of a deformed roll, and a hydraulic ram extending on an axis between said shoes and having first and second parts relatively movable in the direction of said axis, said parts respectively removably engaging said shoes, each of said shoes having means thereon for permitting pivotal motion thereof with respect to the respective part whereby said shoes may generally conform to an out-of-round configuration of said core without exerting side loading on said ram as the same is extended.

2. The apparatus of claim **1** wherein the pivotal means on one of said shoes comprises a raised, part-cylindrical portion on said one shoe engaging one of said ram parts.

3. The apparatus of claim **2** wherein said one shoe is elongated in the direction of its curvature and has opposite ends in said direction, said raised portion having an axis extending transversely of the direction of elongation of said one shoe and being disposed generally midway between said opposite ends thereof.

4. The apparatus of claim **2** wherein said one shoe is elongated in the direction of its curvature and has opposite ends in said direction, said raised portion having an axis extending parallel with the direction of elongation of said one shoe and being disposed generally midway between said opposite ends thereof.

5. The apparatus of claim **1** wherein one of said ram parts includes a pin coaxial with said axis and having a rounded distal end, the pivotal means on one of said shoes comprising a socket for selectively, removably, swivelly receiving said distal end of said pin.

6. The apparatus of claim **5** wherein said socket is positioned generally midway between the opposite extremities of said one shoe in the direction of its curvature, said one shoe having a second socket spaced from said first-named socket toward one of said extremities for selectively, removably, swivelly receiving said distal end of said pin.

7. The apparatus of claim **1** wherein said ram includes a cylinder having open and closed ends, and a piston rod in said cylinder and extending outwardly from said open end, said piston rod having a pin removably secured thereto coaxial with said axis and having a rounded distal end, the pivotal means on one of said shoes comprising a raised, curved portion engaging said closed end of said cylinder, the pivotal means on the other of said shoes comprising a socket formed therein for selectively, removably, swivelly receiving said distal end of said pin.

8. The apparatus of claim **7** wherein said closed end of said cylinder has a flat surface in rolling engagement with said curved portion which is part-cylindrical.

9. The apparatus of claim **1** wherein at least one of said shoes has a curved outer surface generally conforming to the inner surface of an undeformed roll core.

10. The method of straightening deformed rolls of sheet stock comprising the steps of (a) inserting in the core of the deformed roll an apparatus comprising a pair of spaced-apart, outwardly curved shoes, and a hydraulic ram extending on an axis between said shoes and having first and second parts relatively movable in the direction of said axis, said shoes respectively having means permitting pivotal motion thereof with respect to said axis; (b) applying hydraulic pressure to said ram thereby to extend the same so that said shoes respectively engage two generally opposite internal surface areas of said core and force the same relatively outwardly; (c) retracting said ram and rotating said apparatus in said core to a different position; and again (d) applying hydraulic pressure to said ram thereby to extend the same so that said shoes respectively engage another two generally opposite internal surface areas of said core and force the same relatively outwardly.

11. The method of straightening deformed rolls of sheet stock comprising the steps of: (a) inserting in the core of the deformed roll an apparatus comprising a pair of spaced-apart, outwardly curved shoes, and a hydraulic ram extending on an axis between said shoes and having first and second parts relatively movable in the direction of said axis, said shoes respectively having means permitting pivotal motion thereof with respect to said axis; (b) applying hydraulic pressure to said ram thereby to extend the same so that said shoes respectively engage two generally opposite internal surface areas of said core and force the same relatively outwardly; said core initially having a substantially depressed portion extending into its interior, said two areas being respectively on opposite sides of said depressed portion whereby forcing of said first-named areas relatively outwardly causes reduction of said depressed portion.

12. The method of claim **11** comprising the further

steps of: (c) retracting said ram and rotating said apparatus in said core to a different position; and again (d) applying hydraulic pressure to said ram thereby to extend the same so that said shoes respectively engage another two generally opposite internal surface areas of said core and force the same relatively outwardly; said other two areas being said reduced depressed portion and an internal surface area of said core generally opposite said reduced depressed portion.

13. The method of straightening deformed rolls of sheet stock comprising the steps of: (a) inserting in the core of the deformed roll in apparatus comprising a pair of spaced-apart, outwardly curved shoes, and a hydraulic ram extending on an axis between said shoes and having first and second parts relatively movable in the direction of said axis, said shoes respectively having means permitting pivotal motion thereof with respect to said axis; (b) applying hydraulic pressure to said ram thereby to extend the same so that said shoes respectively engage two generally opposite internal surface areas of said core and force the same relatively outwardly; said ram including a cylinder, a piston rod, and a pin removably secured to said piston rod and having a distal end removably swivelly engaging one of said shoes, said step (b) including initially employing a first said pin having a first predetermined length, and thereafter substituting for said first pin a second pin longer than said first pin.

14. The method of claim 10 wherein the shoes initially employed in steps (a) and (b) are elongated in the direction of their curvature, and wherein said step (c) includes substituting a relatively shorter shoe for one of said shoes initially employed, and orienting said apparatus so that said shorter shoe engages said reduced depressed portion upon extension of said ram during said step (d).

15. The method of claim 12 wherein said step (d) includes extending said ram sufficiently so that said shoes form said core into a generally oval configuration.

16. The method of claim 14 wherein said step (d) includes extending said ram sufficiently so that the other of said initial shoes and said shorter shoe form said core into a generally ovoidal configuration with said shorter shoe forming the smaller end thereof.

17. The method of claim 11 comprising the further step of striking the exterior surface of said roll in areas generally radially aligned with the respective boundaries of said reduced depressed portion simultaneously with said step (b).

18. The method of straightening deformed rolls of sheet stock comprising the steps of: (a) inserting in the core of the deformed roll an apparatus comprising a pair of spaced-apart, outwardly curved shoes, and a hydraulic ram extending on an axis between said shoes and having first and second parts relatively movable in the direction of the axis, said shoes respectively having means permitting pivotal motion thereof with respect to said axis; (b) applying hydraulic pressure to said ram thereby to extend the same so that said shoes respectively engage two generally opposite internal surface areas of said core and force the same relatively outwardly; (c) inserting in said core a second apparatus comprising a second pair of spaced-apart, outwardly curved shoes, and a second hydraulic ram extending on a second axis between said second shoes and having first and second parts relatively movable in the direction of said second axis, said second shoes respectively having means permitting pivotal motion with respect to said second axis, said second apparatus being positioned closely adjacent said first-named apparatus with their respective axes generally perpendicular; and (d) simultaneously applying hydraulic pressure to both of said rams whereby the respective shoes engage the respective internal surface areas of said core and force the same relatively outwardly into a generally cylindrical configuration.

19. The method of straightening deformed rolls of sheet stock comprising the steps of: (a) inserting in the core of the deformed roll an apparatus comprising a pair of spaced-apart, outwardly curved shoes, and a hydraulic ram extending on an axis between said shoes and having first and second parts relatively movable in the direction of said axis, said shoes respectively having means permitting pivotal motion thereof with respect to said axis; (b) applying hydraulic pressure to said ram thereby to extend the same so that said shoes respectively engage two generally opposite internal surface areas of said core and force the same relatively outwardly, said shoes being elongated in the direction of their curvature and are of generally equal length, said step (b) including extending said ram sufficiently so that said core is elongated with the internal surface areas respectively intermediate said first-named surface areas defining spaced generally parallel planes.

20. The method of claim 19 comprising the further steps of: (c) inserting in said core a second apparatus comprising a second pair of spaced-apart, outwardly curved shoes, and a second hydraulic ram extending on a second axis between said second shoes and having first and second parts relatively movable in the direction of said second axis, said second shoes respectively having means permitting pivotal motion with respect to said second axis, said second apparatus being positioned closely adjacent said first-named apparatus with their respective axes generally perpendicular; and (d) simultaneously applying hydraulic pressure to both of said rams whereby the respective shoes engage the respective internal surface areas of said core and force the same relatively outwardly into a generally cylindrical configuration; all of said shoes having curved outer surfaces generally conformng to the inner surface of an undeformed roll core.

21. The method of straightening deformed rolls of sheet stock comprising the steps of: (a) inserting an expansion tool in one end of the collapsed core of the deformed roll and expanding the same thereby to widen the opening of said core in said one end; (b) inserting through said widened opening at said one end of said core an apparatus comprising a pair of spaced-apart, outwardly curved shoes, and a hydraulic ram extending on an axis between said shoes and having first and second parts relatively movable in the direction of said axis, said shoes respectively having means permitting pivotal motion thereof with respect to said axis; (c) applying hydraulic pressure to said ram thereby to extend the same so that said shoes respectively engage two generally opposite internal surface areas of said core and force the same relatively outwardly.

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