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W. N. KING ET AL

2,411,042

MACHINE FOR DEWAXING AND LACQUERING PAPER SHOTGUN SHELL CARTRIDGES

Filed Sept. 16, 1944

3 Sheets-Sheet 1

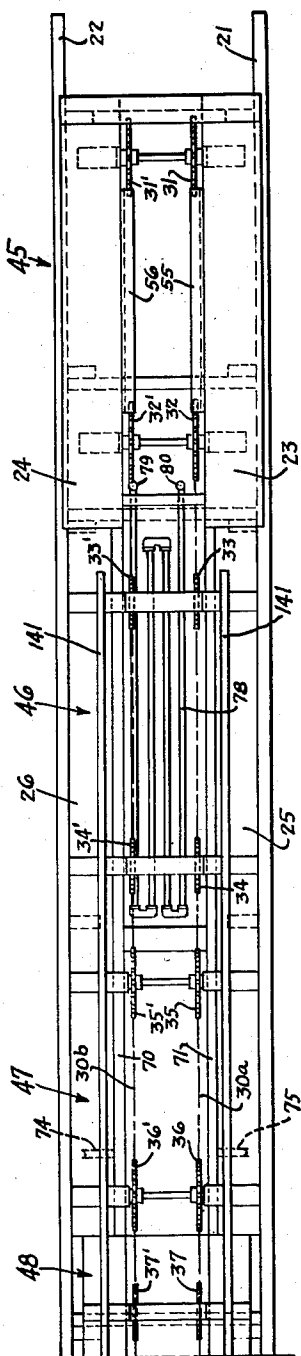


Fig. 2a
TOP COVERS REMOVED

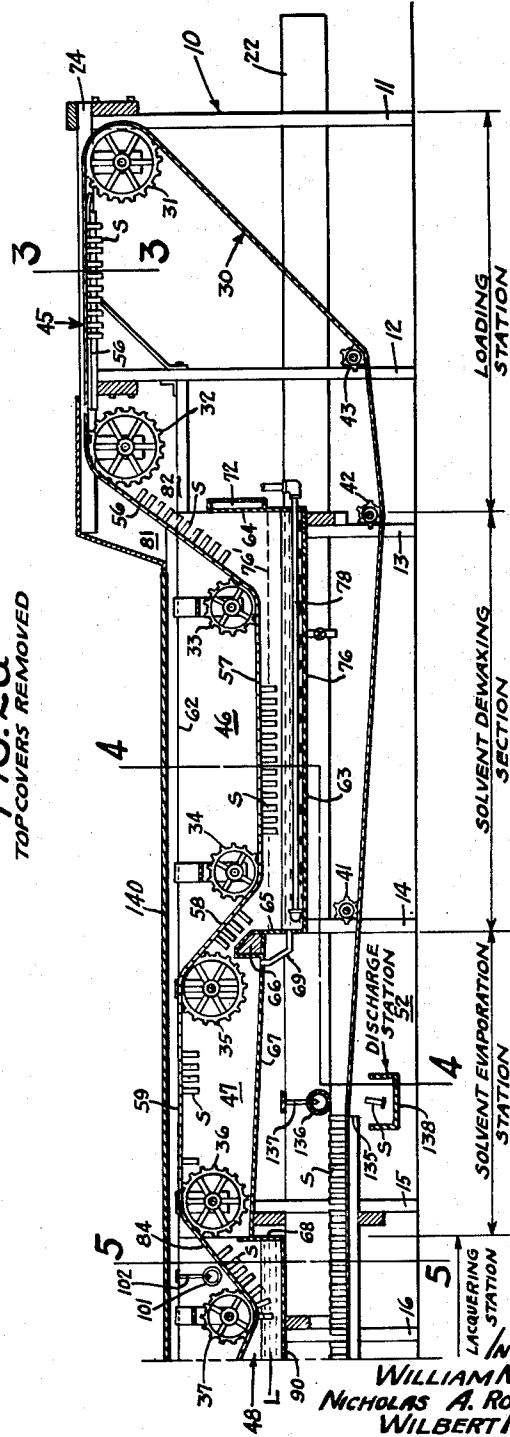


Fig. 1a

INVENTORS
WILLIAM N. KING
NICHOLAS A. ROMANCHUK
WILBERT H. WARD

By Paul, Paul & Moore
ATTORNEYS

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3 Sheets-Sheet 2

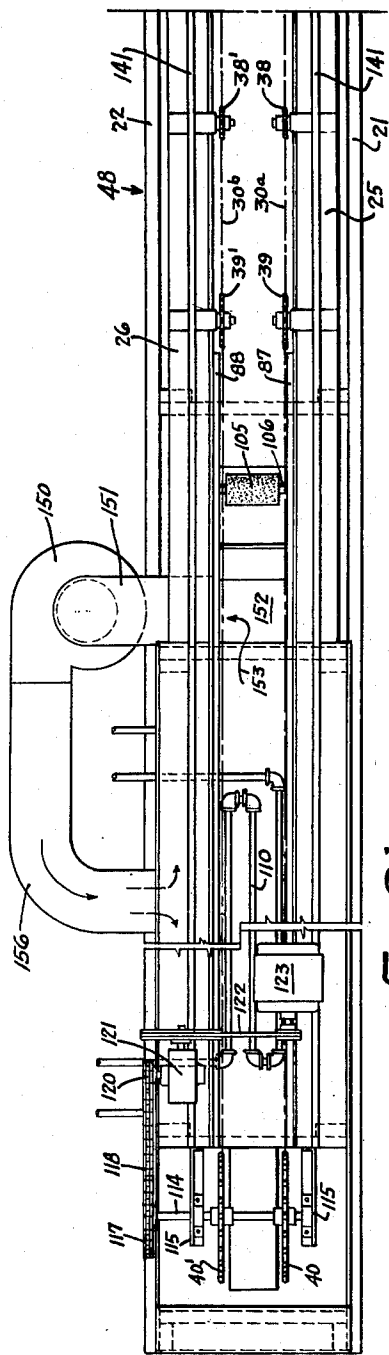


Fig. 2b
TOP COVERS REMOVED

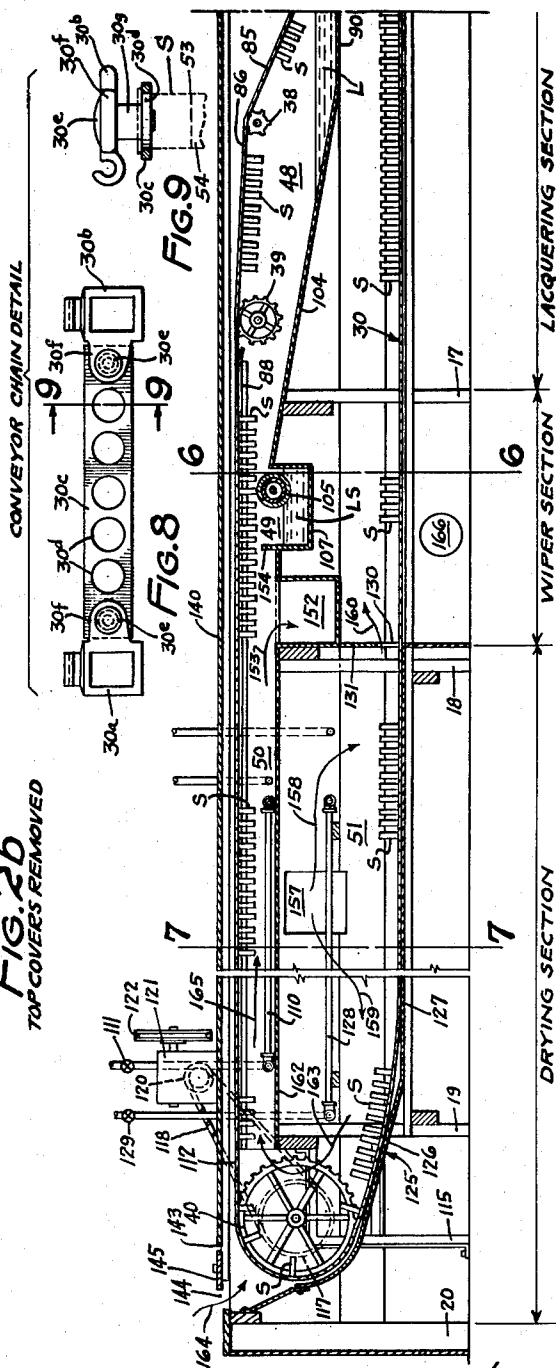


Fig. 1b

INVENTORS
WILLIAM N. KING
NICHOLAS A. ROMANCHUK
WILBERT H. WARD
By *Paul Moore*
ATTORNEYS

Nov. 12, 1946.

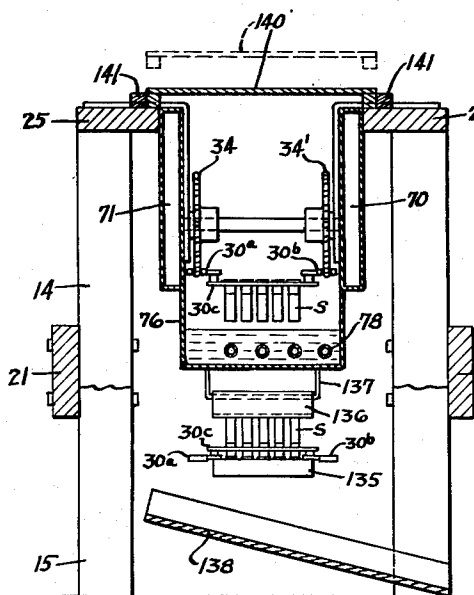
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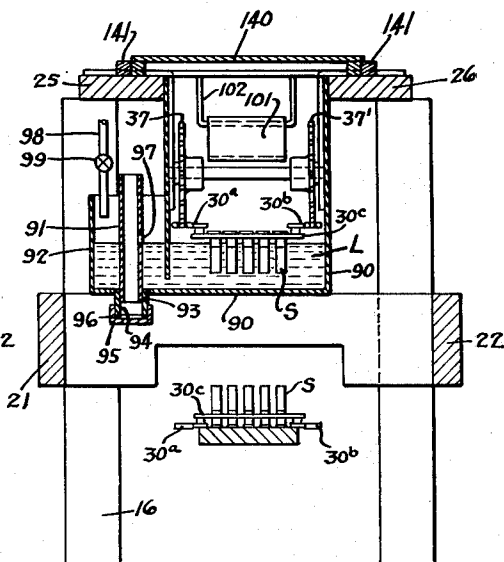
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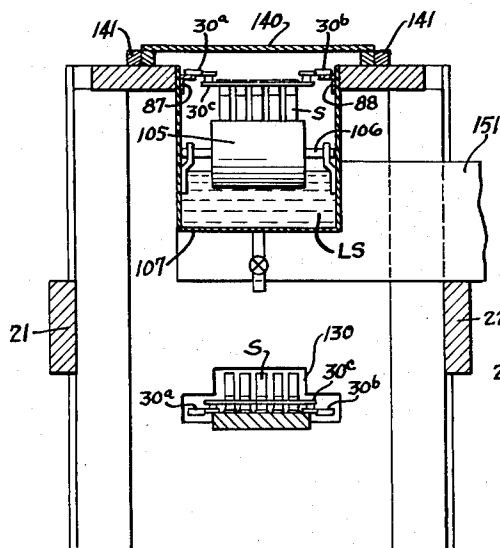
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DEWAXING & DISCHARGE FIG. 4



LACQUERING FIG. 5



UNITED STATES PATENT OFFICE

2,411,042

MACHINE FOR DEWAXING AND LACQUERING PAPER SHOTGUN SHELL CARTRIDGES

William N. King, Nicholas A. Romanchuk, and Wilbert H. Ward, Anoka, Minn., assignors to Federal Cartridge Corporation, Minneapolis, Minn., a corporation of Minnesota

Application September 16, 1944, Serial No. 554,508

10 Claims. (Cl. 91—13)

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This invention relates to an automatic, large capacity apparatus for finishing impregnated paper articles and is especially adapted for the finishing of shotgun shells, mortar shells and the like. As usually constructed such shells are fabricated from a paraffin impregnated paper tube having a suitably shaped brass or other metal cup or base pressed thereon. Shells of this character have limited waterproofness and a relatively poor finish. In the copending application of William N. King, Ser. No. 550,667, filed August 22, 1944, there are disclosed methods and simple manual apparatus for better finishing and waterproofing paper shells.

It is an object of the present invention to provide an apparatus for accomplishing this operation of finishing impregnated paper articles of manufacture, and particularly to provide a large capacity apparatus of such capabilities. It is a further object of the invention to provide an apparatus for the finishing of paraffin wax impregnated paper shotgun shells, mortar shells and the like in one automatic continuous operation.

Other and further objects are those inherent in the apparatus herein illustrated, described and claimed.

The invention is illustrated in the drawings wherein the same parts have the same numbers, and wherein

Figures 1a and 1b, taken together, are a side elevational view, partly in section, of the apparatus of the present invention, and Figures 2a and 2b, taken together, are a plan view with the top cover portions removed. The apparatus is long as compared to its width and height and two sheets of drawings are therefore employed to illustrate these side and top views. The drawings should be set end to end, with the sheet containing Figures 1a and 2a thereon to the right of the sheet containing Figures 1b and 2b.

Figures 3, 4, 5, 6 and 7 are sectional views taken at lines 3—3, 4—4, 5—5, 6—6, and 7—7 of Figures 1a and 1b, respectively. Figure 3 shows the loading station; Figure 4 shows in its upper part the solvent dewaxing section and in its lower part the discharge station; Figure 5 shows the lacquering section; Figure 6 shows the wiping section; and Figure 7 shows the drying section.

Figures 8 and 9 are enlarged detailed plan and side views, respectively, of one of the shell-carrying links of the conveyor chain used in the apparatus.

Referring to the drawings the apparatus com-

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prises a relatively long narrow horizontal frame generally designated 10 which may conveniently be of wood or metal comprising a number of bents 11—20 of varying sizes, depending upon the apparatus supported at the several stations in the treating machine. The bents are held together by horizontal stringers 21 and 22 about mid-way between the top and the bottom and top plates 23 and 24 and 25 and 26.

The article-treating machine includes a conveyor chain generally designated 30 which is guided by a series of sprockets 31—43 and 31'—43' through a series of treating stations and sections including a loading station 45, a solvent dewaxing section 46, a solvent evaporation section 47, a lacquering section 48, a wiper section 49, and a plurality of drying sections 50—51 and finally a discharge station 52. These stations and sections are described in greater detail hereinafter.

The conveyor mechanism comprises a pair of spaced chain links 30a and 30b that are joined together by parallel hanger bars 30c, as shown in Figures 8 and 9. The construction of the hanger bars is such as readily to carry the articles undergoing treatment. The apparatus of the present invention is especially adapted for the treatment of shotgun shells, mortar shells, and the like, and the invention will therefore be described with reference to this adaptation. For the carrying of shotgun shells, mortar shells and the like, the opposite chain links 30a and 30b are joined together by a hanger bar 30c which is provided with a plurality of holes 30d of suitable gauge for handling the particular shells undergoing treatment. Thus, for 12 gauge shells the holes 30d are such as to permit the body of the shells readily to pass through the holes 30d, but they are sufficiently small so that the rim of the shell S, Figure 9, rests on the upper surface of the plate 30c and allows the shell to hang downwardly therefrom. The shell cup which is usually of brass is terminated at 53, Figure 9, the lower part of the shell being the standard paraffin impregnated paper portion 54. It will be noted that the hanger plates 30c are spaced downwardly from the chain links 30a and 30b by means of a spacing collar 30g, the hanger plates 30c being fastened permanently to the chain links by means of rivets 30e which pass through the side ears 30f of the chain links, thence through the spacing collars 30g and the hanger plate 30c and finally are riveted to the bottom. Every chain link in the conveyor is provided with a hanger plate 30c and therefore

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the composite chain presents a relatively solid surface having a large number of properly gauged holes therein into which an operator feeding the machine may readily place the shells. The chains 30a and 30b are represented by the single lines in Figures 2a and 2b, but it will be understood that the conveyor is composed of a series of units like that shown in Figure 8.

At the loading station 45 there is provided a table surface formed by the plates 23 and 24 which serve on their spaced inner edges to support angle iron rails 55 and 56, as illustrated in Figure 3. The links of the chain 30a slide along the horizontal surface of the rail 55 whereas those of the chain 30b slide along the rail 56. As the chains carrying the hanger plates 30c come up around sprocket 31—31', Figure 1a, the operator drops shells S into the holes, preferably filling every hole in the conveyor mechanism.

It might be noted that in most instances each set of sprocket wheels for guiding the conveyor chain is carried on and keyed to a shaft extending across the machine, and the sprocket wheels of each set thus tend to keep one side of the chain from traveling faster than the other side and thus prevent the hanger plates 30 from being pulled askew. There are a few instances where in the sprocket wheels are not mounted upon a single shaft, for example sprockets 38—38', 39—39' where it is desired to allow free space below the sprockets for the dripping of the lacquer from the shells.

From the loading station 45 the chain conveyor passes over the sprocket wheels 32—32' and thence downwardly along the slope 56 and under the sprocket wheels 33—33' and along the horizontal traverse 57, under the sprocket wheels 34—34', thence upwardly at 58 and over sprockets 35—35' and along the upper horizontal traverse 59 to sprockets 36—36'.

The solvent dewaxing section 46 and the solvent drying section 47 are preferably made as a unitary tank that is supported upon bents 13, 14 and 15. The side walls of both sections terminate at the upper line 62. The solvent dewaxing section has a bottom at 63 and end walls 64 and 65. The end wall 65 is blended into the insulated wall 66 and thence continues as bottom 67 of the solvent evaporation section which has a little slope as indicated, downwardly from wall 68 to the drain tube. The drain tube 69 permits condensed solvent which collects on the cold walls of the solvent evaporation section to drain back into the pan of the solvent dewaxing section. The side walls of both sections are water jacketed as indicated, Figure 4, wherein the water jackets are designated 70 and 71. The water jacket 70 which extends along the wall of the solvent evaporation and solvent dewaxing sections, is carried around the end at 72. A cold water inlet pipe 74, Figure 2a, is provided into the side wall 70 at a low level and the water flows thence through the water jacket 70 along the solvent evaporation section and the solvent dewaxing section through the water jacket 72 around the end of the solvent dewaxing section, thence through the water jacket 71 along the opposite wall of the solvent dewaxing and solvent evaporation sections to an outlet pipe 75, Figure 2a, located near the top of the water jacket 71 in the solvent evaporation section. In this manner the side walls of the solvent dewaxing and solvent evaporation sections are maintained very cool for the purpose of condensing any rising solvent vapors.

In the solvent dewaxing section the water jacket

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extends only to the level of line 76', the remaining portion of the side wall below that line being not jacketed and hence not cooled. The bottom of the solvent dewaxing section forms a pan, as indicated at 76 in which there is placed a solvent capable of dissolving the impregnating medium of the shotgun shells. The solvent is chosen so as to dissolve the impregnating material. Paraffin is most frequently used as the paper impregnating medium in shotgun shells and suitable solvents for paraffin capable of being used in the present apparatus are carbon tetrachloride, trichlorethylene, tetrachlorethylene, benzene, hexane, and the like. In order to boil and evaporate the solvent in the pan 76, there is provided a heater coil 78 which has an inlet pipe 79 and an outlet pipe 80, which may, if desired, be suitably controlled by a thermostatic valve not illustrated. An electric heater with automatic temperature control may also be used if desired. A sufficient heater surface is provided so that the solvent is boiled and the solvent vapors rise into contact with the shells S which are suspended along the path of travel 57 a short distance above the level of the boiling solvent in the pan 76.

The solvent rising into contact with the relatively cool shells entering the solvent dewaxing section condenses upon the surface of the shells and dissolves the wax in the surface layers of the paper of the shell. The solvent flows back into the pan 76 carrying the wax with it where the solvent is again evaporated and again flows into contact with the shells passing through the solvent dewaxing section. The condensation of solvent and accompanying dewaxing function continues until the shell has been heated by the hot solvent vapors to a temperature equal to the temperature of the vapors, whereupon condensation substantially ceases. The rate of travel through the solvent dewaxing section is usually sufficient however that the shells continue to condense solvent thereon during the entire period within this section.

The relatively closely spaced hanger plates 30c form a surface which serves to stop a considerable amount of vapors from rising much above the level of the hanger plates 30c but any vapors which do rise above this point are promptly condensed by the cold water-jacketed walls 70, 71 and 72. In this way the solvent is conserved and contamination of air about the machine is minimized. If desired, an exhaust fan having inlets in the region 81 and 82 may be provided.

After having been dewaxed in section 46 the conveyor chain carries the shells upwardly and along the horizontal traverse 59 through the residual solvent evaporation section. In this section the shells which have been heated by the hot solvent vapors cause any residual solvent on the shell to be evaporated and the solvent is promptly condensed by the cold water-jacketed side walls 70 and 71 of this section. The condensed solvent collects on the inclined bottom 67 of this section and is drained via pipe 69 into the solvent pan 76 in section 46.

After passing through the solvent evaporation section the conveyor passes downwardly as indicated at 84 and under the sprockets 37—37' and thence up the gradual slope 85, over sprockets 38—38' and along the nearly horizontal slope 86 and over sprockets 39—39' onto the guide rails 87—88. As the conveyor passes down so as to go under sprockets 37—37' the shells are brought to a sufficiently low point so that the bath of lacquer L in pan 90 coats the shells to a level slightly

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higher than the lower margin of the brass portion of the shell, thus covering the entire paper side wall and end portions of the shell, as well as the lower margin of the brass.

The lacquering section is shown in sectional view in Figure 5, the lacquer pan being illustrated at 90. The depth of lacquer L in the pan 90 is maintained by a stand pipe 91 in the side well 92. The stand pipe 91 is screw threaded at 93 into the nipple 94 and the bottom of the nipple 94 is closed by a cap 95 which is gasketed at 96. If desired, a valve may be placed on the bottom of the nipple 94. The stand pipe 91 is provided with a hole 97 which determines the level of the lacquer L and by substituting stand pipes with holes at different levels, any desired level may be maintained in the lacquer pan 90 so as to accommodate different shells. The lacquer may be introduced into the well by means of a pipe 98 provided with a control valve 99 and the excess lacquer drained off by removal of cap 95.

On the down slope 84 of the conveyor chain, Figure 1a, some shells occasionally have a tendency to lift up a slight amount from the hanger plates 30c, and to insure each shell being firmly in place in the hanger plate and thus insure lacquering to a uniform level, there is provided a short length of heavy pipe 101 which is suspended on a hanger bar 102. The pipe 101 is adjusted so that it is slightly out of contact with a shell head that is properly seated in the hanger plates 30c, but if any shell works up it is promptly pushed back by the pipe 101.

As the conveyor chain passes under the sprocket 37-37' and over sprockets 38-38' and sprockets 39-39', the shells are lifted out of the lacquer bath and the excess lacquer drips downwardly to the bottom of the shell and onto the drain slope 104, whence the drained lacquer returns to the main body of lacquer L in the pan 90. After the shells have thus drained small drops of lacquer form at the lower edge, and to remove them the wiper 49 is provided. Thus when the conveyor has begun its traverse along the rails 87-88 the shells initially pass in contact with the wiper roller 105 which rotates on shaft 106 in a small pan 107 containing a lacquer solvent LS. The roller 105 is preferably made of brush bristles closely set together and is adjusted so that the bottom edges of the shells rotate into contact with it, thus causing the roller to rotate continuously in the lacquer solvent. In this way fresh lacquer solvent is continuously brought up by the bristles into contact with the oncoming shells. The action of brush 105 is to remove the droplets of lacquer which collect on the bottom of the shells.

From the wiper section 49 the shells pass into the first part 50 of the drying section where they are heated by the heating coils 110 which are preferably steam heated, the amount of heat being controlled by valve 111. Electrical heaters or infra-red ray lamps may also be used. The shells are gradually heated in this section so as not to cause blistering. At 112 the conveyor chain leaves the rails 87-88 and passes onto the large drive sprocket wheels 40 and 40' that are mounted on shaft 114 which is in turn journaled upon the angle iron framework 115. The shaft 114 extends through the side wall of the apparatus and is provided with a drive sprocket 117 that is driven through chain 118 by the pinion 120 on the reduction gear box 121. The reduction gear is propelled by a belt drive 122 from the motor 123. By changing the ratio of the large and small

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pulleys on the belt drive 122, any desired conveyor speed may be achieved.

From the drive sprockets 40-40' the conveyor chain passes downwardly along the guide plate 125 which extends downwardly along the slope 126 and thence horizontally at 127 through the drying section 51. The drying section 51 is heated by steam pipes or other heating means 128 which is controlled by a valve 129. The guide plate 125 is as wide as the entire conveyor chain and hanger plates and supports the conveyor chain and the shells in the plates 30c by permitting the shells to slide along with their heads in contact with the guide plate 125. The shells are thus held in the holes in hanger plates 30c from which they would otherwise drop. The guide plate 125 extends throughout the drying section 51 and thence through an opening 130 in wall 131, under the wiper section 49 and lacquering section 48 and is terminated at lip 135 under the solvent drying section, see Figure 1a. At this point there is provided another section of heavy pipe 136 suspended on the hanger 137 to insure the shells S being knocked out of the hanger plates 30c at this point, if they should tend to stick. The shells fall into the discharge trough 138 at the discharge station 52, the trough being slanted as illustrated in Figure 4 so that the shells slide downwardly to inspection and packing departments located at a level below the apparatus here illustrated.

The entire apparatus of the present invention is enclosed along its side walls and is provided with a cover 140 which is preferably made in easily handled sections and held in place by cleats 141, as indicated in Figures 4-7. The cover 140 extends from the loading station, thence down and across the solvent dewaxing section, entirely along the apparatus to the drying section, but is interrupted at 143, Figure 1b, so as to allow a space 144 through which a controlled amount of air may be admitted into the drying apparatus. A small adjustable cover at 145 is fitted so as to vary the size of opening 143, so as more readily to adjust the in-flow of air at this point.

Recirculation of drying air through the drying sections 50 and 51 is provided by a blower mechanism 150 having an inlet pipe 151 extending across the apparatus as indicated at 152. The pipe 152 is open to section 50 and serves to withdraw the drying air from drying section 50, as indicated by arrow 153. The wall 154 at the wiper section is carried up to a position very close to the bottom of the shells S at this point so as to wall off as much as possible the flow of vapors from the lacquering and wiper sections into the drying section. The suction optionally applied at 81 or 82 may also be relied upon to balance the negative pressure at 154 and thus prevent too much solvent vapor from being drawn into the drying section. The outlet from blower 150 is by way of pipe 156 which delivers to port 157 into the drying section 51 where the air distributes by way of arrows 158 and 159. The air is under pressure in the drying section 51 and hence some air escapes, as shown by arrow 160 through the outlet hole 130 in wall 131 through which the dried shells also pass on their way to the delivery station. The air moving along the path of arrow 159 in the drying section 51 continues up around baffle 162 as shown by the arrow 163 and there joins incoming air which has entered through port 144 as indicated by arrow 164 and is drawn horizontally through drying section 50 along the path of arrow 165, and

thence into the inlet 152 of the blower as shown by arrow 153. A negative pressure exists at opening 144 and by controlling the vent plate 145 at this point, a controlled amount of fresh air can be introduced. If desired, a lacquer vapor exhaust fan may be provided and the inlet thereto connected to the space under the wiper section as indicated by the port 166 so as to draw off and exhaust to atmosphere the vapors at this point and prevent them from spreading throughout the under side of the apparatus. The long traverse of the dried shells under the lacquering section to the discharge station permits adequate cooling and hardening of the lacquered shells prior to discharge.

The apparatus of the present invention makes possible the application of lacquers, paints or waxes to impregnated articles, such as shotgun shells, under controlled conditions and insures high output of uniformly treated articles.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that we do not limit ourselves to the specific embodiments herein except as defined by the appended claims.

What we claim is:

1. An apparatus for surface finishing the paraffin wax impregnated paper components of shotgun shells and the like comprising an elongated enclosure, a conveyor mounted for travel from a loading station at one end of said enclosure, thence along the top of said enclosure and back along the bottom of said enclosure and return to said loading station, means for solvent vapor dewaxing the shells and for evaporation of residual solvent from the shells, means for coating the shells with a dryable liquid coating material arranged along the top of said enclosure, and means in said enclosure for heating the shells to dry the liquid coating thereon and for then discharging the shells from the conveyor.

2. The apparatus of claim 1 wherein the means for heating the shells to dry the liquid coating includes a multiple part tunnel in said enclosure, heating means therein, air recirculating means including means for withdrawing air from one tunnel part and for introducing said air into the other tunnel part and said tunnel being provided with an opening for introducing a controlled amount of fresh air into the recirculated air stream at one place while a corresponding amount of air is exhausted during recirculation.

3. The apparatus of claim 1 further characterized in that the loading station, the means for solvent vapor dewaxing and evaporation of residual solvent thereon, the means for coating the shells are all located along the upper part of the elongated enclosure and the means for heating the shells is located partially in the upper part and partially in the lower part of said enclosure.

4. The apparatus of claim 1 further characterized in that the conveyor includes a pair of spaced link chains mounted for movement in parallel, oppositely located links of said chain being connected together with plates having holes therein for hanging shells downwardly therethrough at the loading station, the shells being thus suspended while passing through the means for solvent vapor dewaxing and evaporation of solvent, and while passing through the means for coating the shells with a dryable liquid.

5. In an apparatus for surface finishing shotgun shells and the like, a trough-like vessel having a pan bottom for containing an evaporable

liquid solvent, said vessel being provided with side walls having cooling means thereon, said side walls extending upwardly around said pan, heater means in the pan-like bottom of said vessel, a flexible conveyor having shotgun shell suspending hangers thereon and means for guiding said conveyor chain along a substantially horizontal path located so that shotgun shells suspended by the hangers are slightly above the solvent liquid level of the pan.

6. The apparatus of claim 5 further characterized in that a trough-like residual solvent evaporating chamber is joined to the end of the trough-like vessel, at the end towards which the conveyor chain moves, said chamber also being provided with means for cooling the walls thereof, the bottom of said chamber being at a level above and drained to the pan of said trough-like vessel, and means for supporting the chain for guiding it through said chamber.

7. An apparatus for lacquering tubular shells comprising means for suspending said shells and for conveying the thus suspended shells, means for applying a dryable lacquer to the shells as they are conveyed, and means for brushing the downwardly extending ends of the shells as they are conveyed to remove drops of dryable lacquer forming thereon, said means comprising a brush carrying a solvent for the dryable lacquer.

8. An apparatus for the automatic finishing of impregnated articles which comprises a carrier for said articles movable along a path of travel, a loading station at one point in the path of travel of said carrier, a first enclosure around a further portion of the path of travel of said carrier after it leaves the loading station, said enclosure containing a solvent for the impregnating material in said articles undergoing treatment and means for vaporizing said solvent, said enclosure forming a zone for confining hot vapors of solvent, means for guiding the carrier and the articles thereon through said zone for removal of said impregnating material from the surface of the articles by condensation of the solvent thereon, means for cooling a portion of said enclosure in said vapor zone and further along the path of travel of said carrier for condensing vapors from the residue of solvent on said articles, a second enclosure further along the path of travel of said carrier, a tank in said second enclosure for containing a dryable waterproof finish, means for guiding the articles on said carrier into the finish in said tank for applying said finish to the surface of the articles, means for heating a portion of said second enclosure for drying the waterproof finish applied to said articles and a discharge station further along the path of travel of said carrier for discharging the articles therefrom.

9. An apparatus for the automatic surface finishing of wax impregnated paper articles such as the tubular paper portions of shotgun shells comprising an elongated vessel having a depression along a portion thereof for containing a solvent and a drain sheet extending outwardly from one end of said depression, connected to the vat so as to drain thereinto, heating means for said vat, upwardly extending walls around the vat and drain sheet, cooling means for said walls, a conveyor having means thereon for holding the articles being treated, means for guiding the conveyor past a loading station and then downwardly into the vessel and over the depression through hot solvent vapors arising from solvent in said depression, then over the drain sheet and

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then out from between said walls, a lacquer vat and means for guiding the conveyor downwardly to a position to bring the articles being treated, while still hot from the solvent vapors, into lacquer in said vat and then out of said lacquer for drainage and drying.

10. A lacquering apparatus comprising an enclosure containing a solvent and forming a zone for confining hot vapors of said solvent, said enclosure including a deep trough having a bottom pan and upwardly extending walls, means for cooling said walls, means for suspending the

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articles being treated and conveying them thus suspended through said enclosure, means for applying a dryable lacquer to the articles as they are conveyed, means for brushing the downwardly extending ends of the articles as they are conveyed to remove drops of dryable lacquer forming thereon, said means for brushing comprising a brush carrying a solvent for the dryable lacquer.

WILLIAM N. KING.
NICHOLAS A. ROMANCHUK.
WILBERT H. WARD.