

H. PARKER.

MACHINE FOR FORMING BODIES FROM SUCCESSIVE LAYERS OF PULP.

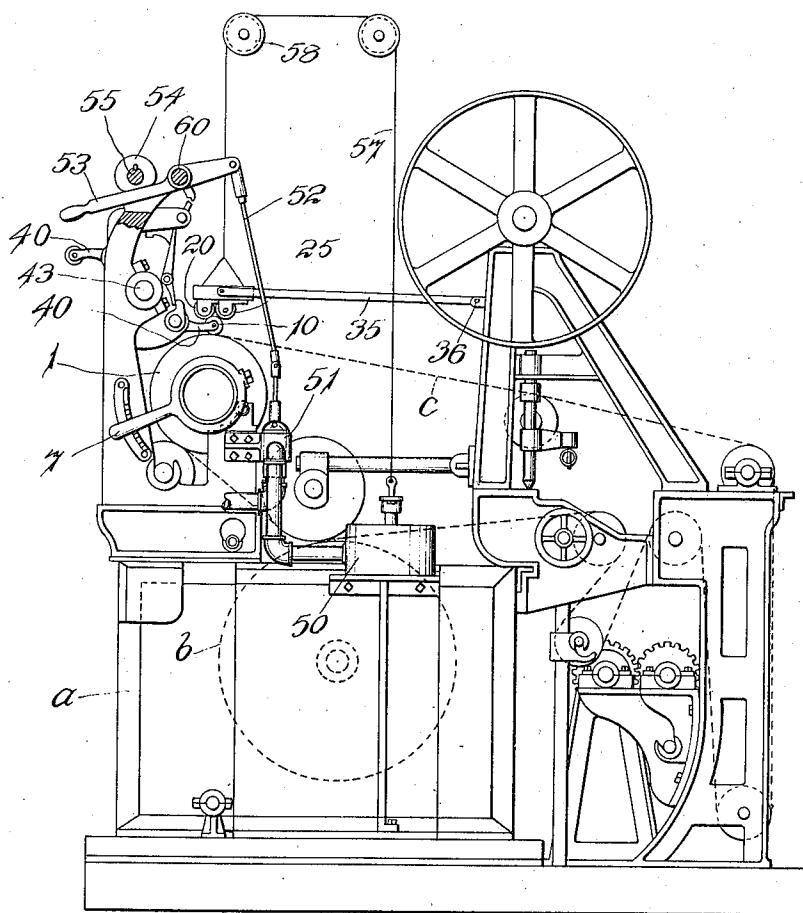
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1,147,262.

Patented July 20, 1915.

4 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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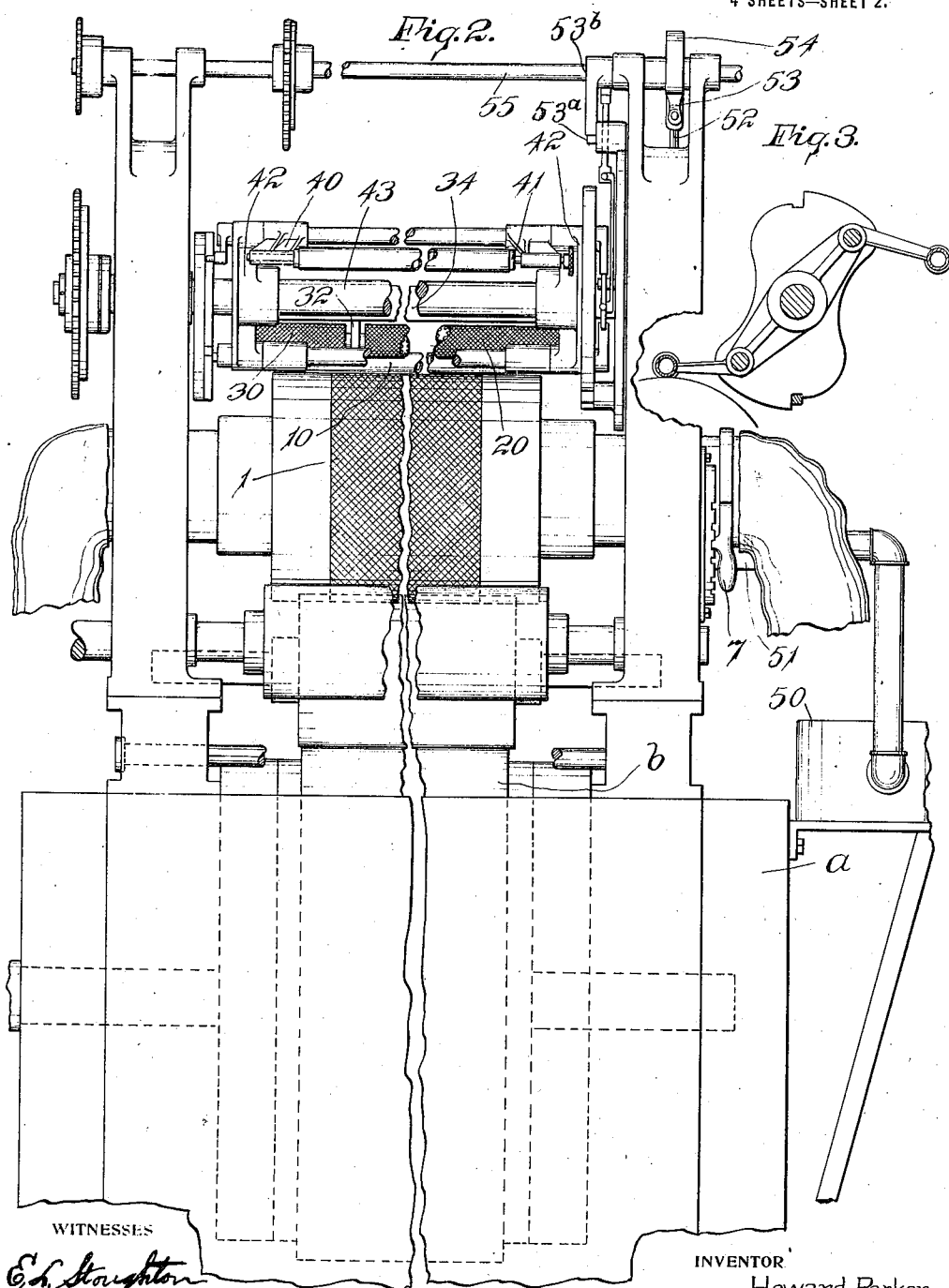
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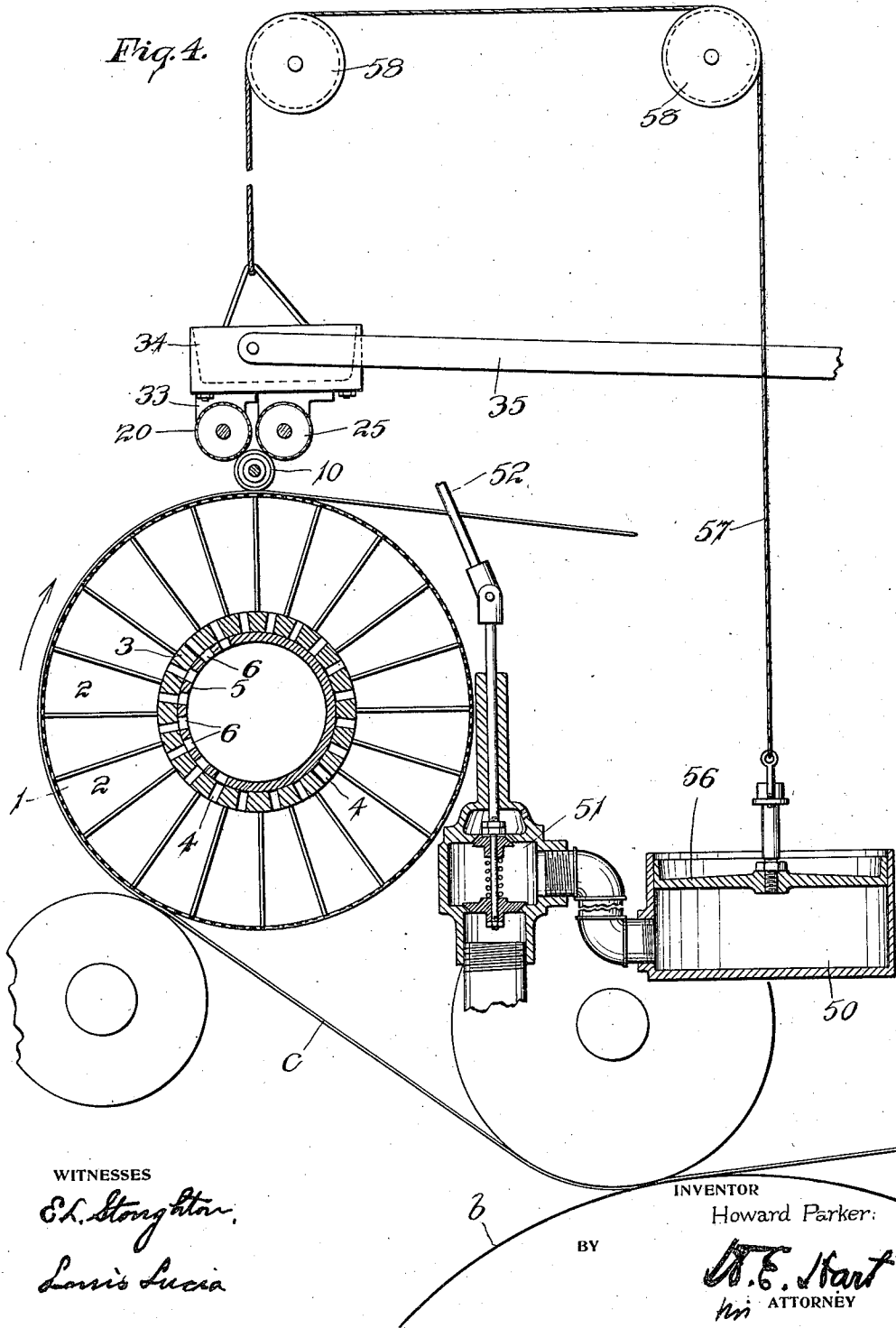
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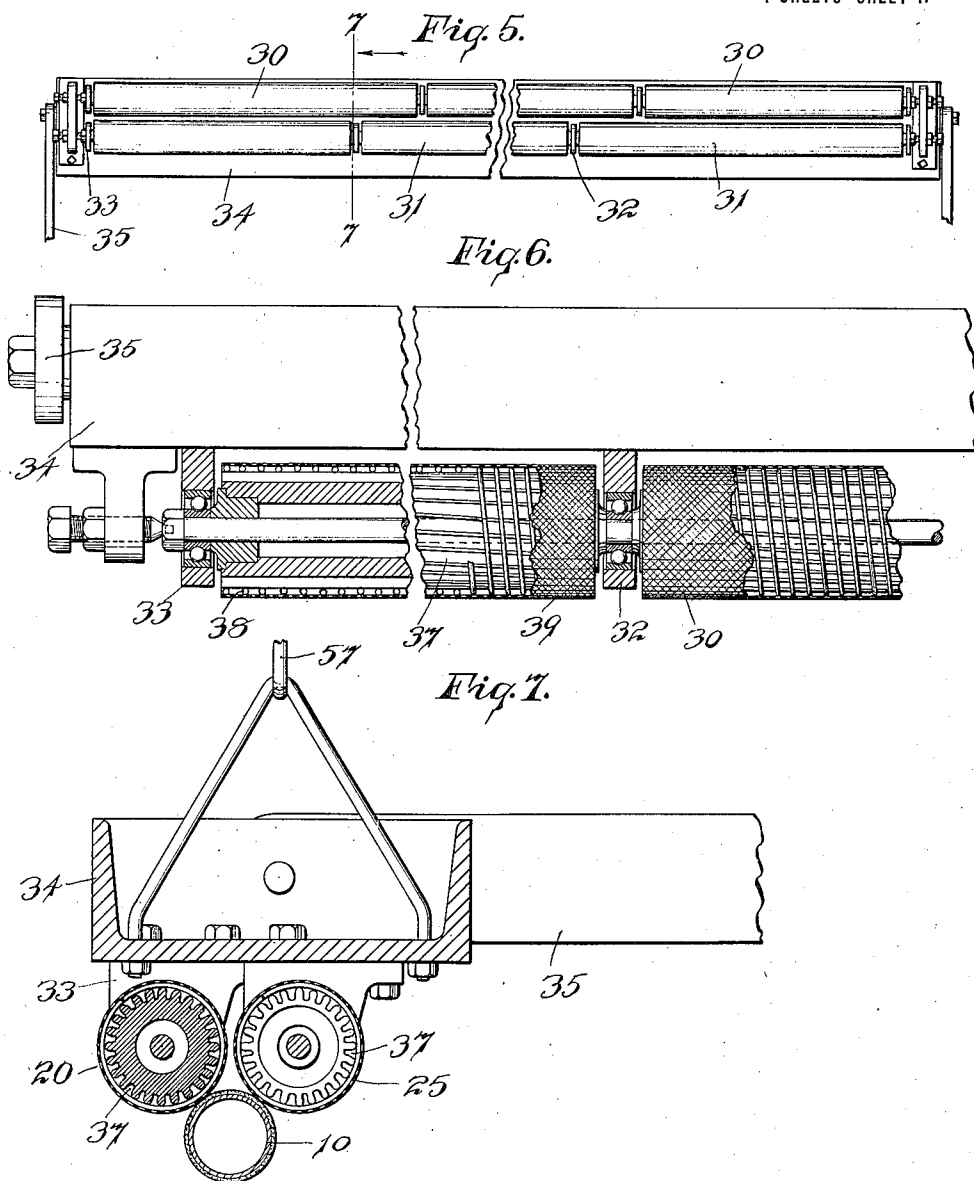
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4 SHEETS—SHEET 4.

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MACHINE FOR FORMING BODIES FROM SUCCESSIVE LAYERS OF PULP.

1,147,262.

Specification of Letters Patent.

Patented July 20, 1915.

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To all whom it may concern:

Be it known that I, HOWARD PARKER, a citizen of the United States, residing at Nashua, in the county of Hillsboro and State of New Hampshire, have invented certain new and useful Improvements in Machines for Forming Bodies from Successive Layers of Pulp, of which the following is a specification.

10 This invention relates to an improvement in apparatus for forming bodies of pulp and in which the pulp is applied in successive layers, and particularly to that class of apparatus in which the successive layers of pulp are wound upon a core or mandrel so that when the required thickness is attained the complete structure may be removed from the mandrel in the form of a tube, or cut longitudinally and removed in the form of a sheet, the object of the invention being to improve the construction of machines of this general type and the mode of operation of such machines.

25 The art of forming sheets or tubes by winding successive layers of pulp on a roll or mandrel is quite old, and reference may be had to Patent #408,092 issued July 30, 1899, to Henry Fairbanks and myself as joint inventors, for a description of one of the first machines designed for accomplishing such a result. From a long experience in the manufacture and operation of machines of this general character, covering the period since the date of the above mentioned patent, I have found that to meet the present day requirements as to the character of the product and the rate of its production, it has been necessary to re-design and re-construct the original machines in essential particulars.

40 In the drawings I have illustrated a machine in which are embodied the various improvements constituting the present invention.

45 Referring to the drawings—Figure 1 is a side elevation of a machine embodying my invention. Fig. 2 is a front view thereof. Fig. 3 is a detail view of part of the mandrel-carrying cage. Fig. 4 is a detail view on enlarged scale showing the winding mechanism and appurtenant parts. Fig. 5 is a bottom view of the press rolls and carrier. Fig. 6 is a side view of the press rolls and carrier, parts being broken away to

show the roll construction. Fig. 7 is a sectional view on line 7, 7 of Fig. 5.

Any proper machine can be utilized for forming the pulp or paper stock into a sheet or web. I have illustrated a cylinder machine, though a Fourdrinier machine would do equally as well.

In the drawings *a* denotes the tank in which the cylinder mold is located and *b* the mold which by preference is of the vacuum type which makes it possible to extract a considerable amount of moisture from the web before it is couched off onto the apron *c* by means of which it is transported to that part of the machine where the winding operation takes place.

70 The winding mechanism comprises a base roll 1 on the top of which rests the core or mandrel 10 upon which the tube is wound, pressure being applied to this mandrel by press rolls 20, 25.

75 To form a proper and acceptable tube from pulp it is necessary that the successive layers of the pulp shall be thoroughly welded together to give the structure what is in effect a homogeneous wall, free from any suggestion of seams which would offer natural lines of cleavage, and care must be taken to avoid wrinkling in any of the pulp layers, or the formation of air pockets or spaces between the various layers. To attain these results the greatest possible care must be taken to deliver the pulp at the winding point in just the proper condition to produce the right kind of a tube. If it be too wet it is so soft that the web will crush and break under the pressure applied or the water pressed out at the winding point will run back on the web washing it away or softening it so it will break when it is subjected to pressure at the winding point. If too dry the successive layers will not weld together properly and in curing the tube the walls are apt to separate between layers. It is further advisable to keep the surface of the web wet up to the point where the winding takes place as thus the welding together of the successive layers is more effectually insured. Consequently, it is advisable to dry the web gradually and continue the drying action as near to the winding point as possible. This result is accomplished in a practical and efficient manner by the use of a vacuum

base roll as illustrated, provision being made for adjusting the point at which the vacuum takes hold and is cut off. The vacuum should take hold at about the point where the pulp first comes in contact with the base roll either directly or through the medium of a carrying apron. The action of the suction is continued during most of the time which it is moving around the roll, and cut off just before the winding takes place, leaving the web of pulp free to wind on the mandrel with its surface just moist enough so that when the proper pressure is applied the successive layers will be compacted or welded together to form a homogeneous wall.

As indicated in the drawings the vacuum base roll 1 is divided into a number of longitudinal compartments 2, 2 and has a hollow core 3 through which there are apertures 4, 4 opening into each partition, the roll being mounted on a hollow shaft 5 having apertures 6, 6 which are adapted to register with the apertures 4 in the core of the roll. These apertures 6, 6 in the shaft are so arranged that only those compartments of the roll which are covered by the pulp are subjected to the action of the suction, it being, of course, understood that the shaft is connected at either or both ends with a vacuum creating apparatus, as a centrifugal fan. By reference to Fig. 4 of the drawings, it will be noted that communication between the interior of the shaft and the compartments is established at about the point where the pulp runs onto the base roll, and that the suction is cut off at a point just before the pulp reaches the mandrel. It is advantageous to continue the suction action up as near the mandrel as possible and provision is made for rotarily adjusting the shaft as by the lever 7 in order to vary the point at which the suction action is cut off to suit different requirements. By properly graduating the force of the suction to which the web of pulp is subjected, and by carrying this suction action to just the proper point near to the point of winding, the pulp is delivered to the core or mandrel in such a condition that with the application of a proper amount of pressure, the successive layers will combine with one another, the fibers of pulp in the contracting faces will interweave and interlock, separating lines between the various layers will be destroyed and a practically solid or homogeneous wall is formed. When sufficient pulp has been wound onto the core to provide a wall of suitable thickness for the article which is being formed, as for instance a tube, it is removed from the machine with the core and subjected to a high degree of heat to drive off the moisture from the pulp and "cure" the tube.

Machines made in accordance with my in-

vention are adapted to make tubes and other pulp bodies from three quarters of an inch in diameter up to any reasonable size desired and of any length up to seventy-two or eighty inches, the length of the tube depending only on the capacity as to width of sheet of the web forming machine. It is essential that these tubes when cured shall be absolutely straight. Great difficulty has been experienced in curing the tubes, especially those of smaller diameter if they have first been removed from the core or mandrel, and great difficulty has also been experienced when the tube has been cured on the core, in removing the core after the curing is completed. Collapsible mandrels of various kinds have been tried, but they are expensive, heavy and difficult to handle, difficult to construct in the small sizes, and necessitate a longer time for the curing. I have discovered that by using a continuous hollow core with a thin wall and of material which quickly responds to changes of temperature, I am able to cure the tube on the core and readily remove the tube from the core after it is cured. I prefer, and have thus far used, aluminum as a material for the core, making the wall thin but of even thickness throughout so that the structure will be sufficiently stiff so as not to collapse during the winding operation. When the core with its tube is first subjected to heat, the core will expand quickly while the pulp is still moist and will remain in that condition during the curing operation. The driving off of moisture from the pulp causes it to contract and hug the core tightly. After the tube is properly cured, it is removed and allowed to cool. The tube will not shrink or contract during the cooling but the core will, with the result that its size decreases sufficiently to free itself from the tube so that it can be readily removed. These cores are comparatively inexpensive, their surfaces can be easily kept clean and polished so as to produce a good surface on the interior of the tube, and their use permits of curing the tube on the core, thus insuring absolutely straight tubes, and the ready removal of the core from the tube after it is cured. These cores are usually of such length that, particularly in the smaller sizes, they are apt to be distorted during the winding operation if not suitably supported. In order to prevent such an occurrence in the case of tubes of smaller sizes, I make use of a pair of pressure rolls arranged on parallel axes and adapted to rest on top of the core at each side of the center, and I utilize these rolls to accomplish two results, namely, to maintain the alinement of the core, and also to provide the pressure under which the tube is wound. These rolls, are, of course, mounted in a suitable carrier and the weight of the carrier and the rolls

must be not more than enough to provide the proper pressure for the smallest tubes with the lightest walls; consequently the rolls themselves cannot be of too large diameter, and if they are small, they themselves are liable to be distorted and so permit of or cause the distortion of the mandrel and consequently of the tube which is being formed. To remedy this trouble, the press rolls which I use are formed in short sections 30, 31, the sections of each complete roll being arranged end to end and supported in proper bearings 32, 33 on the carrier 34 which carrier, as illustrated, is supported by arms 35 pivotally connected with the frame of the machine as at 36.

In order to provide for the escape of air from between the successive layers of pulp and to prevent the pulp from adhering to the press rolls, they are longitudinally fluted as at 37 and the flutings are formed in a quarter spiral as clearly indicated in Fig. 6. The roll is then wound with wire 38, and on this wire is laid a fine wire mesh cloth 39. This provides a proper surface for the roll, permits of the ready escape of air during the pressing and as will be noted by reference to Fig. 5 the joints of the sections between the two rolls are staggered so as to prevent marking the surface of the tube. By this construction means are provided for rigidly supporting the core to prevent its distortion during the winding operation and without any liability of the press rolls themselves being distorted. When heavier pressure is desired, the carrier can be weighted, or the rolls can be forced down onto the core in any other convenient manner. When bodies of larger diameter are being formed the enlarged size of the mandrel is often sufficient to prevent distortion during the winding operation, and in such cases a single press roll can be used which rests directly upon the top of the mandrel and the pulp being wound thereon. This roll may or may not be of the compound type, that is, made up of a series of short sections arranged end to end, but by preference it is of this type, and has the fluted surface covered with the wire mesh cloth in order to allow the escape of air and also to prevent the pulp from adhering to the press rolls.

From the foregoing it will be seen that by the proper drying of the pulp, and a continuation of the drying process through the use of a vacuum base roll up to a point just before the winding operation takes place; by the provision of a mandrel having a smooth metallic surface, and by properly adjusted pressure during the winding operation coupled with means to allow the free escape of air from between the layers of pulp, I am able to so compact or weld or unite the successive layers of pulp as to form a body whose wall is a solid homogeneous structure

without seams, wrinkles or air pockets. By the use of the novel form of mandrel above described, I am enabled to cure the tube on the mandrel and thus prevent warping, and to readily remove the mandrel or core after the curing operation is completed; and the use of the peculiar compound press rolls permit of the use of this novel mandrel, holding it in absolute alinement and preventing distortion during the winding operation.

In order to make the machine as nearly continuous as possible, I prefer to use two or more mandrels so that there is always an empty mandrel ready to be moved down into the winding position as soon as a tube has been completed on the other mandrel and removed from the winding point. In the drawings the machine is illustrated as provided with two mandrels supported by arms 40, 40 having at their ends tapering plugs 41, 41 adapted to enter the ends of the mandrel, these arms being pivotally mounted on cage plates 42, 42 secured near the opposite ends of the shaft 43. Suitable tripping and stopping devices may be provided for causing this shaft to be rotated and stopped at proper times, the preferred form of such mechanism being reserved for a future application. As a means for removing the press rolls while the mandrels are being changed, I have provided a vacuum cylinder 50 connected with the vacuum pump through a valve 51 which is normally held closed and is connected by the link 52 with a lever 53 pivotally supported on the frame of the machine and adapted to be operated by a cam 54 on a shaft 55 driven frictionally by any appropriate mechanism (not shown). The piston 56 in this cylinder is connected by suitable cords 57, running over pulleys 58, with the ends of the carrier upon which the press rolls are mounted. When the tube wall has been formed to proper thickness a trip 53^a connected to the cage plates 42 (Fig. 2) is moved down away from a dog 53^b fast on the shaft 55. This releases the latter to its frictional drive and the cam 54 then becomes effective to rock the lever 53 to open the valve, establishing connection between the blower and the vacuum cylinder, creating a vacuum in the cylinder which draws down the piston, raising the carrier and press rolls out of the way. Immediately the shaft revolves carrying away the mandrel with its completed tube and delivering at the winding point a new mandrel. By this time the cam has completed its revolution, the lever resumes its normal position cutting off the communication between the blower and the vacuum cylinder and opening the vacuum cylinder to the outer air, and the weight of the carrier with the press rolls causes it to drop onto the mandrel. Of course, during the short time that the mandrels are being

changed, the pulp is continuing to travel around the base roll but as soon as the press rolls come down onto the mandrel, the web is cut and immediately begins to wind on the mandrel.

I am aware that the machine herein described is susceptible of various modifications and changes, and it is my intention that the appended claims shall cover any and all alterations and modifications which come properly within the spirit and scope of the invention.

I claim as my invention:

1. The combination with a web forming machine, of a vacuum base roll, a winding mandrel resting upon said roll and upon which said web of pulp is adapted to be wound, means for creating a vacuum in that part of the base roll covered by the web of pulp up to a point just in front of the winding point, and press rolls resting upon said mandrel and the pulp being wound thereon.

2. In a machine of the character described, the combination with a web forming element, and a base roll about which the web is partially wrapped, of a mandrel resting upon the top of said base roll and about which said web is adapted to be wound in successive layers, said mandrel being of tubular form with a relatively thin wall continuous throughout its length, and means for subjecting said mandrel to pressure during the winding operation and for preventing distortion, comprising a pair of press rolls resting upon the top of said mandrel at either side of the center.

3. In a machine of the character described, the combination with a web forming element, and a base roll about which the web is partially wrapped, of a mandrel resting upon the top of said base roll and about which said web is adapted to be wound in

successive layers, said mandrel being of tubular form with a relatively thin wall continuous throughout its length, and means for subjecting said mandrel to pressure during the winding operation, and for preventing distortion, comprising a pair of press rolls resting upon the top of said mandrel at either side of the center, said rolls being formed in short sections arranged end to end and supporting bearings between the ends of the several sections.

4. In a tube winding machine, the combination with a base roll, and a mandrel on which a web of pulp is adapted to be wound in successive layers, of a press roll formed in a plurality of sections arranged end to end, and a carrier provided with bearings for said roll sections.

5. In a machine of the class described, the combination of a mold roll; a couch roll; a base roll; a winding mandrel; an apron co-operating with said rolls for conducting a sheet of pulp from said mold roll to said mandrel; means for subjecting to suction action the part of the base roll covered by the sheet of pulp; and roll means for compacting the pulp on the mandrel.

6. In a machine of the class described, the combination of a base roll; a winding mandrel for receiving a sheet from said base roll; and a pair of presser rolls for maintaining straight alinement of said mandrel.

7. In a machine of the class described, the combination of a base roll; a winding mandrel for receiving a sheet from said base roll; and presser roll means resting on and maintaining straight alinement of said mandrel.

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Witnesses:

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