May 10, 1927. 1,627,729

G. W. DINGEE

EXPANSIBLE AND CONTRACTIBLE MANDREL

Original Filed June 8. 1922 2 Sheets-Sheet 1

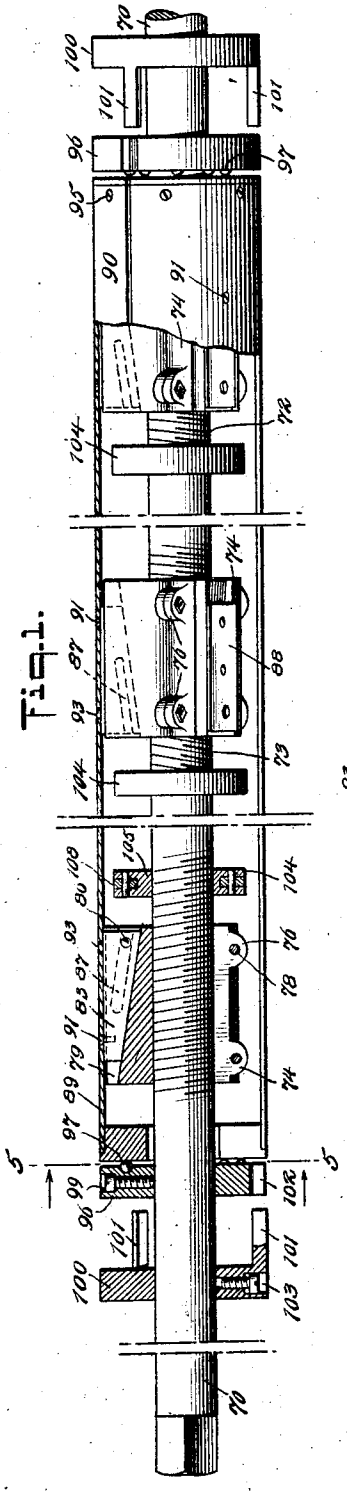


Fig. 1.

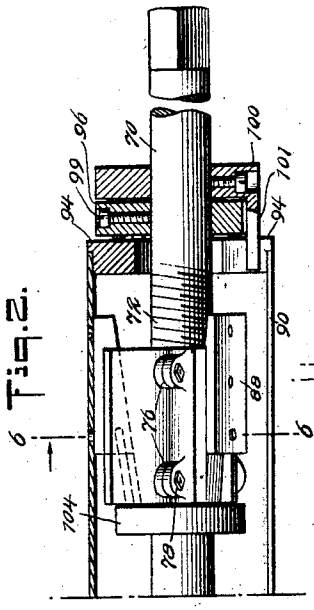


Fig. 2.

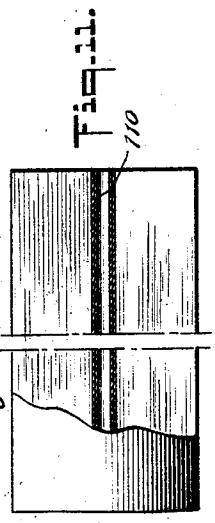


Fig. 11.

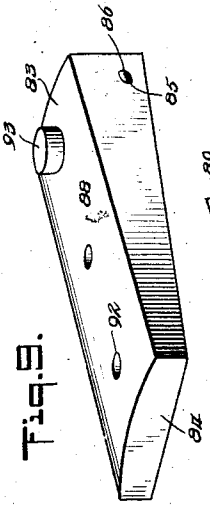


Fig. 9.

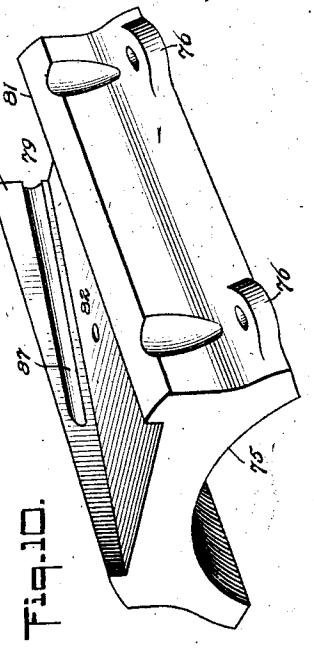


Fig. 10.

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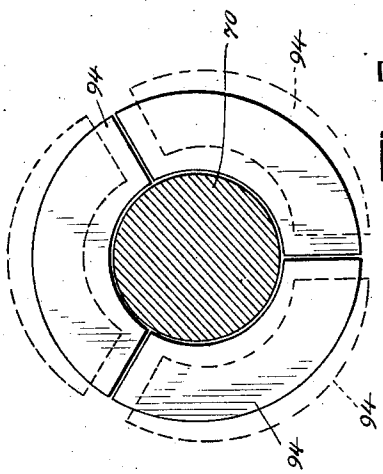



Fig. 5.

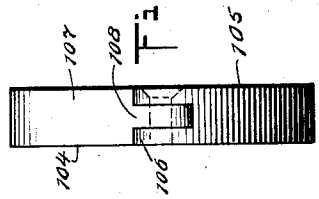



Fig. 8.

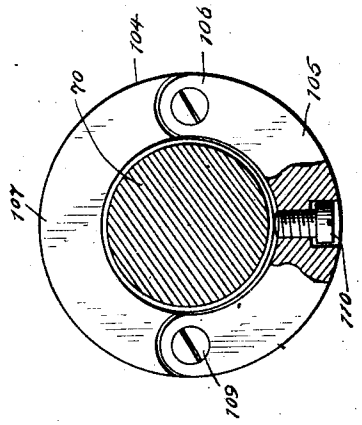



Fig. 7.

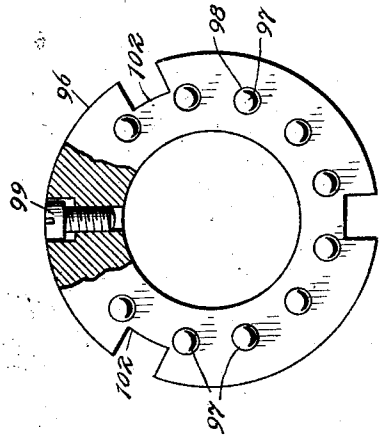



Fig. 4.

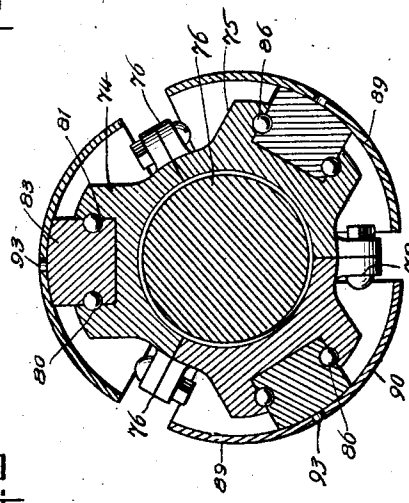



Fig. 6.

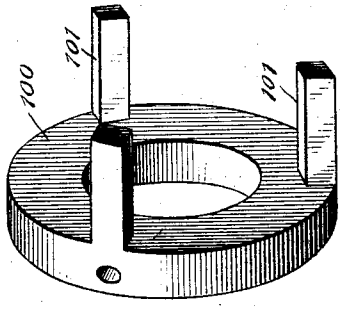



Fig. 3.

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# UNITED STATES PATENT OFFICE.

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## EXPANSIBLE AND CONTRACTIBLE MANDREL.

Original application filed June 8, 1922, Serial No. 566,831. Divided and this application filed December 7, 1922. Serial No. 605,385.

This invention relates to rolls of paper, method of forming, and devices for forming and handling the same. The present application is directed toward an expansible and contractible mandrel particularly designed for use in the forming up of rolls of paper. The subject matter of the present case is divided out of my copending application Serial #566,831, filed June 8th, 1922, in response to a requirement of division.

In the ordinary method of manufacturing paper, such as newsprint-paper, the finished paper taken from the dryer and calender rolls of the paper making machine is rolled onto large rolls known as stock rolls. The paper making machine is usually provided with devices so that the finished product can be rolled upon at least two such rolls. The finished paper forming stock rolls is then passed about suitable rolls to a slitter and trimmer and to a winding mechanism where it is wound in rolls of the proper size to suit the customer. The winding mechanism usually comprises a pair of power driven drums about which the slitted and trimmed paper is passed and on top of these drums the finished roll of paper is formed. In forming this roll of paper the end of the web is wrapped about a pipe, and the pipe and paper rested upon the top of the drums. The frictional contact between the drums and paper causes the pipe to roll about and wind the paper thereon. In mills making newsprint-paper it is common to form two 72 inch rolls of paper simultaneously on two pieces of 4 inch pipe. The finished rolls are then ready for shipment to the printing establishment, the iron pipes being retained in the roll. In the pressroom a long shaft is passed through the pipe, this shaft being provided with devices for cooperating with an adjustable brake carried on the printing-press so that a drag may be imposed on the roll of paper as it is being drawn into the press. As it is inconvenient to fasten the shaft and pipe together, it is usual to drive a clutch into the end of the paper roll. This mutilates the inner quarter inch of the paper roll so that it is not suitable to be carried through the machine and made into finished newspapers. This amount of paper is scrap and must be disposed of as such.

After the used paper and the scrap have been removed from the iron pipes, these pipes are stored until a sufficient number accumulate to fill a freight car whereupon they are returned to the paper mill.

The procedure thus outlined is standard in most paper making and newspaper plants. It has great disadvantages. There is an enormous investment in iron pipe and in facilities for warehousing. Its depreciation is very rapid and considerable labor is entailed in accounting for and handling the pipe, both at the paper mill and in the printing plant. These disadvantages are insignificant as compared with the freight charges for shipping the pipe back and forth. It is shipped as "paper", at a high freight rate, to the printing establishment, and then must be returned as iron pipe to the paper mill. Owing to the distances separating paper mills and printing establishments consuming large amounts of paper, the enormity of this expense is obvious.

This invention relates to an improved method of putting up rolls of fabric such as paper for printing presses and similar materials and consists in winding a roll thereof on to a core so constructed that it can be contracted or expanded at will to remove it from the roll when completed or to mount the roll on a similar core for unwinding, and providing means for preventing the center of the roll from unwinding or otherwise collapsing after the core has been removed.

An object of the invention is to provide a convenient and serviceable, collapsible and expansible mandrel on which the paper may be rolled in the paper mill. This mandrel will be preferably made so that it can be readily collapsed and removed from the paper roll so that the roll can be shipped without shipping the mandrel. The man-

drel is also to be made so that it can be readily inserted into the roll at the printing establishment and expanded to grip the roll so that it can be readily handled in the press.

Another object of the invention is to provide a mandrel which has such interlocks that there is no possibility of its becoming accidentally disassembled.

Another object of the invention is to provide a mandrel with devices whereby it can be locked in expanded position so that there is no possibility of its loosening inside the roll when it is used in the pressroom.

It further consists in so constructing the core that it can be expanded or contracted within the opening in the center of the roll without varying the relation of the roll and the supporting bearings axially of the core.

Other objects of the invention will be obvious as the description proceeds.

The accompanying drawings show for purposes of illustration the invention, one of the many possible embodiments in which the invention may take form.

Fig. 1 is a view partly in section and partly in elevation of a mandrel in contracted position;

Fig. 2 is a section of one end of the mandrel with the parts in the expanded position;

Fig. 3 is an illustration of a locking device;

Fig. 4 illustrates an abutment member;

Fig. 5 is a section taken on the line 5—5 of Fig. 1, the dotted lines indicating the relation of parts when the mandrel is expanded;

Fig. 6 is a section taken on the line 6—6 of Fig. 2;

Figs. 7 and 8 are end and side elevations of a stop;

Figs. 9 and 10 are perspective views illustrating a wedge and split nut respectively; and

Fig. 11 illustrates a roll of paper made in accordance with the present invention.

The mandrel has a shaft 70 considerably longer than the width of the maximum web which is to pass through the winding mechanism above described. The shaft indicated in Fig. 1 is threaded at 71 and 72 near its ends and at 73 near the middle. Nuts 74 are arranged to cooperate with the threads. These nuts are here shown as made of three segments, such as illustrated in Fig. 10. The segments 75 for any one nut are alike. They are provided with lugs 76 through which bolts 78 pass for fastening the segments together. Each segment has a longitudinal slot 79 provided with guideways 80 and 81 and with a bottom wall 82, so arranged that the cross-section (as indicated at the left of Fig. 1) of the segments, is wedge shaped. Cooperative wedge shaped members 83, best shown in Fig. 9, are fitted into the longitudinal slots or passage-ways 79, these wedges having a plane lower surface 84 adapted to cooperate with the bottom surface 82 of the passage-ways. The wedges 83 are shown as provided at 85 with recesses adapted to retain balls 86, and the side walls 80 and 81 of the passage-ways have oblique guide-ways 87 to cooperate with the balls 86. The guideways 87 are open at the lower end to admit the balls 86 in assembling the mandrel. They are closed at the other end and hence the relative movement of the wedges and nuts is limited. This interlocks these parts and prevents accidental derangement of the mandrel. The exposed surface 88 of the wedge shaped members is convex to fit the segments 89 of a longitudinally split shell or casing 90. Segments 89 are fastened to the wedge shaped members by screws 91 threaded into holes 92 and by pins 93 projecting outwardly from the wedges.

In the illustration, three nuts 74 are shown. The threads between two of the nuts and the shaft are right-handed while the threading connecting the other nut and the shaft is left-handed. The wedge shaped members 83 are fastened to the segments 89 of the shell or casing 90 by screws 91 threaded into holes 92 in the wedge shaped members and by studs 93 projecting through holes in the segments 89. The balls 86 are so located in the guideways 87 that, after the parts are assembled, the wedges cannot accidentally come out of the guideways.

Each of the segments 89 of the shell 90 has fastened thereto the segments 94 of a split ring. These segments are fastened to the segments of the shell by screws 95, and the segments 94 extend inwardly as indicated in Figs. 1, 2, and 5. Rings 96 are fastened to the shaft 70 near the ends thereof, and are spaced apart far enough to accommodate the segments 94 of the split ring above referred to. Balls 97 are held in recesses 98 in the inside faces of the rings 96, so as to eliminate friction between the rings 96 and the segments 94. The rings 96 are fastened to the shaft by means of lock screws 99.

There is also provided on either end of the shaft a ring 100, which ring has prongs or members 101 adapted to be passed through grooves 102 in the outside of ring 96 and to extend in between the segments 94, as indicated in Fig. 2. The rings 100 may be clamped in the position indicated in Fig. 1 by a lock screw 103, when the mandrel is in collapsed position or when it is desired to adjust the mandrel. They are moved into the position indicated in Fig. 2 when the mandrel is to be locked in expanded position. In order to prevent over-expansion of the mandrel, there are provided a plurality

of rings 104, each ring having two parts as indicated in Figs. 7 and 8. One part 105 of the ring has bifurcated ends 106, while the other part 107 of the ring has a member 108 adapted to be inserted between the bifurcations 106. Screws or pins 109 are used to fasten the parts 105 and 107 together, and the split ring may be locked on to the shaft 70 by means of a lock screw 110.

Fig. 1 indicates the mandrel in collapsed position. It will be noted that the nuts 74 are spaced a considerable distance from the locking rings 104, and that the segments 89 of the shell or casing of the mandrel are closed down against the outer surface of the nuts 74. Now, when the mandrel is to be expanded, a wrench or other suitable tool is applied to the shaft 70 and it is turned, the shell being held from rotation manually. As the shaft is turned, the nuts 74 advance toward the stops 104, and, as the segments 94 abut against the balls 97 held in rings 96, the wedge shaped members 83 are forced outwardly, and the mandrel is therefore expanded. Owing to the restrictions placed upon the movements of the segments of the mandrel casing by the rings 96, it will be noted that the exterior of the mandrel does not travel lengthwise of the shaft. When the mandrel is in fully expanded position, as indicated in Fig. 2, the nuts 74 will have been brought against the rings 104.

In using this mandrel in the paper mill, it is expanded to the predetermined diameter, and a turn of paper is passed about the mandrel, after which further paper may be drawn on through pasting mechanism. After the roll of paper, such as is indicated in Fig. 11, is completed, the mandrel is collapsed and removed from the roll leaving an opening 110. The walls of this opening being made of freshly pasted paper form a core to prevent the unwinding of the paper. In many mills, it is customary to wind two or more rolls simultaneously, and, where this is the case, a slitter cuts the paper to the proper width and the rolls are readily broken apart after the mandrel has been removed.

In the printing establishment, a mandrel identical with that used in the paper mill, except that it may be shorter, as it handles but one roll of paper at a time, is used. The mandrel is collapsed, then inserted into the opening in the roll and expanded to grip the sides or walls of the opening. The mandrel used in the printing establishment should preferably permit of a slightly greater expansion than the one used in the paper mill, as it must be expanded against the core far enough to grip it tightly. The mandrel and roll may be accurately lined up by placing the ends of the mandrel at the end of the roll. As above pointed out, the mandrel does not travel when it is being expanded. Next, the locking devices 100 are moved to the position indicated in Fig. 2, and it is then impossible for the mandrel to loosen in the roll. The usual brake mechanism is applied to the shaft 70 of the mandrel, and the paper is run off through the press in the usual manner, friction being applied to the shaft for the usual purpose.

It will be noted that in using paper off a mandrel in the manner above indicated all of the good paper is available for use in the press. None of it is destroyed by the locking device, as is customary in the locking devices now in use. It should further be noted that the paper lost in making the pasted tube is substantially the same amount of paper as is mutilated by the locking devices now in use.

While it is preferable to make the paper core out of paper which is to be wound into a roll, it is, of course, obvious that the mandrel could be used on a prepared core and that this prepared core might be either the ordinary spirally pasted cylinder or a prepared cylinder made by winding paper in the fashion indicated in the application above referred to.

By carrying out the handling of paper in the method above indicated, it is obvious that the great expense attendant upon shipping iron pipes to and from the paper mill and printing establishment will be eliminated, together with the fixed charge for the investment in these pipes and the expense and trouble incident to accounting for and handling them. The pasted paper cores are made from paper which is readily available in the paper mill, and the loss resulting from using this paper to make the cores is comparable with that now brought about by mutilating the inner portion of the roll by affixing the locking devices necessary for applying the friction drag in the printing press.

What is claimed is:

1. An expansible mandrel having a cylindrical shell longitudinally split into segments, a shaft, means controlled by the rotation of the shaft for expanding and contracting the shell, a device having members, means for preventing longitudinal movement of the shell along the shaft during expansion and contraction, and means for non-rotatably fastening said device to the shaft in a position whereby said members will co-operate with said means for preventing longitudinal movement of the shell to prevent collapsing of the mandrel.

2. An expansible mandrel having a cylindrical shell longitudinally split into segments, a shaft, means controlled by the rotation of the shaft for expanding and contracting the shell, means for preventing longitudinal movement of the shell along the shaft during expansion and contrac-

tion, said means including a radially movable element, a ring having members disposed parallel to the shaft, and means for non-rotatably fastening said ring to the shaft whereby said members will co-operate with said radially expanding element to prevent collapsing of the mandrel.

3. An expansible mandrel having a cylindrical shell longitudinally split into segments, a shaft, means controlled by rotation of the shaft for expanding and contracting the shell, rings having members disposed parallel to the shaft, and abutment rings fastened to the shaft to prevent movement of the shell along the shaft during expansion or contraction, the rings having slots to accommodate said members, whereby the members may be passed between the segments of the expanded mandrel to prevent collapsing thereof.

4. An expansible mandrel having a cylindrical shell longitudinally split into segments, a shaft, means controlled by the rotation of the shaft for expanding and contracting the shell, means for limiting the expansion, means for preventing longitudinal movement of the shell along the shaft during expansion and contraction, a device having members, and means for non-rotatably fastening the device to the shaft whereby said members will co-operate with said means for preventing longitudinal movement to positively maintain said mandrel in expanded position.

5. In an expansible mandrel, a threaded shaft, nuts threaded into the shaft, a cylindrical shell which is longitudinally split into segments, cooperative wedge devices interconnecting the segments and nuts whereby, upon turning the shaft relative to the shell, the segments may be moved to expand or contract the shell, abutments carried by the shaft for preventing longitudinal movement of the shell relative to the shaft during expansion or contraction, and means adapted to co-operate with said abutments for locking the mandrel in expanded position.

6. In an expansible mandrel, a shaft, a cylindrical shell which is longitudinally split into sections, means controlled by the rotation of the shaft for expanding and contracting the shell, inwardly disposed segmental abutment members carried by the ends of the sections, abutment rings fixedly carried by the shaft adjacent the abutment members to prevent longitudinal movement of the shell, and antifriction balls interposed between the rings and abutment members.

7. In an expansible mandrel, a shaft, a cylindrical shell which is longitudinally split into sections, means controlled by the rotation of the shaft for expanding and contracting the shell, inwardly disposed segmental abutment members carried by the ends of the sections, abutment rings fixedly carried by the shaft adjacent the abutment members to prevent longitudinal movement of the shell, said rings having slots, and rings slidably carried by the shaft and provided with fingers insertible through said slots and between the ends of the abutment members to prevent relative rotation of the shell and shaft.

8. In an expansible mandrel, a threaded shaft, a cylindrical shell which is longitudinally split into sections, means controlled by the rotation of the shaft for expanding and contracting the shell, said means including multiple-part nuts having segments corresponding in number to the number of sections in the shell.

9. In an expansible mandrel, a threaded shaft, a nut longitudinally split into a plurality of parts, each part being provided with an inclined seat for a wedge and devices for fastening the parts of the nut together about the shaft.

10. In an expansible mandrel, a threaded shaft, a nut longitudinally split into a plurality of parts, each part being provided with an inclined seat for a wedge and inclined guides for wedge interlocking members, and devices for fastening the parts of the nut together about the shaft.

11. In an expansible mandrel, a threaded shaft, a nut longitudinally split into a plurality of parts, each part being provided with an inclined seat for a wedge and inclined guides for wedge interlocking members, devices for fastening the parts of the nut together about the shaft, and wedges co-operating with said seat and guides.

12. In an expansible mandrel, a threaded shaft, a nut longitudinally split into a plurality of parts, each part being provided with a longitudinal guideway having an inclined seat and inclined grooves in the side walls thereof, a wedge carried in the guideway, and balls carried by the wedge and cooperating with the grooves.

13. In an expansible mandrel, a shaft having a plurality of threaded portions, and intermediate unthreaded portions, and a plurality of nuts each longitudinally split into a plurality of parts, each part being provided with an inclined seat for a wedge, and devices for fastening the parts of the nut together about the shaft.

14. In an expansible mandrel a shaft of uniform diameter throughout its length, a plurality of spaced threaded portions spaced from the ends of the shaft, and a plurality of nuts each longitudinally split into a plurality of parts, each part being provided with an inclined seat for a wedge, and devices for fastening the parts of the nut together about the shaft.

15. In an expansible mandrel a threaded shaft, a cylindrical shell which is longi-

tudinally split into a plurality of segments, means controlled by rotation of the shaft for expanding and contracting the shell, said means including nuts threaded on the shaft, and adjustable stops carried on the shaft for limiting movement of the nuts in the direction to expand the mandrel.

16. In an expansible mandrel, a threaded shaft, a cylindrical shell which is longitudinally split into a plurality of segments, means controlled by rotation of the shaft for expanding and contracting the shell, said means including nuts threaded on the shaft, and adjustable stops carried on the threaded portion of the shaft for limiting movement of the nuts in the direction to expand the mandrel.

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