Dec. 8, 1953 W. MESSINGER 2,661,545

DRIER

Filed Feb. 1, 1950 2 Sheets-Sheet 1

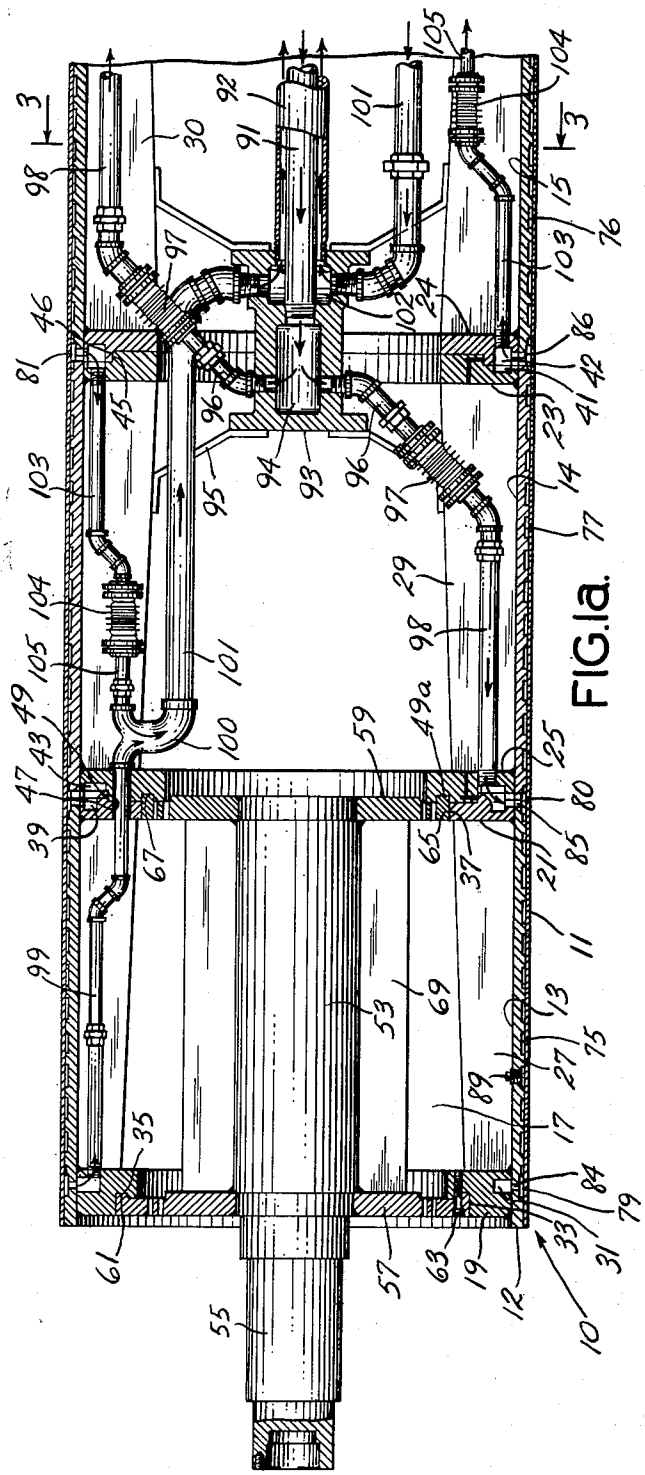

FIG.1a.

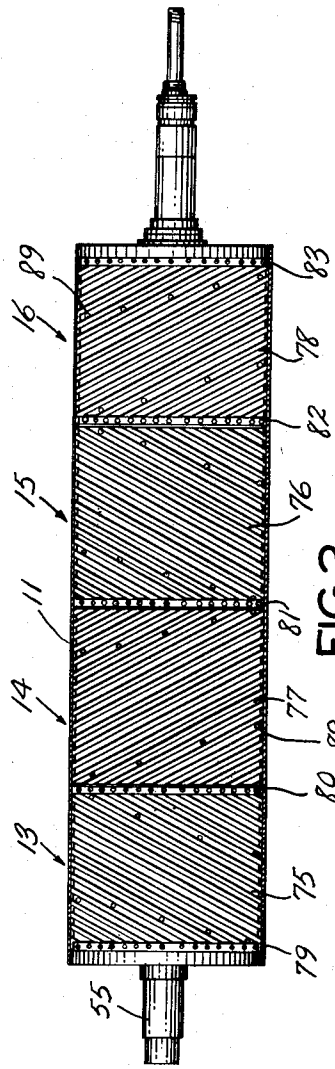

FIG.2.

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DRIER

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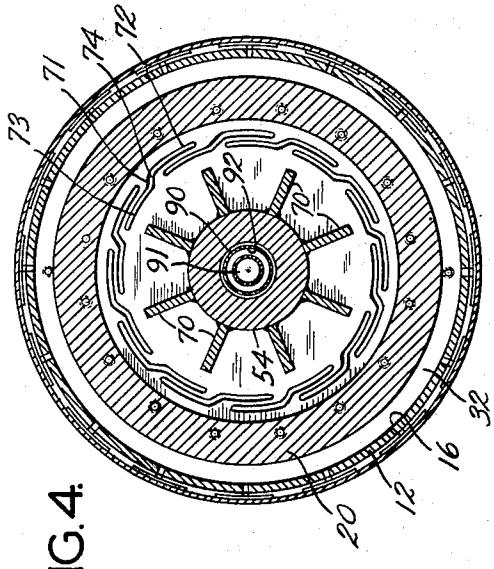

FIG. 4.

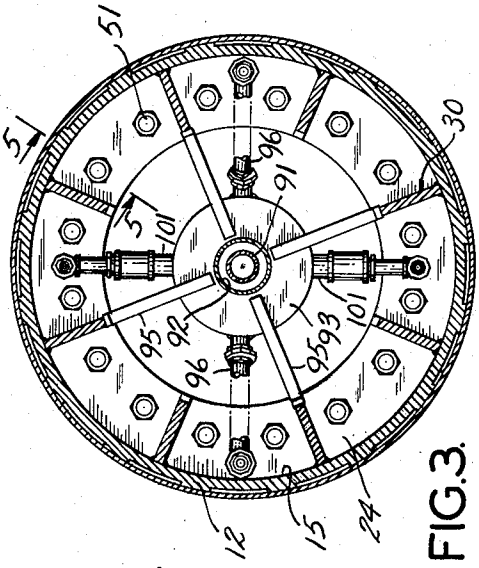

FIG. 3.

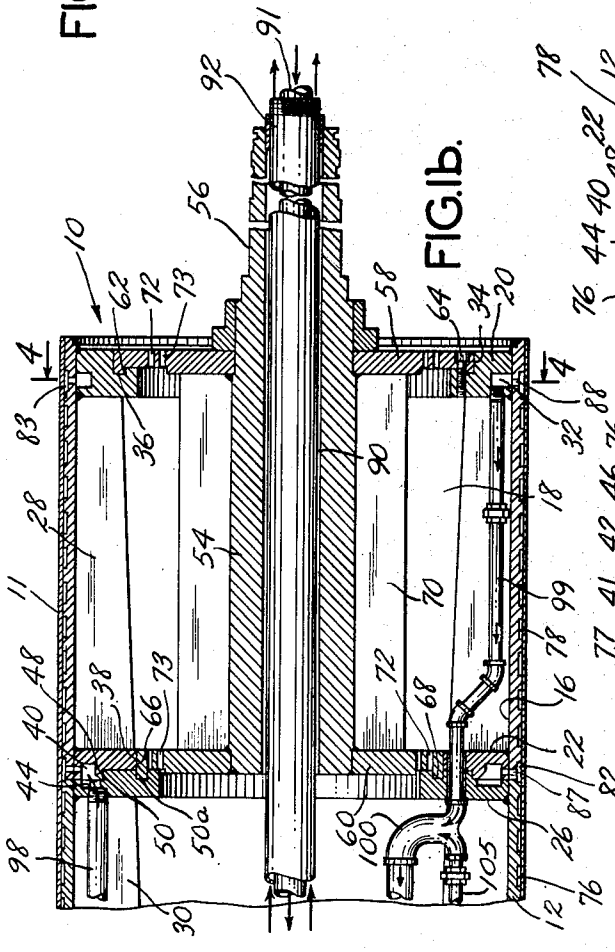

FIG. 1b.

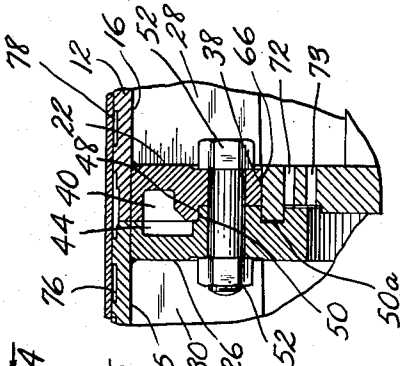

FIG. 6.

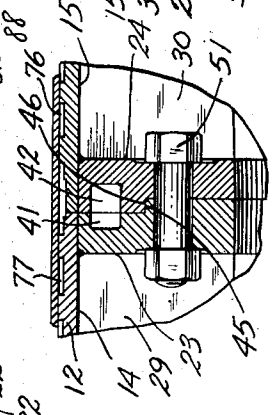

FIG. 5.

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Patented Dec. 8, 1953

2,661,545

UNITED STATES PATENT OFFICE

2,661,545

DRIER

William Messinger, Philadelphia, Pa.

Application February 1, 1950, Serial No. 141,792

10 Claims. (Cl. 34—124)

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The present invention relates to drying mechanisms and embodies an improved form of dryer of the type generally illustrated in my United States Letters Patent No. 2,486,719, granted November 1, 1949. Drying mechanisms of the kind shown and described in my above patent are particularly useful in drying paper webs and, in this operation, the drying drums or cylinders are of great size. The requirement in this operation that all portions of the paper web be subjected to uniform treatment necessitates that the drying drum be supported in such fashion that longitudinal deflection be reduced to an absolute minimum, and that the drying medium utilized in the drum shall be subjected to such conditions of circulation that it will heat all portions of the drum uniformly.

In order to accomplish the foregoing objectives and to provide an improved form of drying mechanism, the present invention has been made, and an object of this invention is to provide a drying mechanism of the above character wherein the drying structure is such as to avoid irregularities and imperfections that would ordinarily result due to expansion and contraction of the mechanism during the operation.

Yet another object of the invention is to provide a mechanism of the above character wherein the structure is such as to reduce, to a negligible amount, defects and irregularities from desired optimum conditions in the mounting and operating of the device.

A further object of the invention is to provide a drying mechanism of the above character wherein the heating fluid, such as, for example, steam, may be introduced into the mechanism and supplied to various portions thereof across the length of the device in such fashion as to provide a desirable substantial uniformity in temperature on the surface of the device.

Other and further objects of the invention will be apparent as it is described in greater detail in connection with the accompanying drawings, wherein

Figures 1A and 1B, taken together, show a drying drum constructed in accordance with the present invention, the view being taken in longitudinal section in a plane passing through the axis of the device;

Figure 2 is a view in somewhat reduced scale showing the drying drum of Figures 1A and 1B in front elevation with the outer casing in section to show the inner shell;

Figure 3 is a view in transverse cross-section, taken on the plane indicated by the line 3—3 of Figure 1A, and looking in the direction of the arrows;

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Figure 4 is a view in transverse cross-section, taken on the line 4—4 of Figure 1B, and looking in the direction of the arrows;

Figure 5 is a partial view in cross-section, taken on the plane indicated by the line 5—5 of Figure 3, and looking in the direction of the arrows, this view illustrating the web structure in the central transverse plane of the device; and

Figure 6 is a partial view, similar to Figure 5, showing the web and supporting structure at a quarter-position of the drum, more specifically, at the quarter- position illustrated in Figure 1A.

Referring to the above drawings, a drying cylinder is illustrated generally at 10, as being formed of an outer casing or shell 11, having a desired surface to accomplish the drying operation to be performed and preferably being formed of continuous material extending axially across the cylinder 10. The outer casing is secured over an inner shell indicated generally at 12 and, in the form of the invention shown and described herein, this shell is formed of a plurality of sections 13, 14, 15 and 16. The end sections 13 and 16 are mounted upon headers or end supports shown generally at 17 and 18, respectively, while the intermediate sections 14 and 15 are secured together and to the end sections, as will be presently described.

In order that the several sections of the inner shell may be secured together effectively and have sufficient strength, each section, at each end thereof, is provided with inwardly extending flanges in the following fashion. The end sections 13 and 16 have secured thereto, at the outer ends, flanges 19 and 20, respectively, these flanges being identical in construction as illustrated in Figures 1A and 1B. The inner ends of the sections 13 and 16 are provided with flanges 21 and 22, respectively, these flanges also being of identical structure. The intermediate sections 14 and 15 are provided, at their adjacent ends, with flanges 23 and 24, respectively, these flanges mating and being adapted to be secured togethed as illustrated in Figure 1A, and as will be described presently. The ends of the sections 14 and 15 remote from the adjacent ends above referred to have secured thereto flanges 25 and 26, respectively, flange 25 being adapted to mate with the previously described flange 21, and flange 26 with flange 22. Reinforcement against longitudinal deflection is provided by means of a series of circumferentially disposed webs formed between the inwardly extending

flanges on the several sections, the portions of these webs on the sections 13 and 16 being illustrated at 27 and 28, respectively, whereas the portions of these longitudinally extending webs on the sections 14 and 15 are illustrated at 29 and 30, respectively.

The flanges 19 and 20 are, respectively, formed with circumferential manifolds or channels 31 and 32, the manifolds being closed by the inner surfaces of the respective inner shells. These flanges are also formed with inner circumferential bearing surfaces 33 and 34, respectively, and with circumferential grooves 35 and 36, respectively, for a purpose to be described presently. The flanges 21 and 22 of the sections 13 and 16 are formed with the respective inwardly facing bearing surfaces 37 and 38 and with circular channels or manifolds 39 and 40, respectively.

The flanges of the respective sections 14 and 15 are formed, as illustrated in Figure 1A, with cooperating structure comprising mating circular channels 41 and 42 in the respective flanges 23 and 24, and 43 and 44 in the respective flanges 25 and 26. The channels 39 and 43 thus cooperate to form a circular manifold, the function of which will be described in greater detail hereinafter, while the channels 40 and 44 provide a similar function. The flanges 23 and 24 are also formed with mating shoulders 45 and 46, while the flanges 21 and 22 and the flanges 25 and 26 are formed with mating shoulders 47, 48 and 49, 50. The flanges 25 and 26 are also formed with circular grooves 49*a* and 50*a*, respectively. In assembling the various inner shell sections together, bolts 51 are provided for securing the flanges 23 and 24 together whereas bolts 52 are provided for securing the flanges 21, 25 and 22, 26 together.

In order that the assembled shell may be mounted in position for operation, it is mounted upon the headers 17 and 18 previously generally referred to. These headers are formed of shafts 53 and 54, respectively, having respective journal bearings 55 and 56. Outer header plates 57 and 58 are secured to the respective shafts 53 and 54 adjacent the respective bearings 55 and 56, while inner header plates 59 and 60 are secured to the opposite extremities of the respective shafts 53 and 54. The outer plates 57 and 58 are formed with circular flanges 61 and 62, respectively, that are received within the respective grooves 35 and 36, bolts 63 and 64 serving to secure the outer plates to the respective flanges 19 and 20. The inner plates are formed with circumferential bearing surfaces 65 and 66, respectively, that engage the respective bearing surfaces 37 and 38, and circular flanges 67 and 68 are formed on the respective plates 59 and 60 to engage the circular grooves 49*a* and 50*a*. It is to be observed that there are no bolts provided to secure the plates 59 and 60 to the flanges which are supported upon these plates. These plates serve effectively to position the flanges thereon while accommodating expansion and contraction of the shell during variations in temperature to which the shell is subjected during operation. Rigidity is imparted to the headers by means of axially extending reinforcing webs 69 and 70, respectively.

In order that the stresses to which the header plates 57, 58, 59, and 60 are subjected may be absorbed without impairing the operation of the mechanism or the structure thereof, each of the header plates is formed with a plurality of webs formed by a circular series of slots 71. Each slot

is formed with a portion 72 that extends substantially at right angles to the radii of the header and lies outwardly with respect to such radii, and portions 73 that similarly lie at right angles to the radii, but inwardly radially from the outer portions 72. A connecting slot portion 74 preferably lies at an acute angle to the radii of the header, and adjacent slots are formed with at least a portion of the outer and inner slot portions overlapping, as illustrated in Figure 4. In this fashion stresses due to expansion and contraction are effectively absorbed.

In order that steam may be circulated through the drying cylinder and used effectively to heat the outer casing or shell, the inner shell is formed with a multiplicity of channels which are closed by the outer casing. These channels may be arranged, as illustrated in Figure 2, wherein channels 75 of the shell section 13 and channels 76 of the shell section 15 lie in general parallelism, and channels 77 and 78 in the respective shell sections 14 and 16 are parallel. The channels 75 communicate with circumferential grooves 79 and 80; channels 77 with circumferential groove 80 and a central circumferential groove 81; channels 76 with circumferential groove 81 and a circumferential groove 82; and channels 78 communicate with the groove 82 and a circumferential groove 83. The respective grooves 79 to 83, inclusive, communicate with manifolds 31, 39, 42, 40, and 32, respectively, through a plurality of series of passages 84, 85, 86, 87, and 88. Each of the channels may be provided with a removable plug 89, as illustrated in Figures 1A and 2.

The steam, or other heating fluid, is supplied to and discharged from the cylinder through an axial bore 90 within which concentric supply and discharge pipes 91 and 92, respectively, are received. The supply pipe 91 communicates with a supply manifold 94 that is formed in a central casing 93. The casing is supported coaxially of the drying cylinder by means of a plurality of brackets 95 and is provided with oppositely extending supply pipes 96 that communicate with bellows sections 97 and supply pipes 98 that are secured to the flanges 25 and 26 to communicate with manifolds 43 and 44. In this fashion the manifolds 43, 44, in cooperation with manifolds 39, 40 supply steam through the ports 85 and 87, to the respective circumferential grooves 80 and 82, from which the steam flows through the plurality of pairs of channels 75, 77 and 76, 78 from which the steam is received by the circumferential grooves 79, 81, and 83.

The steam returns from the grooves 79 and 83 through the respective ports 84 and 88 into the manifolds 31 and 32. From the groove 81, the steam returns through the ports 86 and into the manifold formed by the cooperating manifolds 41 and 42. Pipe return sections 99 return the steam from the manifolds 31 and 32 and direct it to twin connections 100 from which discharge pipes 101 return the steam to a discharge manifold 102 that is formed in the casing 93. Inasmuch as the discharge pipe 92 communicates with the discharge manifold 102, it will be seen that the outgoing steam is thus carried away through the discharge pipe 92. The steam from the manifold 42 is discharged through discharge pipes 103 which are connected through bellows connection 104 to discharge pipe sections 105, and thus to the twin connections 100, to be returned through the discharge pipe sections 101, as previously described.

In the foregoing connections and supports, the

path of travel of the steam is the same for all channels and, in this fashion, the heating of the outer casing is accomplished effectively with a desired degre of uniformity.

While this invention has been described with specific reference to the accompanying drawings, it is not to be limited save as defined in the appended claims.

I claim:

1. Drying mechanism, comprising a cylindrical shell formed with a plurality of series of channels lying upon opposite sides of a transverse plane, a circular manifold in the transverse plane communicating with adjacent ends of each of the channels of each adjacent series, circular manifolds spaced axially equidistantly from the transverse plane and communicating respectively with the remote ends of the channels of the said adjacent series, and means coaxially of the shell and lying in the first mentioned transverse plane to supply fluid to and receive fluid from the manifold.

2. Drying mechanism, according to claim 1, wherein the fluid supply and receiving means comprises a casing having inlet and supply manifolds and ducts connecting the casing manifolds with the first mentioned manifolds.

3. Drying mechanism, comprising a cylindrical shell formed with four axially spaced series of channels, circular end manifolds in the shell adjacent the ends thereof and communicating with the outer ends of the channels of the outermost series, quarter position manifolds lying in transverse planes between the end series and respective inner series of channels and communicating with the ends of the channels of the respectively adjacent series, a central manifold communicating with the inner ends of the channels of the adjacent series, a centrally positioned casing lying axially of the shell and having inlet and discharge manifolds, means to connect the central and end shell manifolds with one of the manifolds of the casing and means to connect the quarter position manifolds with the other of the casing manifolds.

4. Drying mechanism, according to claim 3, wherein coaxially arranged fluid inlet and discharge pipes are connected to the respective inlet and discharge manifolds of the casing.

5. A drying mechanism comprising a cylindrical shell, a pair of bearing means secured in spaced apart relation within the shell at each end thereof and forming a plurality of inner bearing surfaces adjacent each end of the shell, end supports for the shell adapted to be received in each end of the shell, each end support comprising a journal bearing having spaced bearing members thereon, each bearing member being adapted to engage one of the inner bearing surfaces, one of the bearing members being fixed to one of the bearing means and the other bearing member being slidable relative to the other bearing means.

6. Drying mechanism according to claim 5, wherein each of the bearing elements on each journal bearing comprises a disk to engage within a bearing surface.

7. Drying mechanism according to claim 5, wherein each of the bearing elements on each journal bearing comprises a disk to engage within a bearing surface, and means to secure the outermost of the disks to the outermost of the bearing surfaces in each respective end of the shell.

8. Drying mechanism according to claim 5, wherein each end support includes a plurality of spaced disks to engage the bearing surfaces, an axial hub connecting the disks, and axially extending reinforcing webs secured to the disks and hub.

9. Drying mechanism, comprising a cylindrical outer shell, a supporting disk, means to secure the disk in supporting position with relation to the shell and a plurality of slots in the disk formed to lie at angles to radii of the disk, and wherein adjacent slots have portions overlapping in a radial direction and extending at angles to radii of the disk.

10. Drying mechanism, comprising a cylindrical outer shell, a supporting disk, means to secure the disk in supporting position with relation to the shell and a plurality of slots in the disk formed to lie at angles to radii of the disk and wherein each slot is formed with inner and outer portions extending at angles to the radii of the disk and wherein the inner portion of one slot lies in overlapping relation to the outer portion of an adjacent slot.

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