Aug. 18, 1964 W. ALBERT 3,144,905

ROLL CONSTRUCTION

Filed Nov. 15, 1960 3 Sheets-Sheet 1

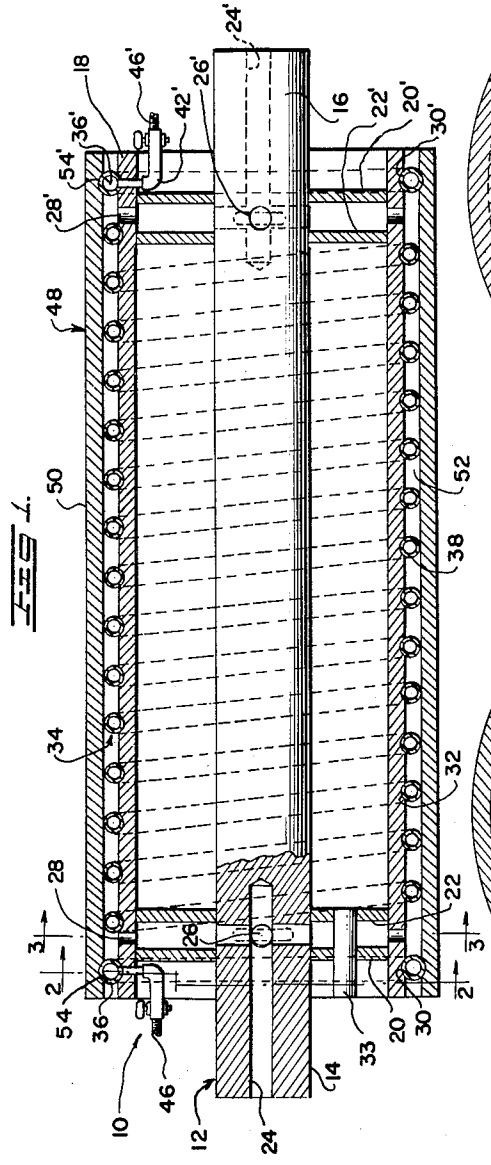


FIG. 1.

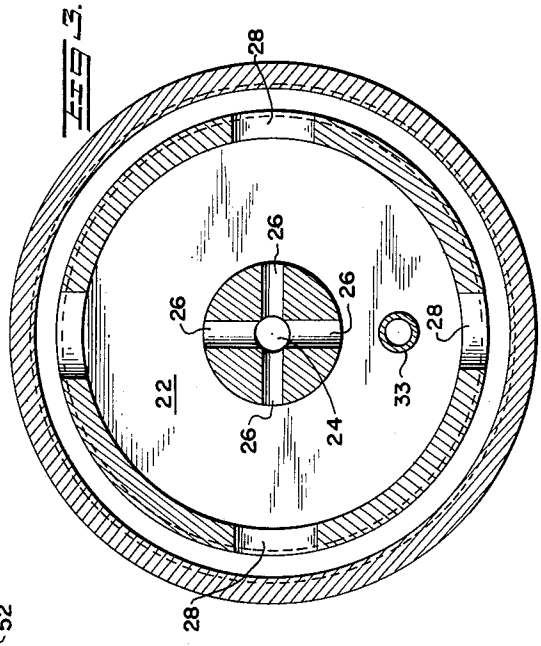


FIG. 3.

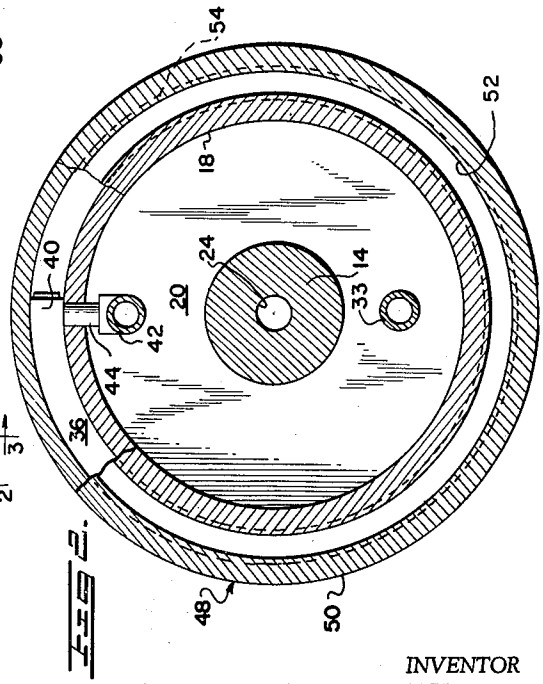


FIG. 2.

INVENTOR
WILLIAM ALBERT

BY Stowell & Stowell

ATTORNEY

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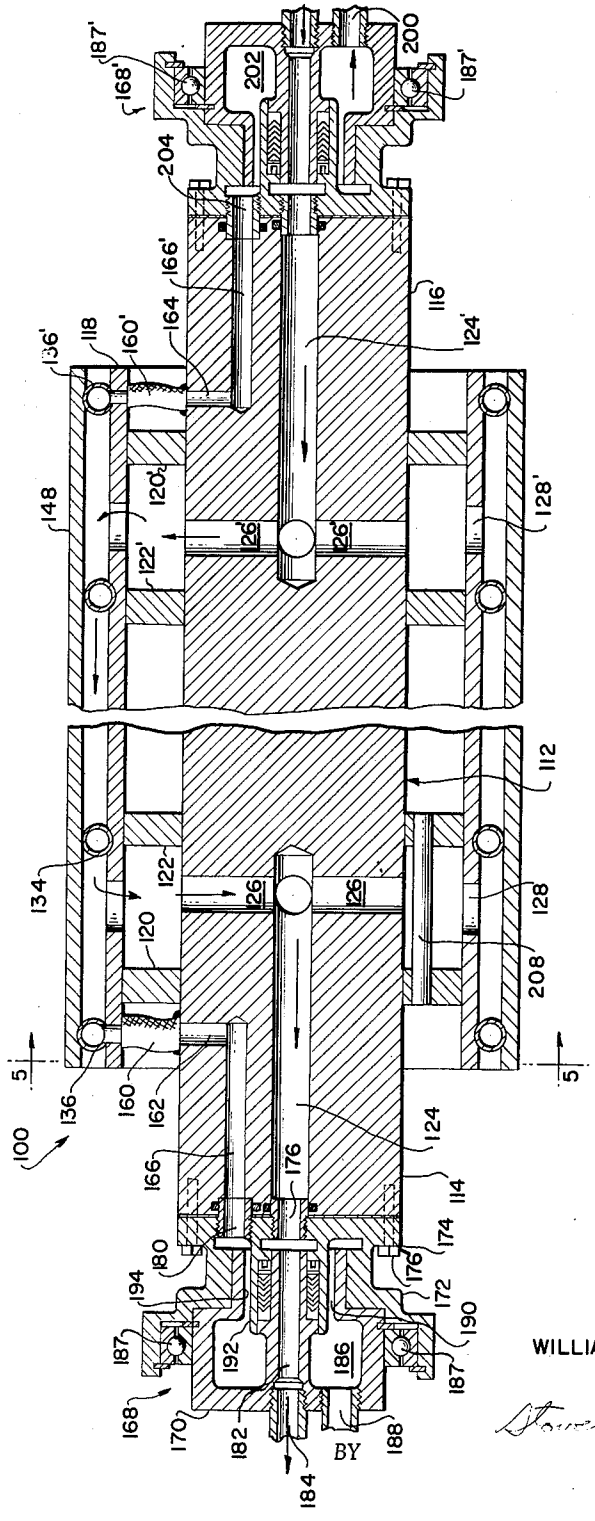


FIG 4

INVENTOR
WILLIAM ALBERT

Stowell & Stowell

ATTORNEY

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ROLL CONSTRUCTION

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Fig 5.

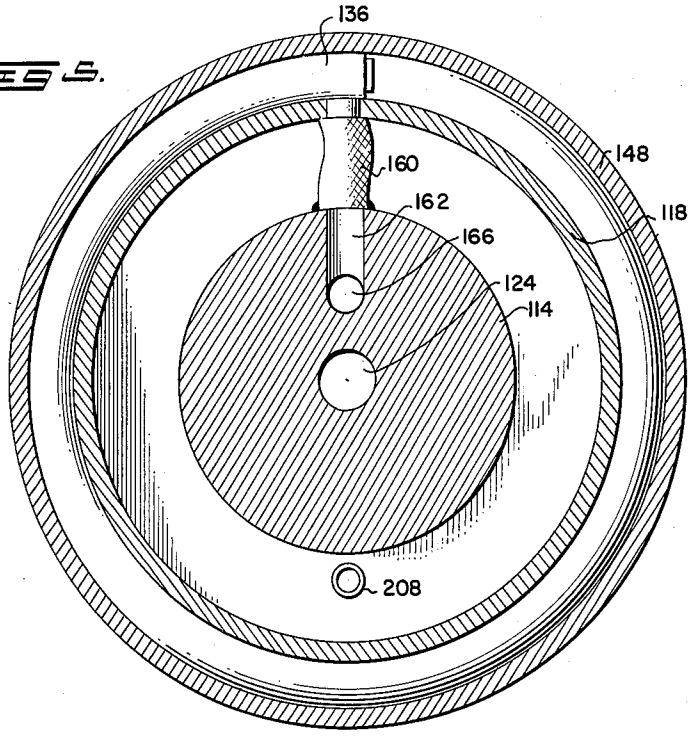
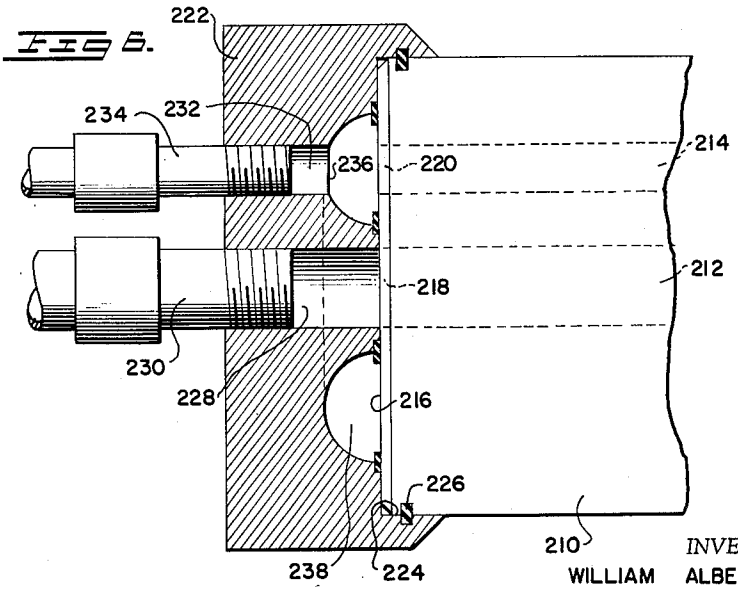


Fig 6.



INVENTOR
WILLIAM ALBERT

BY Stowell & Stowell

ATTORNEY

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3,144,905
ROLL CONSTRUCTION

William Albert, 305 W. Evans St., Middlesex, N.J.

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6 Claims. (Cl. 165—89)

This invention relates to a new and improved roll construction and, in particular, to a roll provided with a resiliently mounted and removable roll surface and to such a roll wherein a heat exchange medium may be directed adjacent the undersurface of the resiliently mounted roll surface for heating or cooling same.

It is a particular object to provide a new and improved roll having a resiliently mounted removable roll surface which may be provided with means for directing dual streams of a heat exchange medium in countercurrent direction adjacent the undersurface of the resiliently mounted roll surface.

A further object of the invention is to provide such a roll having particular utility in the production of plastic films, paper, asphalt shingles, asbestos cement shingles, and products where surface contour or finish of a product is dependent on the outside diameters of cylinders or rolls.

A further object is to provide such a roll which is simple in construction, relatively inexpensive to manufacture and is provided with a roll surface which may be readily removed for repair, reconditioning, or interchanged with other roll surfaces.

A further object of the invention is to provide such a roll at considerable reduction in cost and time of construction and is adapted to maintain "down time" caused by damage to the outside diameter of the roll at a minimum.

These objects are fully accomplished by a roll comprising a shaft having ends adapted for rotatably mounting the shaft, a first rigid sleeve, a circular plate member rigidly connecting each end of the first sleeve to the shaft, a second rigid sleeve having an inside diameter greater than the outside diameter of the first sleeve and adapted to be telescopically received over the first sleeve, expansible tubing received between the outer cylindrical surface of the first sleeve and the inner cylindrical surface of the second sleeve, and means for expanding the expandible tubing whereby the second sleeve rotates with the first sleeve; and to such a roll construction including means for directing a heat exchange medium through and/or about the expansible tubing.

Other objects and advantages of the present invention will be more apparent to those skilled in the art from the following detailed description of the invention when considered in conjunction with the illustrative embodiments thereof wherein:

FIG. 1 is a longitudinal sectional view of one form of the improved roll construction of the present invention;

FIG. 2 is a sectional view substantially on line 2—2 of FIG. 1;

FIG. 3 is a sectional view substantially on line 3—3 of the roll shown in FIG. 1;

FIG. 4 is a fragmentary longitudinal sectional view of a further form of roll constructed in accordance with the teachings of the present invention and adapted for countercurrent flow of a heat exchange medium about the inner surface of the outer roll sleeve;

FIG. 5 is a section substantially on line 5—5 of the device shown in FIG. 4; and

FIG. 6 is an enlarged fragmentary sectional view of a further form of means for conducting dual streams of a heat exchange medium to the ends of the roll shaft.

Referring to the drawings and in particular to FIGS. 1, 2 and 3 thereof, 10 generally designates a roll constructed

in accordance with the invention. The roll is provided with a central shaft 12 having ends 14 and 16 adapted to be received in conventional bearing means for rotational mounting of the shaft.

The roll 10 includes a first cylindrical sleeve 18 preferably constructed of a rigid material such as rolled steel. The first sleeve 18 is rigidly mounted to the shaft 12 by a pair of circular spaced steel plates 20 and 22 adjacent one end of the first sleeve 18 and identical plates 20' and 22' adjacent the opposite end. The plates 20, 22, 20' and 22' may be welded to the shaft and the inner surface of the sleeve 18.

End 14 of the shaft 12 is provided with an axial bore 24 which bore intersects a plurality of radial bores 26. The opposite end 16 of the shaft 12 is provided with an axial bore 24' and a plurality of radial bores 26' similar to the axial and radial bores 24 and 26 at end 14 of the shaft 12. The radial bores 26 open into the space between the pair of circular plates 20 and 22 while the radial bores 26' open into the space between the circular plates 20' and 22'.

The first sleeve 18 is provided with a plurality of openings generally designated 28 adjacent end 14 of shaft 12 which openings are positioned between the pair of plates 20 and 22, while similar openings 28' are provided in the sleeve 18 between plates 20' and 22' at end 16 of the assembly.

In order to provide for a pressure balance between the inner surface of the first sleeve 18 and the atmosphere, one or both of the ends of the roll may be provided with a pressure equalizing tube 33 which tube, as more clearly illustrated in FIG. 1 of the drawings, passes through and is secured about aligned bores in the pair of end plates 20 and 22.

The outer cylindrical surface of the sleeve 18 is provided with a pair of generally circular grooves 30 and 30' and a continuous helical groove 32 connecting the pair of grooves 30 and 30'. The size of the grooves 30—30' and the helical groove 32 are such that a portion of the surface of expansible tubing generally designated 34 may be received therein. The expansible tubing 34 has a pair of generally circular ends 36 and 36' adapted to be received in grooves 30 and 30' respectively and a center section generally designated 38 adapted to be received in the helical groove 32 and to connect the pair of the generally circular ends 36 and 36'.

The expansible tubing may be constructed of wrapped braided metal, rubber, rubber-cored braided metal, plastic, or combinations thereof and the form of the tubing 34 would to some extent depend upon the pressure required in the tube and whether a heating or cooling heat exchange medium is to be passed therethrough or thereabout.

In the form of the invention illustrated in FIGS. 1 through 3 of the drawings, end 40 of generally circular tube portion 36 has connection to a valved coupling 42 through a short pipe section 44. The opposite end 36' of the tube is similarly connected to a valved coupling 42'. The free end of the valved outlet coupling 42 is provided with a short threaded adapter 46 while a similar threaded adapter 46' is provided at the opposite end of the roll. The threaded adapters 46 and 46' receive conventional connectors whereby pressure fluid may be conducted into the expansible tubing 34 as to be more fully described hereinafter.

The roll assembly also includes a second cylindrical shell 48. The cylindrical shell 48 has an inside diameter greater than the outside diameter of the first cylindrical shell 18 and the cylindrical shell 48 is adapted to be telescopically received over the first cylindrical shell 18 and the expansible tubing 34. The outer cylindrical surface 50 of the second shell 48 comprises the roll surface. The particular form of the surface 50 is dependent on the

ultimate use of the improved roll. For example, where the roll is to provide a smooth calendered surface on paper, plastic and the like, the outer surface would be accurately machined anl preferably provided with an electroplated coat of chromium.

It will also be appreciated that the roll surface **50** may have a design configuration thereon where the roll is to impart a design on the surface of the material being processed.

Adjacent the ends of sleeve **48**, the inner surface **52** of the sleeve is provided with a generally circular groove **54** adjacent end **14** of the shaft **12** and **54'** adjacent the other end. Grooves **54** and **54'** correspond to and cooperate with grooves **30** and **30'** in the outer surface of the cylindrical sleeve **18**, and are adapted to receive a portion of the generally circular ends **36** and **36'** of the expansible tubing **34**.

It will also be apparent that where desired a generally helical groove could be provided in the inner surface of the outer sleeve **48** corresponding to the helical groove **32** in the outer surface of the sleeve **18**. However, it has been found that very satisfactory results are provided where only the generally circular grooves **54** and **54'** are provided on the inner surface of the second sleeve **48**.

In operation of the roll shown in FIGS. 1 through 3 of the drawings, the shaft ends **14** and **16** are mounted for rotation in conventional bearing means carried by the processing machine. The second sleeve **48** is mounted to rotate with the first sleeve **18** and the shaft **12** by expanding the expansible tubing **34**. In general, a medium sized roll will require about 150 lbs. per square inch pressure in the tubing **34** to adequately mount the sleeve **48** to the sleeve **18**. The pressure is directed to the tubing **34** through one of the valve couplings **42** from a convenient source of gas or liquid pressure fluid, such as a standard high pressure nitrogen or carbon dioxide cylinder, and then the appropriate valve **42** or **42'** is closed and the pressure cylinder or source of pressure fluid is disconnected from the threaded outlet **46** or **46'**.

Where a heat exchange medium is to be circulated about the helical expansible tubing **34** from one end **14** to the opposite end **16** of the roll, the extended ends of the shaft **12** are connected by swivel couplings to a source of cooling medium whereby the cooling medium is directed, for example, through axial bore **24**, radial bores **26**, openings **28** in sleeve **18** about the helically arranged expansible tubing **34**, out openings **28'**, radially bores **26'** and axial bore **24'** to a further swivel connection.

The distance between the volutes of the helically arranged expansible tubing may be varied to support greater or lesser weights and can be varied to permit greater or lesser volumes of heat exchange medium to circulate between the inner surface of the outer shell **48** and the outer surface of the inner shell **18**.

Where it is necessary to remove the outer shell **48** for replacement, repair, cleaning and the like, the pressure maintained in the expansible tubing **34** is released through one of the valved couplings **42** or **42'**, thereby collapsing the tube and permitting the ready removal of the outer sleeve **48**.

Where it is desired to maintain the temperature of the outer surface of the second sleeve of the roll substantially uniform, it has been found that it is desirable to pass a heat exchange medium in one direction about the helically arranged expansible tubing **34** and in the opposite direction through the tubing **34**. In such a construction, the heat exchange medium passing through the expansible tubing is passed through under pressure whereby the heat exchange medium provides the source of pressure for maintaining the outer shell **48** in operating relationship to the shaft **12** in addition to the means for maintaining the surface of the roll at a substantially uniform temperature.

One form of the present invention adapted for countercurrent travel of the heat exchange medium is illustrated

in FIGS. 4 and 5. Referring to these drawings, the roll generally designated **100** includes a shaft **112** having extended ends **114** and **116** adapted to be rotatably received in conventional bearings. The shaft **112** supports a first cylindrical sleeve **118** on pairs of spaced plates **120**, **122** and **120'** and **122'** adjacent ends **114** and **116** of the roll shaft **112**.

The roll also includes a second or outer cylindrical shell **148** which is telescopically received in spaced relation over the first shell **118** as described in reference to the form of the invention shown in FIGS. 1 through 3 of the drawings. Expansible tubing **134** provided with the generally circular ends **136** and **136'** is connected by conduit means **160** and **160'** to generally radial bores **162** and **164** adjacent ends **114** and **116** of shaft **112**. It will be particularly noted that radial bore **164** has a lesser diameter than radial bore **162**. Radial bore **162** communicates with a generally longitudinal bore **166** provided in shaft end **114** while generally radial bore **164** communicates with a generally longitudinal bore **166'**.

The space between the helically arranged expansible tubing **134** communicates with axial bore **124** and adjacent end **114** and a similar bore **124'** adjacent end **116** of shaft **112** through generally radial bores **126** and **126'** and openings **128** and **128'** respectively. Each end of the shaft mounts a swivel joint generally designated **168** adjacent end **114** and **168'** adjacent end **116**. The swivel joints **168** and **168'** are adapted to provide two fluid conducting passages in unbroken communication during relative rotation of the parts of the swivel joints.

Swivel joints **168** and **168'** are identical in form and include a stationary element **170** rotatably mounted to the rotatable element **172**. The rotating element **172** is rotatably mounted to the rotating element **170** of the swivel joint **168** by conventional thrust bearing means generally indicated at **187**. Rotatable element **172** is provided with a flange portion **174** which is secured to the end of shaft **114** by bolts or the like **176'**. The rotatable element **172** has an axial opening which threadedly receives a bushing **176** which mates with the bore **124** in the shaft **114**.

The rotatable element **172** also is provided with a bore receiving a bushing **180** which bushing is adapted to be received in the bore **166** in the shaft **114**. Bushing **176** communicates with an axial bore **182** provided in the stationary portion **170** of the swivel joint. The bore **182** in the stationary portion of the swivel joint is connected by a conduit **184** to a source of heat exchange medium. In this form of the invention, the conduit **184** is the return conduit for the heating medium flowing about the helical path between the volutes of the expansible tubing **134** as shown by the directional arrows.

The stationary section **170** of the swivel joint **168** is provided with an annular chamber **186** which annular chamber communicates with a pipe or conduit **188** connected to a source of heat exchange fluid under pressure. The annular chamber **186** communicates with the annular space **190** between cylindrical wall **192** of the rotating section **180** of the joint and stationary wall portion **194** of the stationary element of the swivel joint. The annular space **190** communicates with the bushing **180** whereby the heat exchange medium under pressure flows through bore **166**, radial bore **162**, flexible conduit **160**, to and through the expansible tubing **134**.

At end **116** of the improved roll the heat exchange medium flowing through the tubing is exhausted from the shaft via the coupling **168'** and specifically through pipe **200** which communicates with annular space **202** which in turn communicates with the bushing **204**.

As hereinbefore set forth conduit **164** in end **116** of the shaft **112** is of a smaller diameter than the corresponding radial bore **162** in end **114** of shaft **112**. The constricted bore **164** cooperating with the source of pressurized heat exchange liquid pressurizes the expansible tubes **134** maintaining the second sleeve **148** in substantially fixed relation to the inner sleeve **118**.

It will be particularly noted that with a portion of the heat exchange liquid flowing in the direction of the directional arrows through the expansible tubing and another portion of the heat exchange liquid flowing about the helically arranged flexible tubes **134** and in the opposite direction to the flow of the medium through the tubes that very uniform temperature control of the surface of the outer cylindrical member **148** is obtainable.

In this form of the invention as in the form of the invention shown in FIGS. 1 through 3, a tube **208** extending between and through at least a pair of the circular plates **120** and **122** maintains the pressure within the roll at substantially ambient pressure.

Referring to FIG. 6 of the drawings, a modified swivel joint adapted to provide two fluid conducting paths or passages in unbroken communication with the rotating shaft of the roll is illustrated. This form of the swivel joint for the improved roll has particular advantage where the roll is not adapted for high-speed operation and antifriction bearing means for the swivel joint are not required.

Referring specifically to FIG. 6, **210** designates a shaft for a roll such as shown in FIG. 4 of the drawings, which shaft is provided with a conduit **212** for directing a cooling medium about the space between the helically arranged flexible conduits of the roll. The shaft **210** is provided with a further conduit **214** which is adapted to direct a heat exchange medium under pressure to and through the expansible tubings.

Each end of the shaft **210** may be conveniently provided with a bearing plate **216**, which bearing plate is provided with bores **218** and **220** adapted to communicate with the conduits **212** and **214** respectively.

The said extended end of the shaft **210** rotatably receives a fixed block **222** which is provided with a large bore **224** adapted to snugly receive the end of the shaft **210** and the fixed block **222** is maintained in operating relationship to the end of the shaft **210** by a conventional snap-ring arrangement **226**. The fixed block **222** has an axial bore **228** which axial bore communicates with the opening **218** in the bearing plate **216** and conventional conduit means generally indicated at **230** is threadedly received in the bore **228**.

The fixed block **222** is also provided with a bore **232** which bore threadedly receives a conventional conduit **234** connected to a source of heat exchange liquid under pressure. The inner end **236** of bore **232** communicates with an annular chamber **238** whereby continuous communication is maintained between the bore **232** in the fixed block **222** and the opening **220** in the rotating shaft **210**.

As previously described with reference to FIG. 4, the other end of the roll shaft would be provided with a substantially identical fixed block for directing heat exchange medium about the helically arranged expansible tubings and to and from the tubing.

While plural forms of the improved roll construction have been specifically illustrated in the drawings and described in the foregoing specification, it will be apparent to those skilled in the art that various modifications may be made in the form and shape of the structures without departing from the scope of the appended claims.

I claim:

1. A roll construction comprising a shaft having ends adapted for rotational mounting of said shaft, a first rigid sleeve, means for rotating said first rigid sleeve upon rotation of said shaft, said means comprising first circular plate means rigidly connecting each end of the first sleeve to said shaft, a second rigid sleeve having an inside diameter greater than the outside diameter of said first sleeve and adapted to be telescopically received over said first sleeve, means for rotating said second sleeve upon rotation of said shaft, said means for rotating said second sleeve consisting solely of expansible tubing received between the outer cylindrical surface of said first sleeve and the inner surface of said second sleeve, and means for expanding said expansible tubing whereby said second sleeve rotates with said first sleeve and each rotates with said shaft, said expansible tubing being positioned in a helical array across the outer surface of said first sleeve and in contact with the inner surface of said second sleeve.

2. The invention defined in claim 1 including means for directing a heat exchange medium about the volutes of the helically arranged tubing.

3. The invention defined in claim 1 including means for directing a heat exchange medium under pressure through said expansible tubing.

4. The invention defined in claim 1 including means for directing a heat exchange medium about the volutes of the helically arranged tubing, and means for directing a heat exchange medium under pressure through said helically arranged expansible tubing.

5. A roll comprising a shaft having ends adapted for rotatably mounting said shaft, a first rigid metallic sleeve, a pair of spaced circular plate members rigidly connecting each end of said first sleeve to said shaft, said first sleeve having a generally circular groove in the outer surface thereof adjacent the ends of the sleeve and a generally helical groove connecting said generally circular grooves, a second rigid metallic sleeve having an inside diameter greater than the outside diameter of said first sleeve and adapted to be telescopically received over said first sleeve, a pair of generally circular grooves on the inner surface of said second sleeve and corresponding to the generally circular grooves in said first sleeve, expansible tubing received between the outer cylindrical surface of said first sleeve and the inner cylindrical surface of said second sleeve in said generally cylindrical end grooves and said helical groove, means for expanding said expansible tubing whereby said second sleeve rotates with said first sleeve, an axial bore in each end of said shaft, radial bores in said shaft communicating with each of said axial bores, said radial bores being positioned between each of said pairs of circular plates securing said first sleeve to said shaft, and openings in said first sleeve to permit the flow of a heat exchange medium through said axial bores, said radial bores, said openings in said first sleeve, and about the expansible tubings received in the generally helically arranged grooves.

6. The invention defined in claim 5 wherein the means for expanding said expansible tubing includes means for directing a heat exchange medium under pressure through said expansible tubing.

References Cited in the file of this patent

UNITED STATES PATENTS

1,583,333	Bigum	May 4, 1926
2,062,321	Levin	Dec. 1, 1936
2,141,645	Fawick	Dec. 27, 1938
2,250,325	Barnes	July 22, 1941
2,388,003	McCullough	Oct. 30, 1945
2,425,599	Cox	Aug. 12, 1947
2,725,218	Cuming	Nov. 29, 1955

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,144,905 August 18, 1964

William Albert

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.

In the heading to the printed specification, line 3, for "William Albert, 305 W. Evans St., Middlesex, N. J." read -- William Albert, Middlesex, N. J. (305 W. Evans St., Florence, S. C.) --.

Signed and sealed this 22nd day of December 1964.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents