

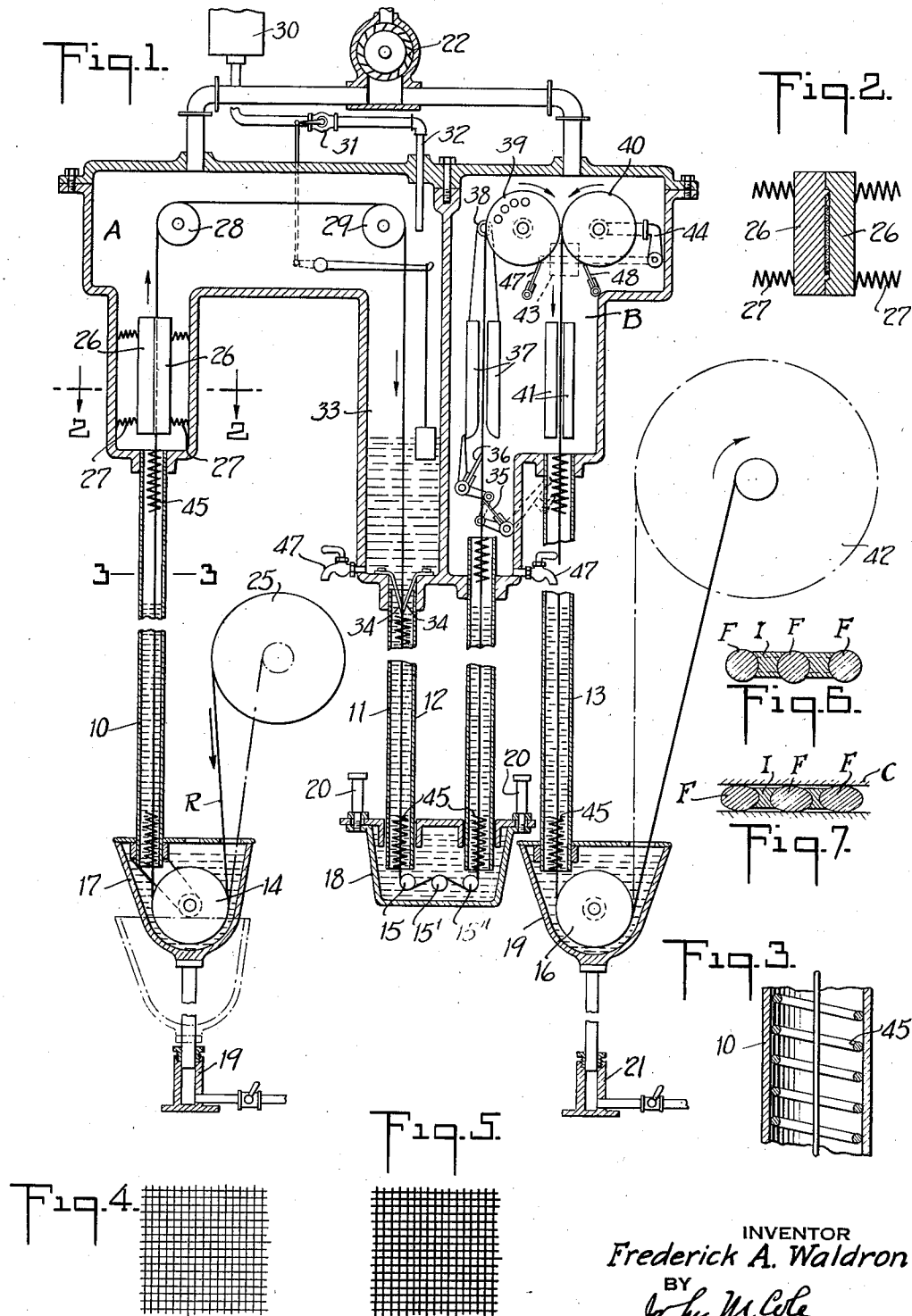
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APPARATUS FOR MANUFACTURING INKED RIBBONS

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APPARATUS FOR MANUFACTURING INKED
RIBBONS

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The present invention relates to apparatus for the manufacturing of inked ribbons such as used in typewriters, computing machines, multigraphing machines and the like.

5 These ribbons are made out of finely woven fabric, such as muslin, cotton, or silk, and according to the methods commonly employed, a strip of this material is, without any preliminary treatment, passed through an ink bath (composed of
10 suitable pigment in an oil base) so that capillary attraction will cause an absorption of ink. It is then subjected to pressure rolls to regulate the inking of the ribbon. A light roll pressure produces a heavily inked, more juicy ribbon which
15 gives wet and darkly shaded, dense printing, and more or less "splash," while with heavier roll pressure the ribbon retains less ink so that the ribbon is less juicy and the printing is of a lighter shade. With the same ink bath, the shade varia-
20 tion is obtained by variation of roll pressure. The rolling or squeezing of the ribbon wet with ink is not a selective operation, for coloring matter and oil are pressed out in substantially the same proportion in which they were present in
25 the ink bath. There is, therefore, less actual pigment in the ribbon subjected to the greater pressure and hence its useful life is much impaired.

In the manufacture of ribbons, no attention seems to have been given to the hygroscopic
30 property of the fabric, whereby more or less moisture is absorbed from the atmosphere. This moisture variation varies the condition of the fibres (as is well known in the textile art) and its presence resists the absorption of the oil and
35 pigment. This brings about a lack of uniformity of the finished product.

The fabric used for ribbon manufacture appears to the naked eye to be closely woven, but when held up to the light, or when observed under a low power microscope, it has the appearance of a fairly open screen. When this fabric is immersed into the ink bath, the ink penetrates the fibres and fills the interstices between the threads. The pressure applied by the rolls not
40 only squeezes out the pigment and oil but also acts to flatten out the threads and reduce the interstitial areas. Release of the pressure allows the threads to resume their original form so as to absorb more or less of the ink film extending across the interstices. There is, however, considerable free ink in this film causing juiciness.
45 When the ribbon is struck by the type, the threads are flattened out, the interstitial spaces reduced, and this free ink splashes out onto the paper and type. On release of the pressure, the threads
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resume their original form with a thinner film of ink between them. This juicy condition continues until the free ink has been removed by splashing it out of the ribbon.

The present invention contemplates improvements in the manufacture of typewriter ribbons and the like whereby the pigment oil ratio in the finished ribbon is predetermined and materially greater than in the original ink bath, so that the ribbon may have a longer life and be of more
10 uniform shade during use. At the same time excessive juiciness of the new ribbon is avoided and initial outward flow of ink to paper retarded and held back for more efficient future use. Furthermore the recovery of the ribbon after a rest is
15 improved.

Accordingly, the ribbon is, during the process of manufacture, subjected to a process wherein the impregnation is accomplished in a vacuum treated strip of fabric without mechanically
20 squeezing the strip or flattening out the fibres. This impregnated strip will absorb more pigment and vehicle than where the former squeezing process is relied upon. To retain the added pigment, the invention contemplates expanding or
25 exploding the threads of fabric and reducing air space and the removal by evaporation under reduced pressure and at low heat of the excess vehicle (or oil) only, in order that the finished product shall contain a maximum amount of ink
30 of a predetermined controllable content of oil and pigment whereby the pigment is not injured.

According to the present invention, the material is passed rapidly from the atmosphere through a liquid seal (preferably mercury) and communicating with a high vacuum chamber, so
35 that moisture, air, and gases (principally water vapor) may be removed from the strip. The escape of the air and gases is so sudden that the fibres are loosened and expanded, and hence the thread size is increased. The vacuum chamber is associated with one side of a liquid seal having coating and impregnating bath of ink, preferably floated on mercury. The surface of the liquid in the seal may be exposed to the atmosphere so as to permit the sucking up of the liquid. In this manner the strip material is passed
40 directly from the vacuum into the ink bath without affording any opportunity for the absorption of air or gases by the vacuum treated material. It is carried through the coating liquid directly into mercury so as to be subjected to a pressure difference depending upon the amount of vacuum and the depth of immersion below the exposed surface of the coating or impregnating
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liquid or mercury. The liquid pressure acts to force the ink into the evacuated strip and does not mechanically squeeze it out, as do the pressure rollers.

5 The strip material then passes upwardly through the liquid seal and into the same or a second vacuum chamber where it is heat treated under vacuum. For typewriter ribbon manufacture, this operation is carried out so that the temperature of the ribbon is kept below that injurious to ink or pigment, but above the vaporization point of the oil vehicle. This temperature will vary in range depending on the characteristics of materials used and final oil content required, but will in no event impair or injure the pigment of the ink, but will be sufficient to vaporize and promote rapid evaporation of the oil to the required amount. The strip now contains all the pigment which it had absorbed, but less oil. It is then preferably subjected to a squeezing operation while still under the vacuum, so that the pigment is compacted, and kneaded into the fabric, and a suitable, smooth finish provided. The material is then passed through another mercury seal to compensate for the pressure difference between this second chamber and the atmosphere.

The accompanying drawing shows, for purposes of illustrating the present invention, one of the many embodiments in which the invention may take form, it being understood that the drawing is illustrative of the invention rather than limiting the same.

In this drawing:

35 Figure 1 is a diagrammatic sectional view through an apparatus suitable for the manufacture of typewriter ribbons;

Figures 2 and 3 are fragmentary sectional views on the lines 2—2 and 3—3 of Figure 1;

40 Figures 4 and 5 are diagrammatic views illustrating the normal thread size and the enlarged thread size caused by sudden evacuation of moisture and gases from the fabric; and

45 Figures 6 and 7 illustrate the condition in former ribbons overcome in ribbon made as described herein.

The apparatus comprises two stationary vacuum compartments A and B carrying downwardly extending suction tubes as indicated at 50 10, 11, 12, and 13, and guides in the form of rollers 14 and 16, or glass rods 15, 15', 15''. These guides are immersed in containers or pots 17, 18, and 19. These containers may be carried on some form of jack, such for example as a hydraulic jack, as indicated at 19 or 21, or they may be carried on a suspension, such as shown at 20.

When the containers are in the upper position, they receive the guides and when lowered they are a substantial distance below the guides to facilitate threading the strip through the apparatus. Each of these containers is adapted to contain an inert liquid, such as mercury, into which the lower ends of the tubes 10, 11, 12, and 65 13 extend. The chambers A and B are connected to a suitable exhaust pump, indicated at 22, so as to evacuate the air and gases from the chambers, and when the air is evacuated from these chambers, the mercury is sucked up into the tubes 10, 11, 12, and 13 as indicated. The two-compartment arrangement is preferred over a larger single vacuum chamber, as it permits a more flexible control.

75 A supply of ribbon fabric R is indicated at 25. It is fed down underneath the roller 14 up

through the suction tube 10, and into vacuum chamber A where it passes between two electric heaters 26, 26 pressed toward one another by springs 27 so as to heat the fabric, preferably without ironing it.

The compartment A contains two guide rollers 28 and 29, one above the suction tube 10, the other above the suction tube 11.

10 An ink reservoir is indicated at 30. It is connected by float valve 31 and pipe 32 so as to discharge ink into the lower part 33 of the chamber A where it floats on top of the mercury in column 11.

15 The ribbon R passes down through the ink bath between scrapers indicated at 34 and into the mercury tube 11. It then passes underneath between the glass guides or rolls 15, 15', and 15'' which exert some scraping action, and continues up through the mercury column 12. It then passes by scrapers indicated at 35 and 36 and between electric or other heaters 37, 37. These heaters may be suspended from the point 38, if desired. The ribbon then passes about a roller 39 (which may, if desired, be heated) and between this roller and a second or pressure roller 25 40.

The meeting line of these rollers is directly above suction tube 13. If desired, the ribbon may be passed between heaters 41, 41 before entering the mercury in the tube 13. It then passes down 30 underneath the roller 16 and up into a winding reel 42. The rollers 39 and 40 are power driven and are pressed toward one another by an adjustable weight 43 carried on a bell crank arm 44 which pushes the roller 40 against the roller 39. 35 The reel 42 is driven by a suitable reeling mechanism.

The strip of fabric R is drawn through the apparatus at a comparatively high speed in the direction indicated by the arrows. The fabric on 40 the roller 25 is the ordinary fabric employed for typewriter ribbons. It contains air, moisture, and gases, and is drawn underneath the mercury in container 17 and up through the tube 11. It suddenly emerges into the vacuum chamber and immediately passes through the heating zone caused by the heaters 26, 26. This operation brings about a sudden release of the air and gases, particularly moisture vapor, from the fibres, and causes the fibres to swell, expand materially as indicated diagrammatically in the differences between Figures 4 and 5. The rapid escape of the air and gases from the inside of the fibres loosens and expands the fibres and closes up the interstices between the threads. 55

While the fabric is in this condition, it is highly absorbent. It is plunged underneath the ink in the ink bath and carried directly down into the mercury tube 11 under and underneath the guides. 60

Owing to the great difference in the specific gravity of the ink and mercury the mercury acts as a frictionless distributor of ink throughout the fabric. This method of ink distribution in the fabric is also useful in processes wherein there is no preliminary evacuation of air and gases. 65 As the coated fabric becomes more submerged in the mercury column, the ink absorbed by the evacuated fibres is pressed into the fibres by liquid pressure above atmospheric. This effects a true impregnation of the fabric for the fabric with fresh ink is subjected to the pressure above atmospheric while the ink is still in the liquid state without any drying or evaporating of the vehicle. True impregnation cannot be accom- 75

plished in a vacuum alone. In the present case the mercury column acts as a hydrostatic impregnator producing a continuous effect normally obtained by pressure pumps on the intermittent impregnating processes. It also acts as a seal. A pressure difference, somewhat more than fifteen pounds per square inch, is available for pressing the ink into the fibres without any rolling or squeezing action which would tend to distort the fibres or remove the ink from the fibres. The mercury itself effects a fixed and uniformly distributed quantity of ink in the fabric. The ribbon then passes between the scrapers 35 and 36, which are adjustable by means of the linkage indicated, so as to remove mechanically carried excess of ink.

The ribbon then passes between the heaters 37, 37 which effect a heat treatment on the ribbon. The temperature of these heaters and the speed of motion of the ribbon, is so adjusted that a very substantial portion of the volatile matter of the ink, principally oil, is evaporated at the reduced pressure, thereby decreasing the amount of oil carried in the ribbon without decreasing the amount of pigment carried by the ribbon. This temperature is so low as not to effect the pigment hence the color and other inking properties are not injured.

This operation effects an increase in the pigment-vehicle ratio so that the ribbon passing between the pressure rollers 39, 40 carries the full quota of pigment but much less oil or vehicle than would be the case were the ribbon subjected to the usual pressure rolling. The pressure rolling operation acts to further press the pigment into the fibres and to give a smooth finish to the ribbon. The ribbon is then passed through the inert mercury column in tube 43 and under roller 46 to the winding mechanism.

Owing to the speed at which the ribbon is passed through the apparatus, there is some tendency of the mercury to be bodily displaced by the ribbon, or to surge on account of its movement. To cut down the movement of the mercury, one may insert an open coiled spring in each tube, as indicated at 45. Drain cocks 46 and 47 may be provided for draining off the ink or scrapings, and additional scrapers 47, 48 may be provided for the rollers 39 and 40.

Figures 6 and 7 illustrate the conditions present in ribbons of the prior art. The fibres F are partially filled with ink and the free ink fills the interstices as shown at I, Figure 6. When a type character c strikes the ribbon, it flattens out the threads and closes the interstices somewhat as shown in Figure 7. The free ink splashes out onto the type and paper making a ragged impression. On release of the pressure, the threads resume their former shape but less ink is in the interstices, as indicated by the dotted lines in Figure 6.

Ribbons made according to this process are characterized by a marked increase in opacity when held up to the light. They have a much greater pigment-vehicle ratio than is possible in the usual process of rolling which merely removes oil and pigment in the same proportions as in the ink bath. This effects a material and controlled increase in the viscosity and flowing power of the ink in the finished ribbon. There is no free ink to splash out and the juiciness of the new ribbon is materially reduced. This materially prolongs the life of the ribbon. The process furthermore provides a very well filled storage reservoir in the margins of the ribbon

and in the center of the ribbon (not struck by the type) so that the recovery of the ribbon after a rest period is far greater than that normally experienced with ordinary ribbons. Uniform, clear, sharp impressions are produced until the fabric is destroyed.

The shade of the written matter may be controlled by changing the ink used rather than by changing the pressure. Shade of writing is, therefore, not solely dependent on the amount of pigment carried by the ribbon but depends rather upon the color of the pigment used.

The present application is a division of my co-pending application Serial No. 623,368, filed July 19, 1932.

It is obvious that the invention may be embodied in many forms and constructions, and I wish it to be understood that the particular form shown is but one of the many forms. Various modifications and changes being possible, I do not otherwise limit myself in any way with respect thereto.

What is claimed is:

1. Apparatus for continuously manufacturing typewriter ribbons, and the like, from a strip of fabric, comprising a two-compartment vacuum chamber, a liquid inlet seal having a suction tube connected to one compartment, a liquid outlet seal having a suction tube connected to the other compartment, a dual seal having two suction tubes, one connected to each compartment, each seal including a liquid container and a guide, the containers being open to the atmosphere and containing an inert liquid adapted to be sucked up into the tubular connections, an ink bath floated on top of the liquid in the tube leading from the first compartment to the dual seal, and guides in the compartments, all the guides being arranged for the continuous movement of the strip from the atmosphere through the seals and compartments and to return it to the atmosphere.

2. Apparatus for continuously manufacturing typewriter ribbons, and the like, from a strip of fabric, comprising a two-compartment vacuum chamber, a heater in each compartment, a liquid inlet seal having a suction tube connected to one compartment, a liquid outlet seal having a suction tube connected to the other compartment, a dual seal having two suction tubes, one connected to each compartment, each seal including a liquid container and a guide, the containers being open to the atmosphere and containing an inert liquid adapted to be sucked up into the tubular connections, an ink bath floated on top of the liquid in the tube leading from the first compartment to the dual seal, and guides in the compartments, all the guides being arranged for the continuous movement of the strip from the atmosphere through the seals, heaters, and compartments and to return it to the atmosphere.

3. Apparatus as defined in claim 1, having means for heating the strip as it passes through the vacuum compartments, and pressure rolls in the second chamber through which the heat treated strip passes.

4. Apparatus as defined in claim 1, having ink removing devices in the second compartment and acting on the fabric strip after it emerges from the second seal, a heater in the second compartment for removing a portion of the vehicle from the fabric, and pressure rollers for pressing the pigment into the fabric.

5. Apparatus for manufacturing typewriter ribbons and the like, comprising an ink bath, a liquid container open to the atmosphere, an inert

liquid therein, a guide in the liquid container, tubes extending upwardly from the liquid container and opening below the surface of the liquid, vacuum chambers into which the upper ends of
5 said tubes open, and guide rollers in each chamber, liquid seals between the atmosphere and each chamber, each seal having a guide immersed in the liquid therein, all said guides being below the exposed surfaces of the liquid seals and disposed
10 to guide a ribbon through the seals, chambers,

and tubes, and to subject the ribbon to pressures above atmospheric in each seal, the ink bath being disposed in the path of the ribbon and intermediate the inert liquid and the first chamber.

6. Apparatus as set forth in claim 5, characterized in that each of the three seals is a mercury seal and in that the ink floats on top of the mercury in the admission side of the first mentioned seal. 5

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