March 23, 1954 J. WESTERBERG 2,672,650

CORK EXTRUSION MACHINE

Filed Jan. 5, 1949

4 Sheets-Sheet 1

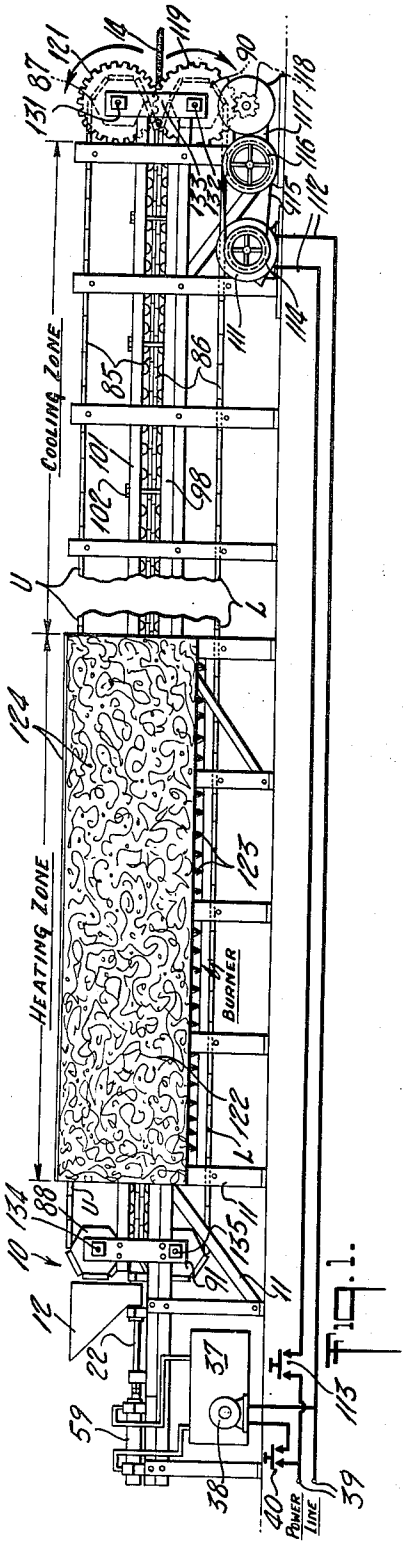


FIG. 1.

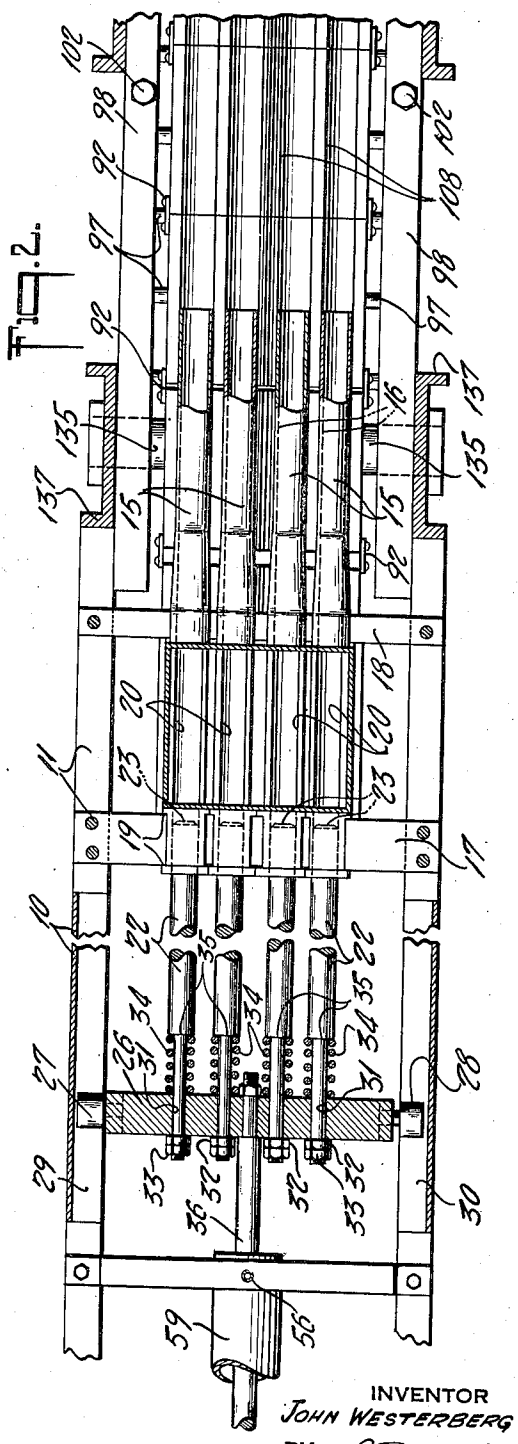


FIG. 2.

INVENTOR
JOHN WESTERBERG
BY John M. Cole
ATTORNEY

March 23, 1954 J. WESTERBERG 2,672,650

CORK EXTRUSION MACHINE

Filed Jan. 5, 1949

4 Sheets-Sheet 2

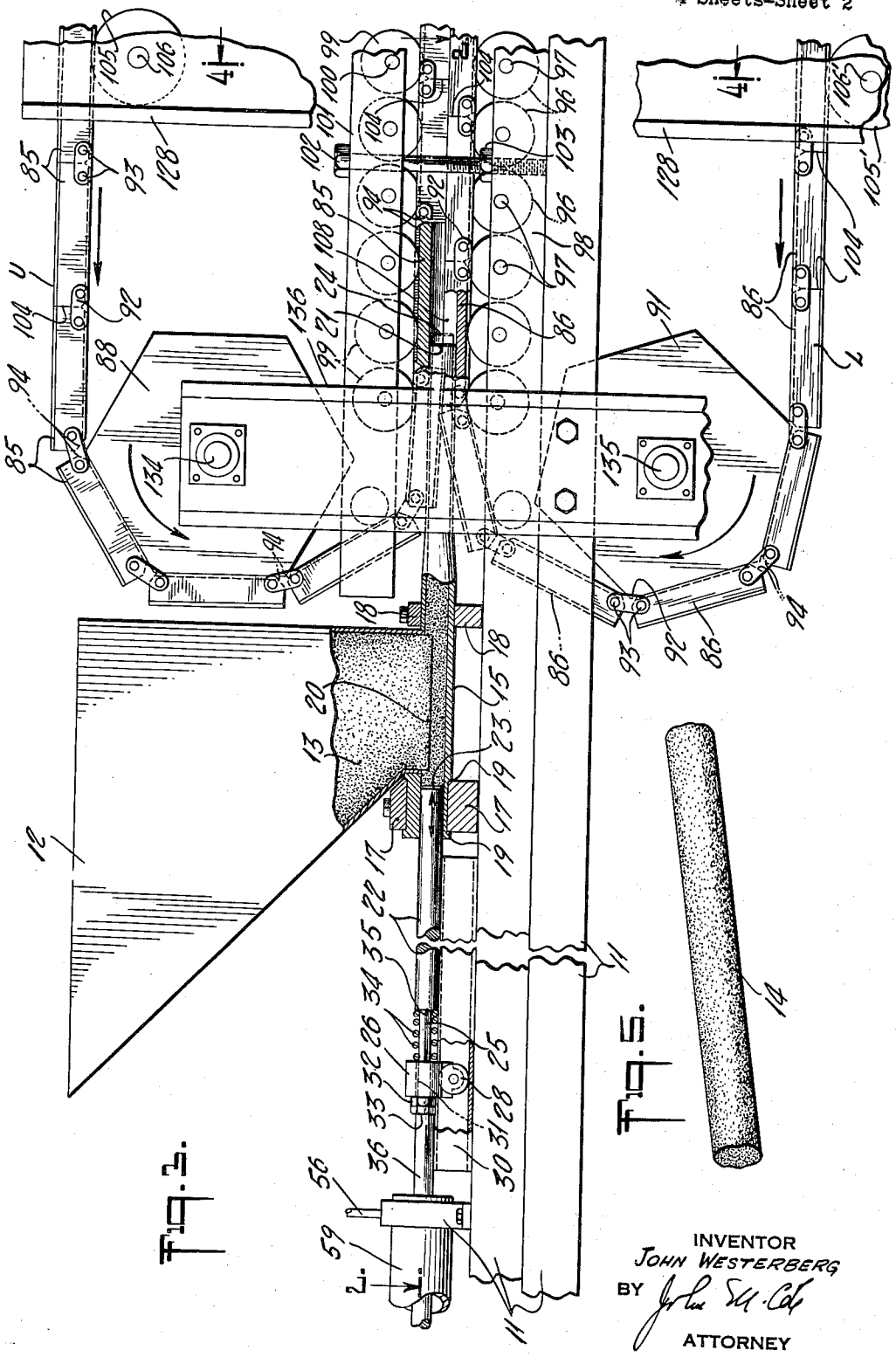


Fig. 4.

Fig. 5.

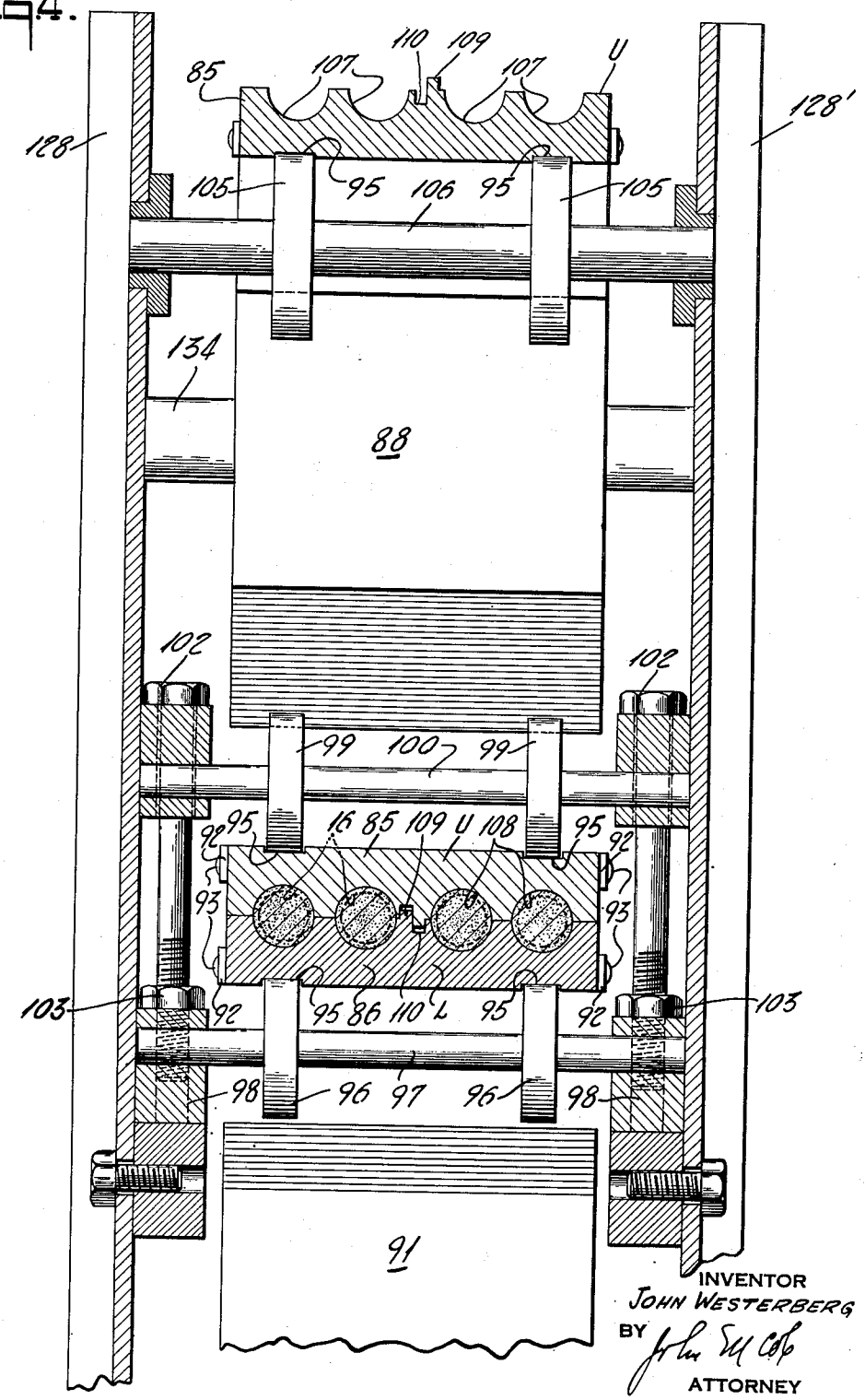
INVENTOR
JOHN WESTERBERG
BY
ATTORNEY

March 23, 1954 J. WESTERBERG 2,672,650

CORK EXTRUSION MACHINE

Filed Jan. 5, 1949 4 Sheets-Sheet 3

Fig 4.



INVENTOR
JOHN WESTERBERG
BY
ATTORNEY

March 23, 1954 J. WESTERBERG 2,672,650

CORK EXTRUSION MACHINE

Filed Jan. 5, 1949

4 Sheets-Sheet 4

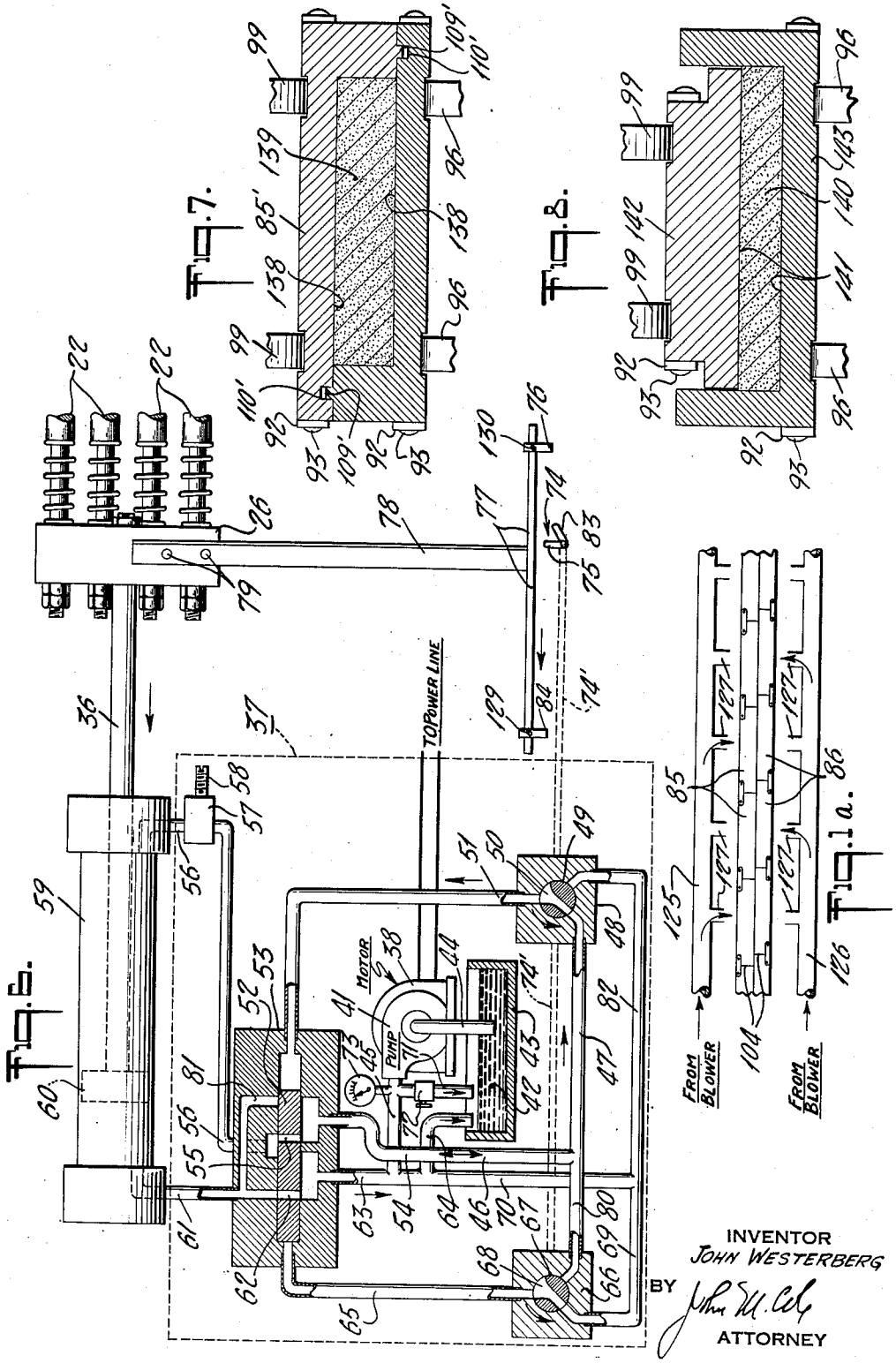


Fig. 6.

Fig. 7.

Fig. 8.

Fig. 10a.

INVENTOR
JOHN WESTERBERG
BY John M. Coe
ATTORNEY

Patented Mar. 23, 1954

2,672,650

UNITED STATES PATENT OFFICE

2,672,650

CORK EXTRUSION MACHINE

John Westerberg, Yonkers, N. Y.

Application January 5, 1949, Serial No. 69,294

4 Claims. (Cl. 18—5)

1

This invention relates to an improved machine for extruding cork. More particularly, the invention relates to the extrusion of cork rod from which slices are to be cut for use as liners for bottle caps, but it will be understood that the invention is also applicable to the production of various other cork extrusion products.

One object of the invention is to produce a continuous extrusion product of unlimited or indeterminate length from material which is capable of being extruded in only relatively short lengths by methods heretofore practiced.

It has been customary in the past to make cork liners for bottle caps by compacting round rods of cork about one inch in diameter from a supply of ground cork mixed with a binding cement of well known type used for that purpose. These rods are then sliced transversely into thin sections to produce discs which serve as liners for the bottle caps. In the compacting operation small charges of the loose particles of ground cork mixed with the binder, are rammed into, but not entirely through, a tube, each charge being of such size that when compressed, it adds about one inch to the filling in the tube. When the tube is filled to the desired length, it is manually removed from the cork ramming device and placed in an oven to harden the binder and bond the particles together to form a rigid rod which is then laboriously extruded from the tube. So such pressure is required to thrust the cork rod from the tube that the cork at one end of the rod tends to become objectionably compressed and permanently hardened and to lose its natural resiliency, so that it is no longer suitable for the intended purpose. The rods are usually made with a length of only 20 to 24 inches. While it is possible to make longer rods up to a maximum length of about 30 to 36 inches by this prior art method, such lengths are impractical, because of increased labor and increased waste of material spoiled by the extrusion operation.

Regardless of length, the rod is always subject to an undesirable waste when made by that method. Due to imperfections at the ends of the rod, each end has to be trimmed to square it off before the rod can be placed in the slicing machine, thus wasting a certain amount of material and time. The ramming pressure and the pressure required to extrude the cork from the tube, produce a more compressed cork at the pressed end than at the free end, thus producing a different density of cork at the two ends of the rod. As a result the free end contains a portion of insufficient density which has to be

2

discarded, thus increasing the amount of waste. The resulting rejected material may amount on the average to about one quarter inch loss to each foot of the rod, or about two per cent of the rod.

The prior art method of manufacture is also objectionable in cost, because of the large amount of labor required to attend to the different operations, and because of the reduced production of the machine resulting from the idle periods when the machine is stopped after each filling of the extrusion tube.

Other objects of the invention are to overcome or reduce one or more of the objections and difficulties experienced with the prior art method of making bottle cap liners; to provide apparatus for producing a continuous extruded product of unlimited length from non-rigid material, such as ground cork with binder, or other suitable material, for use in making bottle cap liners or for other uses; to improve the quality and uniformity of the product; to prevent or reduce waste of material; and to reduce the cost, labor and attention required in the different operational steps of making an extrusion product of the kind referred to.

Another object of the invention is to provide an efficient and relatively simple machine for accomplishing one or more of the above mentioned objectives.

According to the present invention, ground cork, adapted to be converted into a permanently rigid mass, is withdrawn from a supply of the material in successive charges which are pressed in succession into predetermined cross-sectional form, each charge as it is pressed into form being pressed against the previously formed charge to unite the formed charges together into a continuous length of material of uniform cross section. This continuous length of material is maintained under pressure and moved continuously away from the place where the charges are successively united, the continuous length being moved with such timing as to permit the next successive charge to move up and make suitable pressure contact with the continuous length to unite therewith, the force moving the continuous length being applied thereto separately from the force applied to the successive charges for uniting them together. The resulting continuous length of material is moved under pressure at substantially constant speed over a predetermined path wherein the material is made permanently rigid, as by heating and then cooling, the pressure being then progressively removed

from those portions of the length that have passed this path, to progressively release the material as a finished product ready for its intended use.

The machine for carrying out the operation has a primary extrusion conduit and a secondary extrusion conduit aligned therewith for completing the extrusion operation. The secondary extrusion conduit has an extrusion duct which is slightly larger than that of the primary extrusion conduit, so that the secondary conduit may telescope over the primary conduit in the extrusion direction to extrude the material through the secondary conduit. The secondary conduit maintains the extrusion material under pressure and moves it over the predetermined path wherein the material is made rigid. The secondary conduit has separable sub-sections which are progressively removed from registration with each other after passing the predetermined path, thereby releasing the finished product at the output end of the machine. The sub-sections are arranged in separate trains moving in closed loops which return the sub-sections into registration with each other around the primary extrusion conduit.

The extrusion product is especially adapted for use as stock from which bottle cap liners may be sliced, but may be applied to other uses, and can be produced as a continuous rod or sheet of unlimited length, so that the time and labor of squaring off the imperfect ends of the prior art rods of short length, can be entirely eliminated, and appreciable waste of material from this cause is thus avoided. Since the quality and density of the material in the rod are substantially uniform throughout the length of the rod, the waste of material due to inadequate density at one end of the prior art short length rod, is entirely eliminated.

These and other objects and features of the invention will be understood more clearly from the following detailed description in connection with the accompanying drawings and the appended claims.

In the accompanying drawings:

Fig. 1 is an elevation of an extrusion machine; and Fig. 1*a*, on a slightly larger scale than Fig. 1, is a schematic diagram showing a portion of the Fig. 1 in elevation with forced air cooling applied thereto;

Fig. 2, on a larger scale than Fig. 1, is a horizontal section of a portion of the machine, taken on line 2—2, Fig. 3;

Fig. 3 is an elevation, partly broken away, of a portion of the machine, showing some of the details of the extruding mechanism;

Fig. 4, on a larger scale than Fig. 3, is an elevation in section, taken on the line 4—4, Fig. 3;

Fig. 5 is a perspective view of a rod extruded by the machine;

Fig. 6 is a schematic diagram of hydraulic mechanism for operating the extrusion rams shown in more detail in Fig. 2;

Figs. 7 and 8 are vertical sections of modifications of the extrusion mechanism for producing flat extrusion products.

Referring to Fig. 1, the extrusion machine **10**, having the frame **11**, supports the input hopper **12** for receiving a supply of ground cork or other non-rigid material **13**, Fig. 3, to be extruded. The ground cork **13** is mixed with any well known adhesive, binder or cement, such as glue, suitable for the purposes of the final product, for binding the loose particles together as a rigid body in the form of a round rod **14**, Figs. 1 and 5, from which bottle cap liners can be sliced, or in any desired cross-sectional form for liners or other uses.

The extrusion material **13**, Fig. 3, falls into the bottom of the hopper **12**, emptying into the input end of one or more primary extrusion conduits **15**, Figs. 2 and 3, which for the purpose of shaping round rods, comprise tubes having a circular cross-sectional duct **16**. The input ends of the tubes **15** are rigidly clamped between the blocks **17**, **17** and **18**, **18**, bolted to the frame **11**, and have the shoulders **19**, **19** to prevent axial displacement thereof. The upper portion of each tube **15** is cut away at **20**, Fig. 3, to provide an opening for admitting the material **13** from the bottom of hopper **12**. The wall of each extrusion tube **15** is made thin at its output end **21**, as compared with the wall at the input end of the tube, so that there is only a slight difference between the inside and outside diameters at the output end. A ram **22** fits closely within each tube **15**, but is free to reciprocate therein from the full line end position **23**, Fig. 3, to an extreme right position indicated by the dotted end position **24**, slightly beyond the output end **21** of tube **15**. Each ram **22** has an end portion **25** of reduced diameter, supported by the travelling block **26**, yoking together the rams **22**. The block **26** carries the freely rotatable rollers **27** and **28** at the opposite ends thereof, these rollers being arranged to track, respectively, within the U-shaped channels **29** and **30**, fastened to the frame **11** of the machine. The end portion **25** of each ram is freely slidable through a corresponding hole **31** in block **26**, the axial movement being limited in one direction by the stop nut **32** and lock nut **33**, threaded on the screw threaded free end of the end portion **25**, and being limited in the opposite direction by the helical spring **34**, surrounding the end portion **25** of the ram. The springs **34** are axially compressed between the block **26** and the shoulders **35** of rams **22**, to urge rams **22** toward the right and control the density of compression of the cork or other extrusion material, and to equalize the pressure of the rams, as well as prevent excessive pressure from being applied to the extrusion material. As the ram occupies the entire extrusion tube, all the cork granules received in a charge are compacted in the extrusion tube or primary extrusion conduit and forced out of the tube and into the secondary extrusion conduit (to be described) in a uniformly compacted condition.

The reciprocating piston rod **36**, bolted fast to the middle of block **26**, supplies the driving force for reciprocating the rams **22**. Rollers **27**, **28** in channels **29**, **30**, serve to guide the block **26** and to prevent upward or downward displacement of the driven ends of rams **22** when subjected to strong driving forces.

The hydraulic drive

The hydraulic drive unit **37**, Figs. 1 and 6, for reciprocating the piston **60** in the cylinder **59**, is driven by the electric motor **38**, of substantially constant speed, connecting with the power line **39** through the switch **40**. The motor **38** is mechanically coupled with the rotary pump **41** for pumping oil or other well-known suitable hydraulic fluid **42** from the reservoir **43** through the intake pipe **44**. The pump output pipe **45** transmits fluid pressure through pipes **46** and **47** to the conventional two-way rotary valve **48**, having its rotor **49**, when in the position shown, with its

port 50 connecting pipe 47 with pipe 51 through which the pressure is applied to the right-hand end of the piston 52 of the relay valve 53, thus forcing the piston 52 to the left wherein a passage is provided from the pump output pipe 45 through pipe 54, port 55 in piston 52, pipe 56, including valve 57, to the right-hand end of cylinder 59. Valve 57 has the adjusting screw 58 for regulating the speed of fluid flow into the cylinder 59. The fluid pressure forces the piston 60 toward the left-hand end of the cylinder 59. The fluid to the left of piston 60, when the piston moves to the left, escapes through pipe 61, port 62 of piston 52, pipes 63 and 64, and back to reservoir 43. The bypass pipe 71 includes the control valve 72 for regulating the amount of fluid bled from the pump to regulate the fluid pressure, indicated by indicator 73 and transmitted through the pump output pipe 45.

The rotors 67 and 49 of two-way valves 66 and 48, respectively, are mechanically coupled together so that they may be rocked in unison, as indicated schematically by the dotted line valve stem or shaft 74', which extends to and rigidly carries the tripping lever unit 74. The unit 74 has an arm 75 extending therefrom in the path of the control arm 76, which is rigidly fastened to the right-hand end of the control rod 77, welded or otherwise suitably secured to the free end of the bracket 78, which in turn is rigidly fastened by the screws 79 to the reciprocating block 26.

With the valves 66 and 48 set in the positions shown in Fig. 6, the piston rod 36 and control rod 77 are moved in the direction indicated by the arrows, until control arm 76 trips arm 75, thereby rocking arm 75, valve shaft 74' and valve rotors 49 and 67 in a counter-clockwise direction, as indicated by arrows, thereby blocking the passage from pipe 47 to pipe 51 through port 50, and opening up a passage for the transmission of pressure from pump output pipe 45, through pipes 46 and 80, valve port 68, and through pipe 65 to the left-hand end of piston 52 of relay valve 53. Piston 52 is then forced to the right by the fluid pressure, thereby blocking the passage from pipe 54 to pipe 56 through port 55, and opening up a new passage from pipe 54 to the branch passage 81 and pipe 61 to the left end of cylinder 59. The resulting fluid pressure on the left of piston 60, forces the piston to the right, the fluid to the right of piston 60, escaping through valve 57 and pipe 56, port 62, pipe 63, and pipe 64 to reservoir 43. The fluid to the right of valve piston 52, escapes through pipe 51, port 50, pipes 82, 70 and 64 to reservoir 43.

The tripping lever unit 74 has the arm 83 extending therefrom in the path of the control arm 84 which is rigidly fastened on the left-hand end of the control rod 77. When the piston 60 approaches the limit of its travel to the right, control arm 84 trips arm 83 and rocks unit 74, valve shaft 74' and the valve rotors 49 and 67 in a clockwise direction, thereby restoring these elements to the positions shown in Fig. 6. The above described cycle of events is then repeated in successive cycles, so that the piston 60 is thus automatically reciprocated at a speed under the control of adjustable valves 57 and 72. The control arms 84 and 76, which slide along control rod 77, are fastened thereto by set screws 129 and 130, respectively, which permit of adjustment of the positions of the arms on rod 77, to adjust the length of stroke of piston 60 and the rams 22 driven thereby, and to adjust the limit of travel of the rams 22 in either direction by selecting any

desired position where the unit 74 is tripped to reverse the direction of travel of piston 60.

Extrustion conveyor

An upper closed loop U, employing a train of extrustion blocks 85, of equal length and forming sections of the secondary extrusion conduit, is looped over the upper hexagonal driving drum 87 at the output end of the machine, Fig. 1, and over the idler drum 88 at the input end of the machine. A similar lower closed loop L, employing a similar train of extrusion blocks 86, is looped over the lower hexagonal driving drum 90 at the output end of the machine, and over the hexagonal idler drum 91 at the input end of the machine. The driving drums 87 and 90 are rigidly secured, respectively, to the shafts 131 and 132, journalled, respectively, at one end in the fixed frame member 133 and at the other end in a similar fixed frame member, not shown. Idler drums 88 and 91 are supported, respectively, on the shafts 134 and 135, journalled, respectively, at one end in the fixed frame member 136 and at the other end in a similar fixed frame member 137, Figs. 2 and 3.

The adjacent blocks 85 or 86 in loops U and L are coupled together by two flat links 92, each link being free to turn on a headed pivot pin 93, at either end of the link, and each pin 93 being rigidly supported by its associated block 85 or 86. It will be seen in Fig. 3 that the blocks 85 and 86 correspond approximately in length with the length of the sides of the polygon 88 or 91, over which they feed. Since the adjacent blocks 85 and 86 are linked together as closely as possible, to reduce the width of the joint between them to a minimum when the blocks are in straight alignment with each other, I have found it advantageous to provide a bevelled edge 94 at the transverse edges of each block, at the inside of the loops U and L, to provide clearance when the blocks are disposed at an angle to each other in passing over the drums 88 and 91, for example.

The back of blocks 85 and 86 are provided with parallel guide recesses 95, Figs. 3 and 4, extending lengthwise of the blocks to form continuous recesses which align with each other from block to block along the inside of loops U and L. The guide rollers 96, positioned below the upper run of the lower loop L, fit closely at their rims within the recesses 95 and roll freely therein to provide an anti-friction track for guiding and supporting the upper run of the lower loop so that it feeds in a straight line path between the input and output ends of the machine. Rollers 96 rotate freely on the fixed shafts 97, rigidly supported at their ends by the horizontal bars 98, forming a part of the fixed frame of the machine. Rollers 96 are held in fixed positions axially of shafts 97, by well-known means, not shown, so that they may serve to limit lateral movement of the lower loop as it feeds through the machine.

The guide rollers 99, similar to and spaced directly above the rollers 96, fit closely at their rims within the recesses 95 of the blocks 85 in the lower run of the upper loop and roll freely within recesses 95 to guide the lower run of the upper loop and to limit lateral movement thereof. Rollers 99 rotate freely on the fixed shafts 100, rigidly supported at their ends by the horizontal bars 101, which are secured by the bolts 102 to the fixed frame bars 98 into which they thread. By adjusting bolts 102 up or down, the pressure between the upper and lower registered

blocks may be varied. Lock nuts 103 retain the bolts 102 in their adjusted positions.

The blocks 85 in the upper loop U are preferably so positioned in relation to the blocks 86 in the lower loop L that the transverse joints 104 between the adjacent blocks in one loop are out of registration with the transverse joints 104 in the other loop, as indicated in Figs. 3 and 1a. Under these conditions, the blocks mutually brace each other and tend to keep in better alignment with each other at the transverse joints 104, thereby interrupting and reducing the annular flash on the extruded product.

The upper run of loop U and the lower run of loop L may be kept from excessive sagging by providing rollers at suitable points along these runs, as for example, rollers 105 and 105', Fig. 3, which are freely rotatable on the fixed shafts 106 and 106', supported rigidly by the fixed frame member 128 of the machine.

Opposite the faces of the blocks having the recesses 95 are parallel grooves 107 of semi-circular cross section and extending lengthwise of the blocks. The grooves 107 are so positioned that when the grooved sides of two blocks are brought into registration with each other, as shown in Fig. 4, where loops U and L come together, the resulting ducts 108 between the blocks are of circular cross section and extend in alignment with each other from block to block between the input and the output ends of the machine. The grooved blocks thus serve as sub-sections forming secondary extrusion conduits. Each of the extrusion ducts 108 is slightly larger in cross sectional area than the primary extrusion duct 16 with which it is aligned.

The blocks 85 and 86 are preferably cut from an aluminum extrusion. In addition to the roller receiving grooves 95 and the grooves 107, which form the extrusion ducts 108, the extrusion has a fin 109 and groove 110 so located that when one length of the severed extrusion is reversed and placed on the other, the fins 109 enter the grooves 110 and assure registry of the grooves 107. Owing to the staggering of the opposed blocks, the fin on one block enters grooves in two adjacent blocks.

At the output end of the machine, to the right in Fig. 1, the electric motor 111, of substantially constant speed, connects through the line 112 and the switch 113 with the power line 39. The motor pulley 114 drives belt 115, which in turn drives pulley 116, coupled through speed reduction gearing, not shown, in gear box 117, thereby driving gear pinion 118, meshed with the drive gear 119, rigidly coupled to the drum 90 through the shaft 132. Gear 119 also meshes with the drive gear 121, rigidly coupled to the drum 87 through the shaft 131. Gears 119 and 121 are of the same size and thus rotate drive drums 87 and 90 at the same speed and in opposite directions, as indicated by the arrows, to feed the upper loop in a counter-clockwise direction and the lower loop in a clockwise direction. The inner runs of the loops are thus fed between the sets of rollers 96 and 99, into close registration with each other, as shown in Fig. 3, around the output end of each primary extrusion conduit 15, where the registered blocks 85–86 telescope over the thin walled ends 21 of the primary extrusion conduits. The secondary extrusion conduits formed by the blocks travel at substantially constant speed over the secondary extrusion path to the output of the machine where the driving drums 87 and 90 progressively remove the loops U and L from registration with each other between the sets of rollers 96 and 99, thereby progressively removing the blocks 85 and 86 from the extrusion product 14.

An oven 122, Fig. 1, having any suitable heating means, such as the gas burner 123, and covered at the top and side walls with insulating material 124, provides a heating zone for drying or otherwise setting the glue or other binding means employed for binding together the particles of cork or other non-rigid material being extruded. The heating zone surrounds the extrusion path and preferably extends as indicated by the arrows in Fig. 1, from a point in the secondary extrusion path spaced slightly from the input end thereof, to a point farther along the path in the output direction, leaving room for a cooling zone extending from the heating zone to the output end of the machine as indicated by the arrows. The cooling zone shown in Fig. 1 depends entirely on natural convection, conduction and radiation of the heat from the extrusion material and parts of the machine being cooled.

In order to expedite cooling of the extrusion material within a relatively short zone, forced cooling may be employed, as shown in Fig. 1a, in which cooling air from a blower, not shown, is fed through the conduits 125 and 126, respectively above and below the registered blocks forming the secondary extrusion conduit, the air being directed toward the blocks through the air blast outlets 127, positioned at intervals along the conduits 125 and 126. The heating or cooling zones, or both, may be omitted where the nature of the extrusion material is such that these zones are not needed to convert the non-rigid material into rigid form.

The operation

The extruding operation is continuous so long as material is supplied and the oven heated (where necessary). Motor 38 operates the hydraulic drive 37, causing the rams 22, Figs. 2 and 3, to reciprocate between the positions 23 and 24, Fig. 3. Each time a ram 22 moves to the right of the position 23, the ram withdraws a charge of extrusion material 13 from the bottom of the hopper 12 and starts pressing it with increasing pressure toward the output end of the primary extrusion conduit 15, thereby compressing the charge to close the gaps in the extrusion material and to press the charge into a form corresponding with the cross sectional shape of the extrusion duct 16, which in the example chosen is a cylindrical form corresponding with the circular cross sectional shape of the extrusion duct. The ram 22 continues to press the formed charge until it is extruded as a partially completed extrusion product from the primary extrusion duct 16 into the secondary extrusion duct 108 formed by the moving blocks 85—86 in registration with each other.

The upper and lower trains of blocks, comprising the secondary extrusion conduits, travel in the extrusion direction at substantially constant speed, while the formed charges extruded by the primary extrusion conduits are fed only intermittently into the duct 108, but are timed in such relation to the movement of the duct 108, by adjustment of the valves 58 and 72 and by selection of motor speeds and gears and pulleys between motor 111 and drive drum 90, that the ram 22 separately rams each formed charge from duct 16 into bonding contact with the previously formed continuously moving charge in duct 108, with

sufficient force to add the successive charges together, one at a time, thereby uniting them into a single continuous length of material, held under the ramming pressure and by the clamping action of the blocks between the upper and lower sets of rollers 96 and 99.

At the same time that the successive charges are united together, the charge being pressed by a ram 22, is pressed by the ram from the form defined by duct 16 into the slightly larger diameter for corresponding with duct 108.

It will be seen that the continuous stream of extrusion material is moved at a uniform speed toward the output end of the machine by a power derived from motor 111. This power is independent of that exerted by the rams 22 in compressing the extrusion material and in uniting the successive charges together, and the speed depends upon the motor speed and gear ratios. It will also be noted that the material is extruded through the secondary extrusion conduits formed by the blocks, without any sliding friction between the extrusion conduit and the extrusion material, thus freeing the extrusion material from excessive distortions and undesirable forces, in contrast to the condition in the usual prior art operations wherein the material slides with high frictional resistance through a stationary duct, thereby limiting the extrusion of cork rods to short lengths of not over about 24 inches.

The glue or other means, by which the ground cork or other extrusion material is made rigid, is cured or otherwise made effective in the heating zone, followed by the cooling zone which further completes the binding operation, or cools the product for use.

At the output end of the machine, the extrusion blocks are drawn by the drums 87 and 90 from the space between rollers 96 and 99 and are carried over the drums 87 and 90, thereby removing the pressure of the blocks 86 from the rod 14, or other extrusion product, and releasing the product for its intended use.

The extrusion product may be made of any desired unlimited continuous length and has been found in practice to have a high degree of uniformity in quality and density of material, thus adapting it particularly for use as stock for making bottle cap liners, as referred to above, without appreciable waste of material and with a relatively small amount of attention and labor.

While four extrusion ducts 108 are shown in Fig. 4, it will be understood that the number and the cross sectional shape of the ducts, as well as the width of the blocks, may be varied within wide limits. Fig. 7 shows such a modification, in which the extrusion opening 138 between the blocks 85' and 86' is of rectangular cross sectional shape instead of circular (as in the case of the extrusion duct 108 in Fig. 4), and in which the one duct 138 takes the place of the four ducts 108 in Fig. 4. The extrusion product 139 is in the form of a flat bar of cork or other extrusion material, formed between the blocks 85' and 86', which are fed between the two sets of guide rollers 96 and 99, shown only in part, as in the case of blocks 85 and 86, Fig. 4, which are fed between similar rollers 96 and 99. The fin 109' and channel 110' on each block interlock, respectively, with the channel 110' and fin 109' of the other block to prevent objectionable lateral displacement of the blocks with respect to each other.

Fig. 8 shows a modification of the secondary extrusion block arrangement adapted for adjustment of the thickness of the extruded flat bar 140 extruded through the extrusion duct 141 between an upper block 142 and a lower block 143, fed between the lower set of rollers 96 and the upper set 99. In order to change the thickness of the extruded bar 140, the upper rollers 99 are adjusted up or down by the bolts 102, Fig. 4, by an amount corresponding the higher or lower position of block 142 for providing the desired spacing between blocks 142 and 143.

The cross section of the primary extrusion conduits and the ramming mechanism could be altered to correspond with the cross section of the product.

Since it is obvious that the invention may be embodied in other forms and constructions within the scope of the claims, I wish it to be understood that the particular form shown is but one of these forms, and various modifications and changes being possible, I do not otherwise limit myself in any way with respect thereto.

What is claimed is:

1. A cork extrusion machine having a primary extrusion conduit of uniform cylindrical bore throughout its length and having a hopper at the input end of the conduit adapted to receive a supply of coated cork granules, the outer diameter of the output end of the conduit being less than that of the input end to provide a thin wall, a plurality of trains of conduit sections split along a longitudinal axis, means for continuously moving said trains into registration with each other and closing them tightly around the thin walled output end of said primary conduit and for moving the registered trains away from the primary conduit in the direction of extrusion and at uniform speed, said sections when in registration forming a secondary extrusion conduit, a reciprocating ram closely fitting the bore of the primary conduit, means to operate the ram to move it from a rear position, where it allows a charge of material to fall from the hopper into the primary conduit, through the primary conduit and into the secondary conduit to extrude the entire charge through the primary conduit and force the charge beyond the end of that conduit and into the secondary contact and against the previously compacted charge therein, means for heating a portion of said secondary conduit to cure the compacted granules, and means for progressively removing said trains from registration with each other for releasing the extruded material from said secondary conduit.

2. A cork extrusion machine for operating on granulated cork precoated with adhesive and comprising a stationary tube of uniform internal dimension and having a charge receiving portion and a delivery end, a closely fitting ram in the tube, means for operating the ram from a rear position behind the charge receiving portion entirely through the tube and beyond the end of the tube whereby it compacts each charge in the tube to uniform diameter and completely forces the charges of compacted cork granules beyond the end of the tube, a longitudinally split, sectionalized, continuously moving tubular receiver for the charges and into which the ram enters when thus forcing the charges, means to close the receiver while in contact with the discharge end of the tube so that the compacted material cannot escape, means to hold the receiver against splitting when thus closed, a heating zone and a cooling zone through which the closed receiver successively passes, and means to open the re-

ceiver to separate it from the finished product.

3. In an extrusion machine for producing an unlimited length of round cork rod from loose particles of granulated cork precoated with adhesive and adapted to be permanently bonded together while under pressure, comprising a hopper for the granules, a horizontal tubular ram chamber open at both ends and having an opening to receive a charge of granules from the hopper, the ram chamber being of uniform circular cross-section throughout the length and extending forwardly of the hopper to form a primary extrusion conduit, the outer diameter of the output end of the primary extrusion conduit being less than that of the input end to provide a thin wall, a ram traversing the ram chamber and of corresponding cross-section, means to operate the ram from a rear position behind the hopper to a front portion where it protrudes from the primary conduit, the ram when retracted opening the ram chamber opening to the hopper and when moved forwardly pushing the charge in front of it, compacting it to a uniform density in the forward end of the ram chamber and forcing all of the compacted granules from the primary extrusion conduit and a substantial distance beyond the same, a plurality of trains of conduit section split along a longitudinal axis, means for continuously moving said trains into registration with each other and closing them tightly about the thin walled portion of the primary conduit and for moving the registered trains away from the primary conduit in the direction of extrusion and at uniform speed whereby the expansion of the cork granules upon entering the secondary conduit corresponds to the thin wall thickness, and means for heating a portion of said secondary conduit to cure the compacted granules, and means for progressively removing said trains from registration with each other for releasing the extruded material from said secondary conduit.

4. A cork extrusion machine having a primary extrusion conduit of uniform cylindrical bore throughout its length and having a hopper at the input end of the conduit adapted to receive a supply of coated cork granules, the outer diameter of the output end of the conduit being less than that of the input end to provide a thin wall, a plurality of trains of conduit sections split along a longitudinal axis, means for continuously moving said trains into registration with each other and closing them tightly around the thin walled output end of the said primary conduit and for moving the registered trains away from the primary conduit in the direction of extrusion and at uniform speed, said sections when in registration forming a secondary extrusion conduit, a reciprocating ram closely fitting the bore of the primary conduit, and means to operate the ram to move it from a rear position, where it allows a charge of material to fall from the hopper into the primary conduit, through the primary conduit and into the secondary conduit to extrude the entire charge through the primary conduit and force the charge beyond the end of that conduit and into the secondary contact and against the previously compacted charge therein.

JOHN WESTERBERG.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
815,647	Simpkin	Mar. 20, 1906
1,455,946	Wester	May 22, 1923
1,577,922	Marsa et al.	Mar. 23, 1926
1,603,140	Muller	Oct. 12, 1926
1,671,079	McManus	May 22, 1928
1,680,952	Muller	Aug. 14, 1928
1,905,663	Wallace	Apr. 25, 1933