Sept. 29, 1953 J. H. McCUSKER 2,653,466

APPARATUS FOR SEPARATING PIECES OF FABRIC JOINED BY SOLUBLE THREADS

Filed Feb. 21, 1948 4 Sheets-Sheet 1

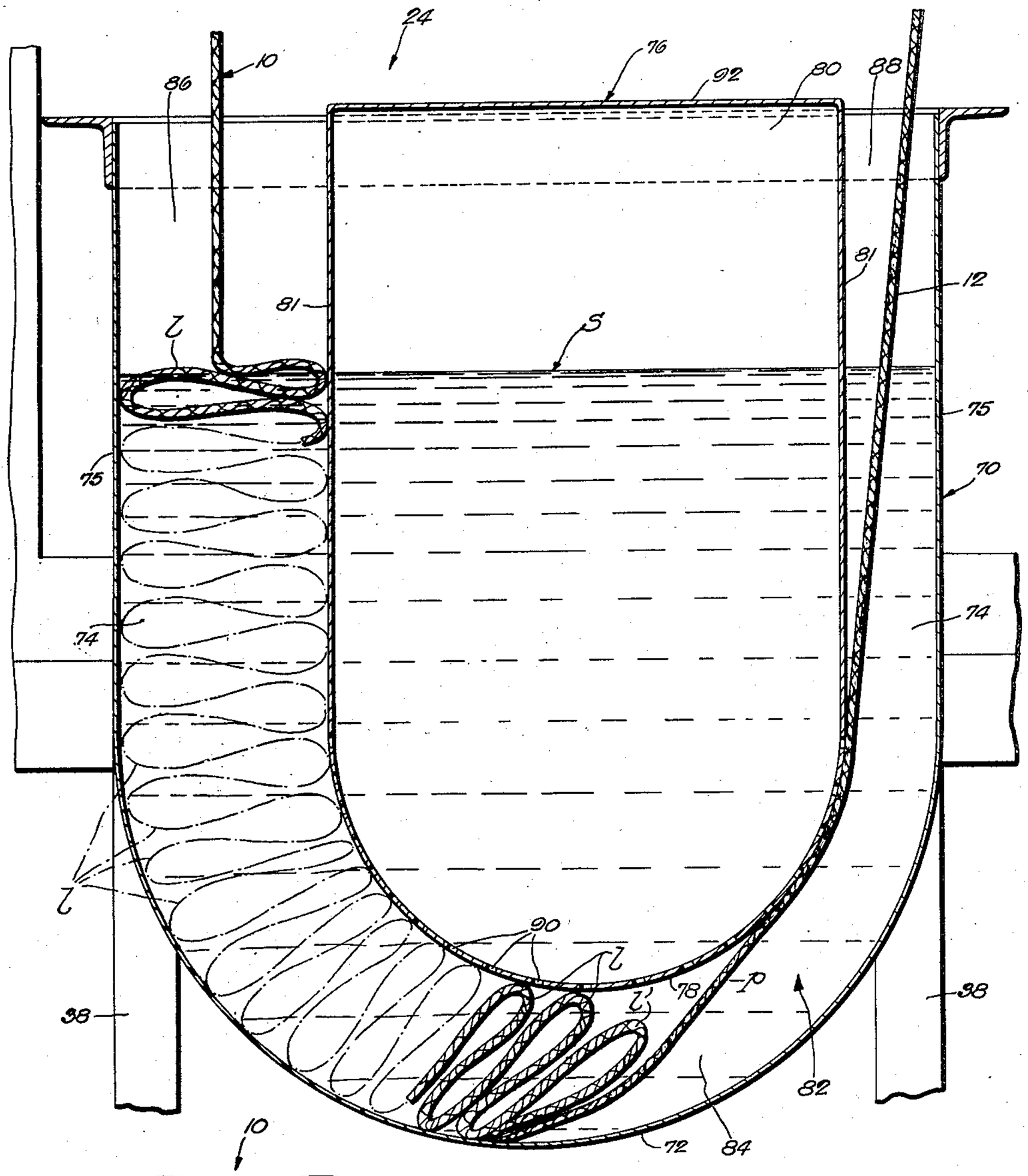

FIG. 3

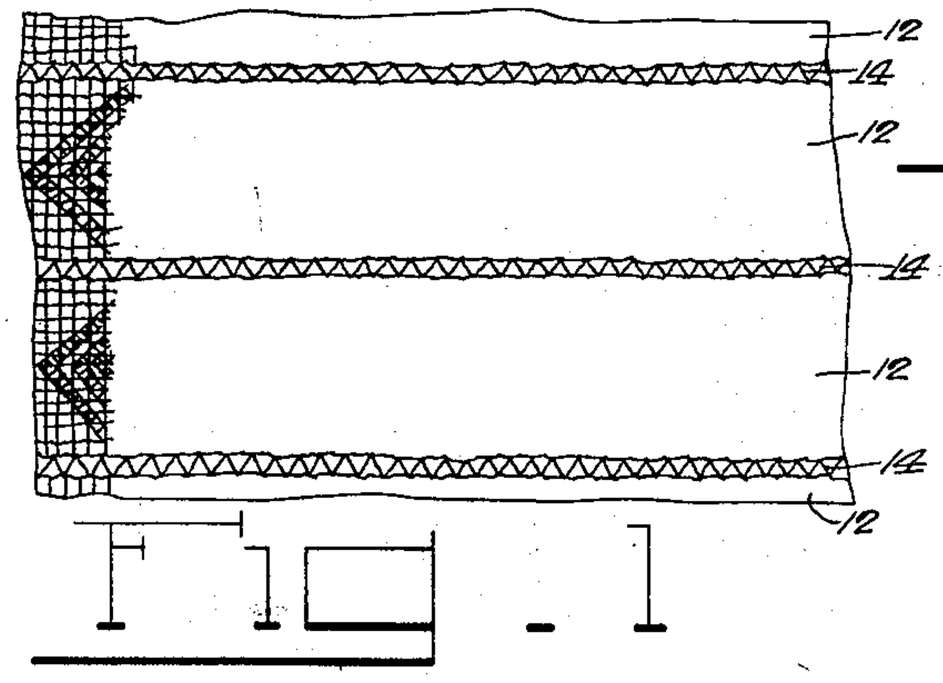

FIG. 1

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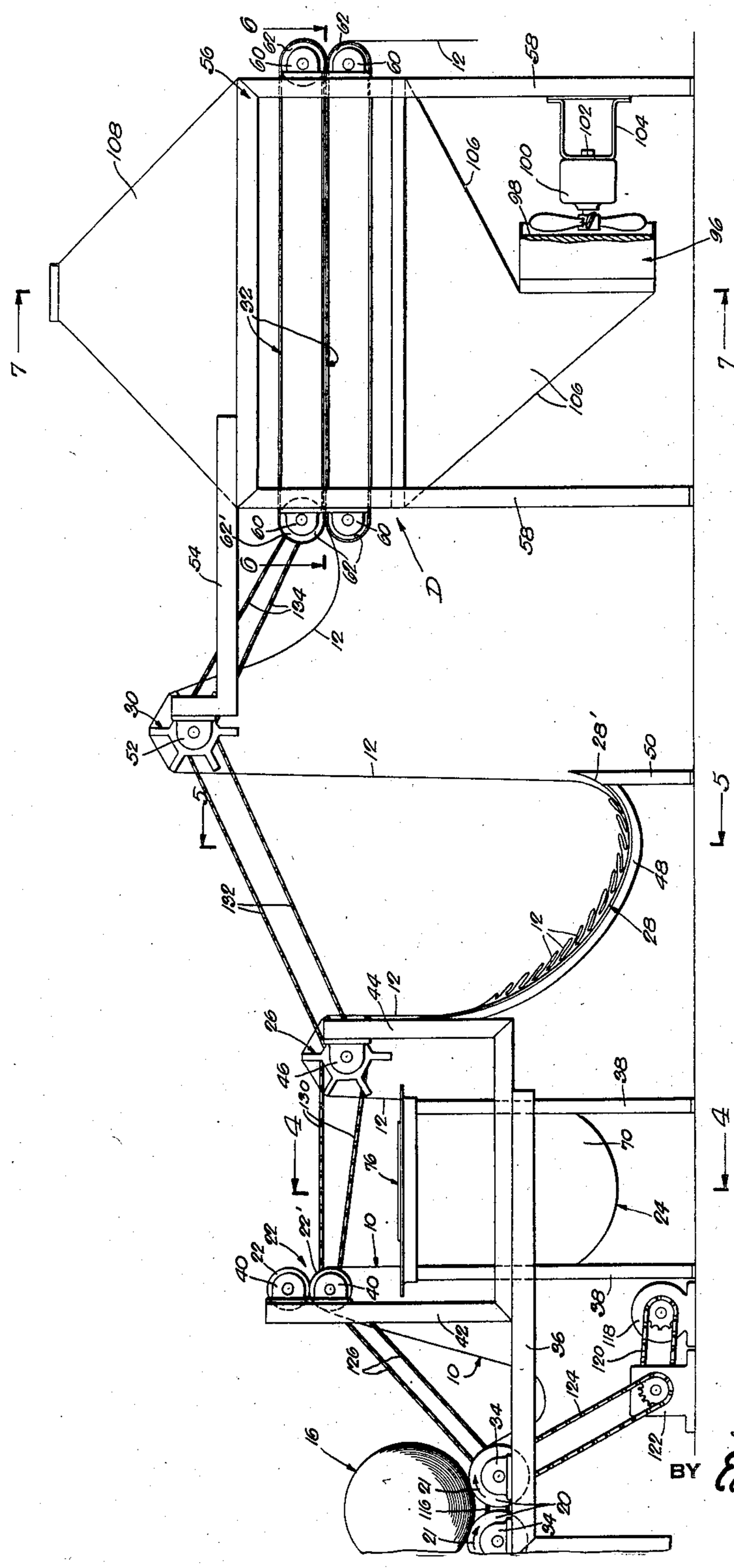
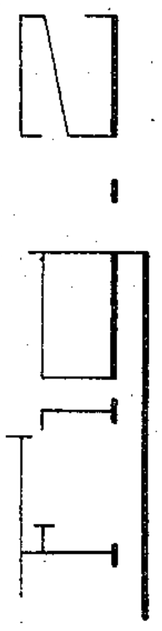
Filed Feb. 21, 1948 4 Sheets-Sheet 2





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4 Sheets-Sheet 3

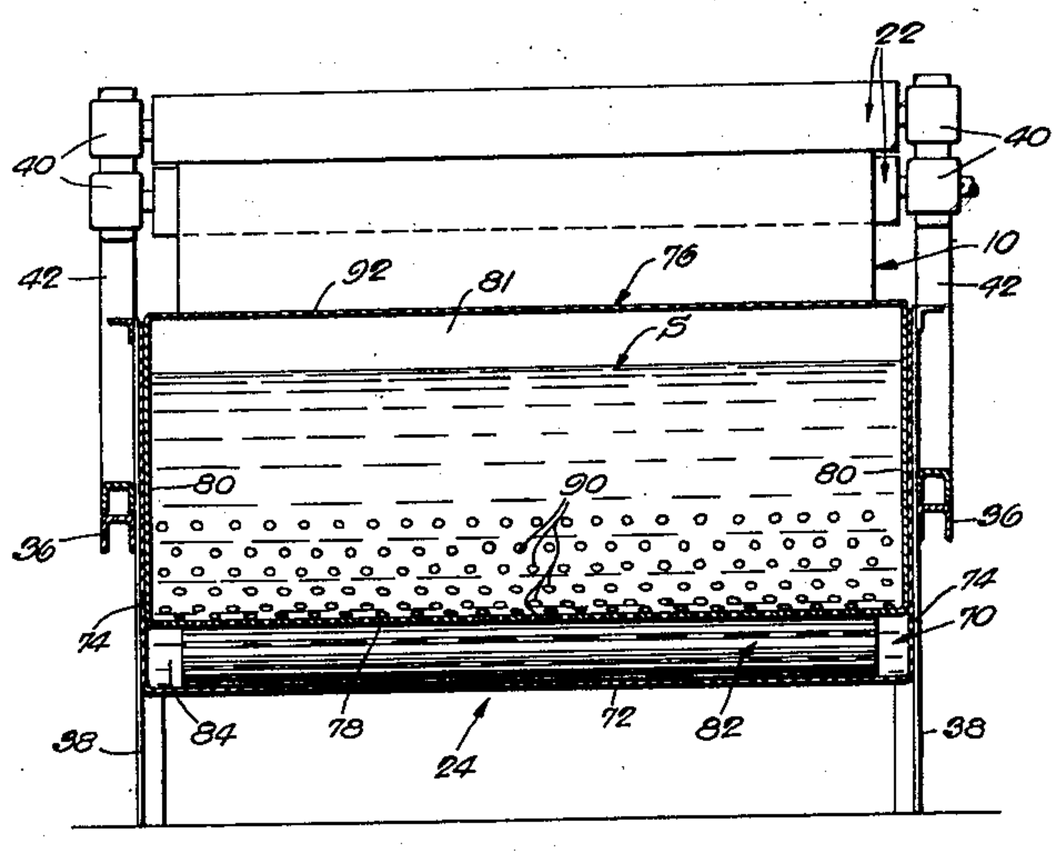

FIG. 4

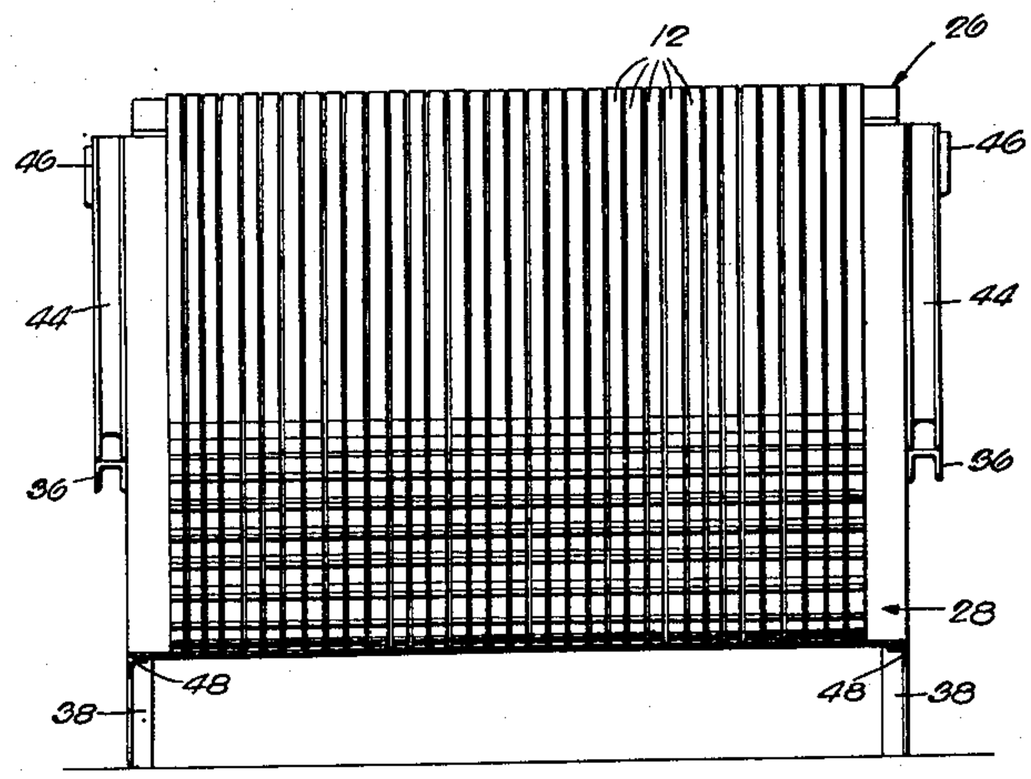

FIG. 5

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4 Sheets-Sheet 4

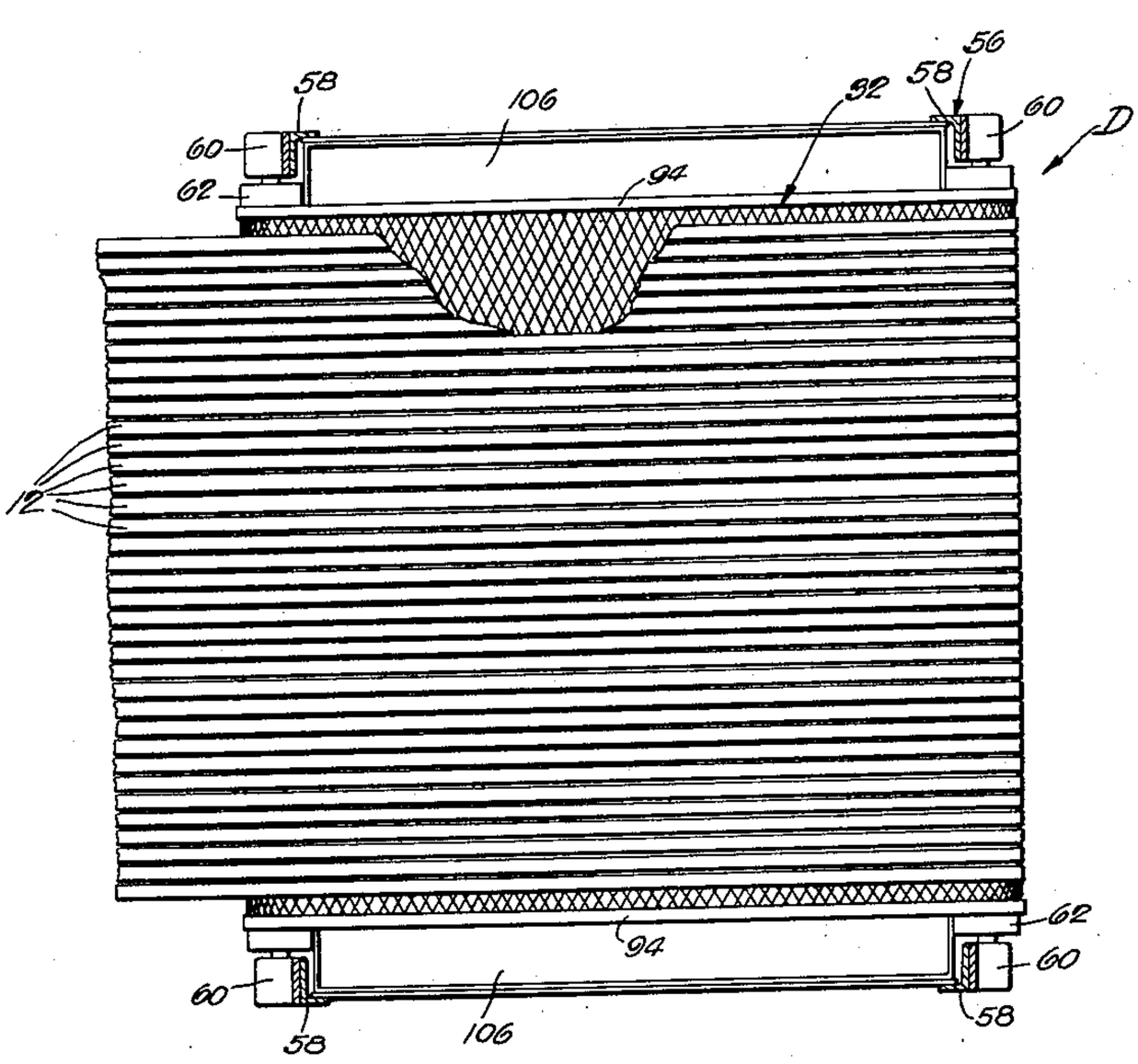

FIG. 6

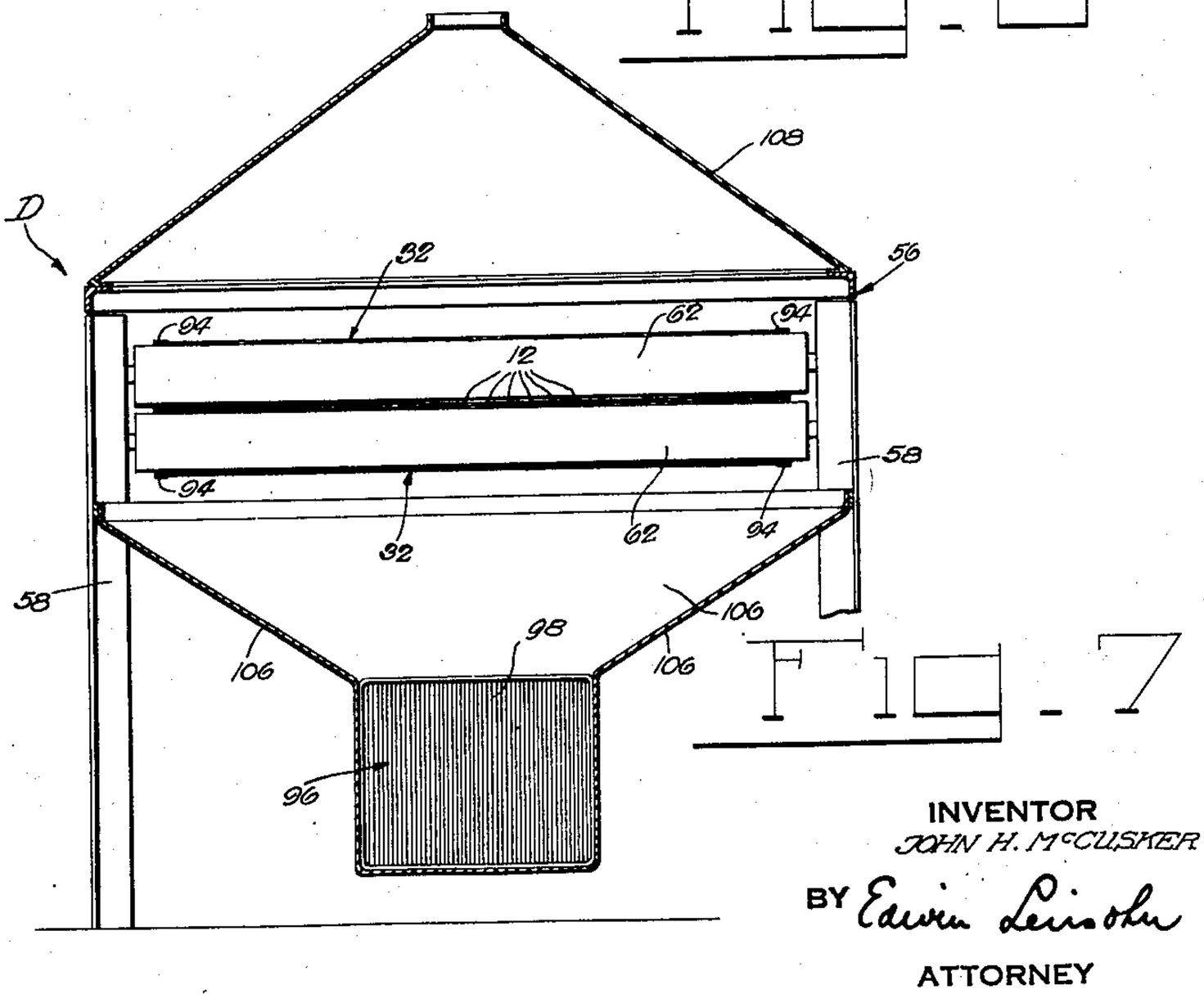

FIG. 7

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UNITED STATES PATENT OFFICE

2,653,466

APPARATUS FOR SEPARATING PIECES OF FABRIC JOINED BY SOLUBLE THREADS

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Application February 21, 1948, Serial No. 10,095

2 Claims. (Cl. 68—178)

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This invention relates to apparatus for separating pieces of fabric which in their manufacture were joined by soluble threads.

A typical example of fabric requiring separation, and one to which the present invention is particularly applicable, is a continuous sheet of machine-made lace material in the width of which are contained a large number of longitudinal lace bands that are arranged side by side and joined by soluble threads. Various synthetic threads, which are soluble in certain chemical solutions, may be used for this purpose, and it is the established practice to subject the material to the proper chemical solution until the synthetic threads are dissolved, whereupon the separated goods are customarily dried. This has hitherto been accomplished by way of batch operation, in that a certain amount of the material to be separated was first wound or piled into a package and then subjected in this form to the solvent bath, and subsequently dried. This type of operation not only requires considerable handling of the material and is obviously never as efficient as continuous operation, but it frequently leaves the material with serious defects that render it useless for its intended purpose. Thus the drying medium, customarily air, is usually heated to a fairly high temperature in order to penetrate to and dry the innermost portions of the packaged material within a reasonably short period of time, with the result that certain types of material are adversely affected by the highly heated drying medium. For instance, subjection of the material in the referred packaged form to fairly high drying temperatures results frequently in migration in the material of dyestuff, and other chemicals used in finishing, from the inner portions of the package to the outer portions thereof, which leaves the material spotty and streaked in places. This migration is caused by the solvent used in the separation of the material which, in the drying process, is drawn by capillary action from the inner, wetter portions of the package to the outer, drier portions thereof and carries with it small amounts of dyestuff and other chemicals in the material that are deposited in concentrated form on the outer portions of the package. The referred batch-type operation further entails in the specific separation of a multitude of narrow lace bands the difficult task of removing the separated lace bands without hopelessly entangling them.

Accordingly, it is the primary aim and object of the present invention to provide apparatus which lends itself to the described separation of

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fabric in a continuous operation, whereby to overcome the various objections to and disadvantages of the batch-type operation.

It is a more specific object of the present invention to provide apparatus of this type which lends itself to continuous separation and drying of fabric without subjecting the same at any time to tension such as might distort the particular pattern of the fabric.

It is another specific object of the present invention to provide in the arrangement of the apparatus a solvent tank through which the material to be separated is fed, and which is constructed to guide the material therethrough so that the separated bands will not become entangled but emerge from the tank clearly spaced from each other.

It is another specific object of the present invention to interpose between the solvent tank and the drying equipment of the apparatus a support on which the continuously fed separated bands are permitted to fold loosely and maintain thereon a considerable accumulation of intermediate slack in the bands. This accumulated intermediate slack in the bands is highly advantageous, not only because it exposes considerable lengths of the bands to atmospheric air for preliminary drying, but also because it is a valuable factor in assuring the tension-less feed of the material through the apparatus for a long period of operation despite practically unavoidable changes in the rate of feed of the material on its course through the apparatus.

The above and other objects, features and advantages of the present invention will be more fully understood from the following description considered in connection with the accompanying illustrative drawings.

In the drawings:

Fig. 1 illustrates, by way of example, a fragmentary piece of fabric requiring separation;

Fig. 2 is a side elevation of the overall arrangement of apparatus embodying the present invention;

Fig. 3 is an enlarged longitudinal section through the solvent tank of the apparatus;

Figs. 4 and 5 are sections taken substantially on the lines **4—4** and **5—5**, respectively, of Fig. 2;

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

Fig. 7 is a sectiton taken substantially on the line **7—7** of Fig. 2.

Referring to the drawings, and more particularly to Fig. 1 thereof, there is shown a fragmentary sample of a fabric which requires separa-

tion and which is in the form of a continuous sheet 10 of lace material, in the width of which are contained a multitude of relatively narrow lace bands 12 which are solely joined by soluble threads 14 that have been conventionally interlaced with the regular threads of the lace material in the normal progress of machine-making the sheet. These threads 14, which are usually synthetic threads, are to be dissolved in the apparatus hereinafter described for the purpose of obtaining the separate lace bands 12. The continuous sheet 10 of lace material is preferably wound into a supply roll 16, and the latter is unwound for the longitudinal passage of the sheet through the apparatus.

Referring now to Fig. 2, the sheet roll 16 is placed on power-driven "batcher" rolls 20 which turn as indicated by the arrows 21, in order to unwind the roll 16 at a constant rate of speed. The unwinding sheet material is passed successively between a pair of feed rolls 22, through a solvent tank 24, over a paddle wheel 26, onto a support or "scray" box 28, over another paddle wheel 30, and between opposite belt-type conveyors 32. The batcher rolls 20 are mounted at the front end of the apparatus in bearings 34 on suitable framework 36. The solvent tank 24 is suitably mounted on upright supports 38 (see also Figs. 3 and 4). The feed rolls 22 are journalled in suitable bearings 40 on upright frame bars 42 which are suitably mounted on the framework 36 and have rearwardly spaced upward extensions 44 on which opposite bearings 46 for the paddle wheel 26 are mounted. The "scray" box 28, which may be made of sheet metal, is curved in the fashion illustrated in Fig. 2, and is sustained in this curved dispostion by correspondingly curved angles 48 (Figs. 2 and 5) which are secured at one end to the upright frame extensions 44 and at the other end to suitable upright supports 50. The second paddle wheel 30 is journalled in bearings 52 on suitable forward extensions 54 on the skeleton frame 56 of the drier D of the instant apparatus. Mounted on upright supports 58 of the frame 56 are bearings 60 (Figs. 2 and 6) on which are journalled rolls 62 over which the endless belt conveyors 32 pass. The batcher rolls 20, feed rolls 22, paddle wheels 26 and 30, and the foremost pair of associated conveyor rolls 62 are power driven, in a manner hereinafter described, so that the unwound sheet 10 moves on its passage through the apparatus at a substantially uniform rate of speed.

Solvent tank

Referring now primarily to Figs. 3 and 4, the solvent tank 24 comprises a container 70 which is open at the top and has a smoothly curved bottom 72, and preferably flat side walls 74 and end walls 75 of which the latter may be made integral with the bottom 72. Projecting into the container 70 from the top thereof is a core 76 which is, in the present instance, in the form of a hollow container having a curved bottom 78 and preferably flat side walls 80 and end walls 81. Core 76 is held in the container 70 by having its opposite side walls 80 suitably secured to the adjacent side walls 74 of the container 70 (Fig. 4), as by welding, for instance. The core 76 is so located in the container 70 as to form in the latter a U-shaped passage 82 which is of the full width of the container as measured across the side walls 74 thereof (Fig. 4). The core 76 is furthermore so offset in the container 70 as

viewed in Fig. 3, that the straight inlet and outlet portions 86 and 88, respectively, of the passage 82 are of different breadth transversely of the width of the container 70, and the curved intermediate portion 84 of the passage 82 is of gradually varying breadth. The container 70 holds any solvent S suitable for the dissolution of the synthetic threads 14 in the sheet 10, and the hollow core 76 is provided at its bottom 78 with perforations 90 so as to admit the solvent into the core to the same level therein as in the container 70. The core 76 is preferably provided provided with a top wall 92 so as to reduce to a minimum the contact area between the solvent S and atmospheric air and accordingly reduce the loss of solvent through evaporation from the tank.

Drier

Referring now to Figs. 2, 6 and 7, the separated lace bands 12 are guided by the paddle wheel 30 between the belt conveyors 32 in single layers and in the side-by-side relation shown in Fig. 6. The belt conveyors 32 feed the orderly arranged separated lace bands 12 through a heated zone in which they become thoroughly dried. More particularly, each belt conveyor 32 is an endless sheet of open-mesh textile netting similar to a fish net, of which the opposite side margins are securely bound in any suitable manner to strong flexible bands 94 of fabric or the like, which pass over the rolls 62. The lace bands 12 between the conveyor belts 32 are thus to all intents and purposes fully exposed to heated air from a heater 96 which comprises, in the present instance a steam radiator 98 through which room air is forced in heat-exchange relation therewith by means fo a power-driven fan 100. The fan 100 may be mounted at 102 on a suitable bracket 104 on the rearmost upright supports 58 of the drier frame 56 (Fig. 2). Suitable baffles 106 preferably extend from the outlet end of the heater 96 to the area immediately beneath the conveyor belts 32 in order to direct the forced heated air against the lace bands 12 between these conveyor belts. A hood 108 is suitably provided on top of the drier frame 56 in order to direct the evaporated solvent as well as the heated drying air to an exhaust stack (not shown). The instant preferred drier is claimed per se in my copending application Ser. No. 10,097, filed Febuary 21, 1948, and now Patent No. 2,572,172, issued on October 23, 1951.

Power feed of sheet through apparatus

Referring to Fig. 2, the feeding devices are the previously described batcher rolls 20, feed rolls 22, paddle wheels 26 and 30, and the conveyor belts 32. A leading length of the sheet 10 is originally unwound from a newly-placed sheet roll 16 on the batcher rolls 20 and guided through, over and between the referred feeding devices in such manner that slack sheet material of varying amounts is left between consecutive ones of these devices. These devices are power-driven at such relative speed that slack in the sheet 10 between consecutive feeding devices is maintained substantially constant over a long period of operation of the apparatus. Thus, the batcher rolls 20 may be drivingly connected with each other by a chain drive 116, and one of these rolls may be driven from a prime mover, such as an electric motor 118, through intermediation of a chain drive 120, suitable reduction gearing 122 and a chain drive 124. The lower feed roll 22′ may be drivingly connected with the driven batcher roll

20 through intermediation of a chain drive 126, and the other feed roll 22 may press against its companion roll 22' by the force of its own gravity. The chain drive 126 is such that the feed rolls 22 will take up the sheet 10, as it is unwound from sheet roll 16, at a rate at which to maintain the prevailing slack in the sheet 10 between the roll 16 and the feed rolls 22.

A considerable accumulation of slack in the sheet 10 in the solvent tank 24 is originally provided for (Fig. 3), and this accumulation of slack is maintained without appreciable change over a long period of operation of the apparatus by the provision of an appropriate chain drive 130 between the power-driven feed roll 22' and the paddle wheel 26. Further considerable accumulation of slack in the sheet 10 is originally provided between the paddle wheels 26 and 30, to the extent that the then separated lace bands 12 each fold loosely and orderly in multiple layers on the scray box 28 as shown in Fig. 2. In order to main this accumulation of slack in the sheet 10 between the paddle wheels 26 and 30, paddle wheel 30, which is preferably of the same dimensions as wheel 26, is driven at the same angular speed as the latter through a chain drive 132. Preferably, there is further original slack provided in the separated lace bands 12 between the paddle wheel 30 and the conveyor belts 32 in a fashion similar to that shown in Fig. 2. In order to maintain this latter slack in the separated lace bands 12, one of the front rolls 62, namely roll 62', is drivingly connected with the paddle wheel 30 through an appropriate chain drive 134, while the adjacent roll 62, being of the same diameter as the driven roll 62', is geared to the latter (not shown) at the ratio 1:1.

Mode of operation

The method involved in the herein-described preferred mode of operation of the instant apparatus, is claimed in my copending application Ser. No. 10,096, filed February 21, 1948, and now abandoned. While the apparatus is in operation, sheet material 10 is continuously unwound from the supply roll 16 and is taken up and fed by the rolls 22 into the solvent tank 24 substantially at the same rate of speed at which the separated lace bands 12 are withdrawn from the tank by the paddle wheel 26. The paddle wheel 26 delivers the withdrawn lace bands 12 onto the scray box 28 substantially at the same rate of speed at which they are withdrawn therefrom by the other paddle wheel 30, and the conveyor belts 32, in turn, grasp and feed the separated lace bands 12 at substantially the same rate of speed at which the paddle wheel 30 supplies them to the conveyor belts. Thus, wherever there is slack originally and deliberately provided in the sheet 10 anywhere in its course through the apparatus, such slack is maintained substantially constant. It also follows from the preceding that the sheet 10 is on its course through the apparatus tensioned nowhere, and this is of the greatest importance in the present continuous mode of operation of the apparatus in order to avoid distortion of the pattern of the lace bands 12 and reduction in their original width. As the dried lace bands 12 emerge from the conveyor belts 32, they may be gathered in any convenient manner for storage or immediate use.

The curved bottoms 72 and 78 of the container 70 and core 76, respectively, of the solvent tank 24 lead the slack in the sheet 10 to the deepest

portion of the bottom of the tank, and the constant pay-out of sheet material into the container 70 induces it to fold neatly and orderly into superposed layers in a manner similar to or like that shown in Fig. 3. Moreover, the core 76 in the container 70 prevents the folded layers of sheet material from floating to the level of the solvent S. Thus, despite fairly rapid feed of the sheet 10 through the apparatus, each portion of the sheet will, on its passage through the solvent S in the tank, be subjected to the solvent for a sufficient length of time to assure dissolution of the synthetic threads 14 in the foremost folded layer 1 of the sheet 10 at the bottom of the tank. In withdrawing the separated lace bands 12 from the solvent tank through the action of the paddle wheel 26, the unfolding portions *p* of the lace bands 12 at the bottom of the tank are compelled to pass first around the bottom of the core 76 before ascending through the narrow outlet 88 of the passage 82 through the tank. Thus the unfolding band portions *p* are directed away from the foremost folded layer 1' of separated lace bands at the bottom of the tank in a plane which is near coplanar with that of layer 1' (Fig. 3), with the result that the separated bands 12 unfold in a manner which is least conducive to cause entanglement of adjacent separated bands. Hence, the offset core 76 in the container 70 secures the highly important advantage of preventing entanglement of the separated lace bands 12 in the solvent tank, by compelling the folded separated bands to unfold in a manner that will least disturb the subsequent folds in the material. Thus, by constructing the solvent tank and feeding the sheet 10 therethrough, as described, the separated lace bands 12 are safeguarded against entanglement. Without this safeguard, hopeless entanglement of the separated lace bands would occur and the apparatus would, in consequence, be rendered useless for the specific task of separating a sheet into a multitude of relatively narrow bands.

The provision of the scray box 28 and the retention thereon of a considerable accumulation of orderly folded slack in the separated lace bands 12 serves a two-fold purpose. Thus, a considerable length of each separated lace band 12 is, after its emergence from the solvent tank 24 and prior to its subjection to the drier D, exposed to atmospheric air for a considerable period of time during which some of the solvent retained in the bands 12 evaporates, wherefore the drier D has to remove a correspondingly lesser amount of solvent from the lace bands 12. Further, the accumulation of slack in the lace bands 12 on the scray box 28 is an important compensating factor in the continuous feed of the sheet 10 through the apparatus assuredly without being tensioned at any time despite practically unavoidable variations in the rate of feed of the sheet at different places in the apparatus. This accumulation of slack in the separated bands 12 on the scray box 28 may safely be provided without danger of causing hopeless entanglement of adjacent bands. This is due to the gradually sloping and smoothly curved arrangement of the scray box 28 which compels the continuously delivered separated lace bands 12 to fold neatly and orderly in a manner which assuredly will avoid their entanglement. The amount of orderly folded slack in each band 12 on the scray box 28 is such as to extend to the upwardly curving tail end 28' of the scray box, so that the paddle

wheel 30 will remove the folded slack bands 12 in a manner least conducive to disturb the subsequent slack folds of the bands and thus avoid entanglement of the adjacent bands as assuredly as their entanglement is avoided in the solvent tank 24.

By virtue of the evaporation of part of the solvent in the separated lace bands 12 during their exposure to atmospheric air while on the scray box 28, the drier D is, as previously mentioned, called upon to cause evaporation of a correspondingly lesser amount of solvent left in the lace bands, with the result that the bands 12 may be fed by the conveyor belts 32 at a fairly fast rate of speed through the heated zone of the drier. Furthermore, the feed of the separated lace bands 12 in single layers and in side-by-side relation to each other makes for maximum efficiency in drying the bands quickly and completely within a minimum area to which the heated air is directed by the baffles 106. Also, because of the high efficiency of the instant drier, and also because the lace bands 12 have already given up part of the solvent contained therein on their travel from the solvent tank 24 over the scray box 28 and to the conveyor belts 32, the drying air directed into the drying zone, through which the conveyor belts 32 pass, need be heated only to an extent which assuredly has no adverse effect on certain finishes that may be used in the material. Of course, the feed of the separated lace bands 12 in single layers and in side-by-side relation to each other between the conveyor belts 32 is of further great importance, in that in the ensuing drying process no migration of dyestuff and other chemicals used in finishing the material can possibly take place, with the result that the lace bands emerge from the apparatus without being spotty or streaky at any place.

While I have shown and described the preferred embodiments of my invention, it will be understood that various changes may be made in the present invention without departing from the underlying idea or principles of the invention within the scope of the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. Apparatus for disintegrating into separate bands a fabric sheet in which they extend longitudinally thereof in side-by-side relation to each other and are joined by soluble threads, comprising a tank for a solvent, said tank having a first U-shaped wall having opposite wall portions and a curved connecting wall portion into which said opposite wall portions merge tangentially, other walls on the opposite sides, respectively, of said first wall forming with the latter a container the width of which is measured across said other walls and the bottom of which is formed by said curved wall portion, and a U-shaped partition in said container extending between said other walls and being so unevenly spaced from said first wall as to define in said container a U-shaped unimpeded passage of which the opposite portions are of different breadth transversely of the width of said container and the connecting portion is of gradually varying breadth, the bottom of said partition being perforated whereby to provide

fluid communication through said partition to said passage.

2. Apparatus for disintegrating into separate bands a fabric sheet in which they extend longitudinally thereof in side-by-side relation to each other and are joined by soluble threads, comprising a tank for a solvent, said tank having structure forming an unimpeded U-shaped passage therethrough of a width to permit the widthwise passage of the fabric sheet therethrough, said structure forming the U-shaped passage having first and second upright portions terminating at the inlet and oulet ends, respectively, of said passage and a curved bottom portion into which said upright portions merge tangentially, said second portion being narrower than said first portion transversely of their width, and said bottom portion being of gradually reduced breadth transversely of its width starting at said first portion and ending at said second portion, and means above said tank for longitudinally feeding the fabric sheet into the inlet end of said passage and simultaneously withdrawing the separated bands from the outlet end of said passage at substantially the same speed at which the sheet is fed into said inlet end of the passage, the space between said upright portions defining a core, the latter being perforated at the bottom thereof to provide fluid communication between said core and said passage, the latter being closed to the surrounding atmosphere except at said inlet and outlet ends thereof and at said perforations.

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