Nov. 11, 1947. B. SCHONROCK 2,430,648

MACHINE FOR MAKING SWABS

Filed Oct. 8, 1943 7 Sheets-Sheet 1

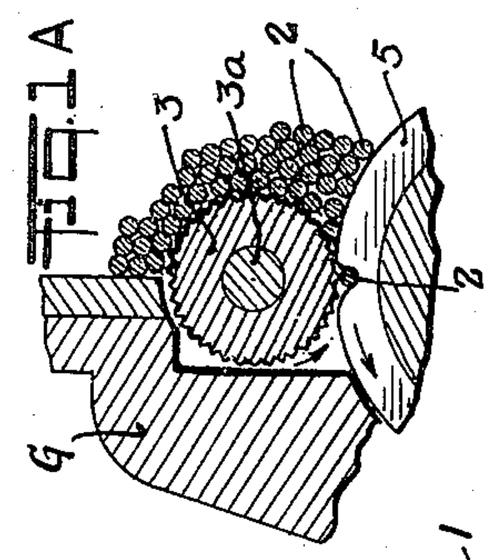

FIG. 1A

FIG. 1

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MACHINE FOR MAKING SWABS

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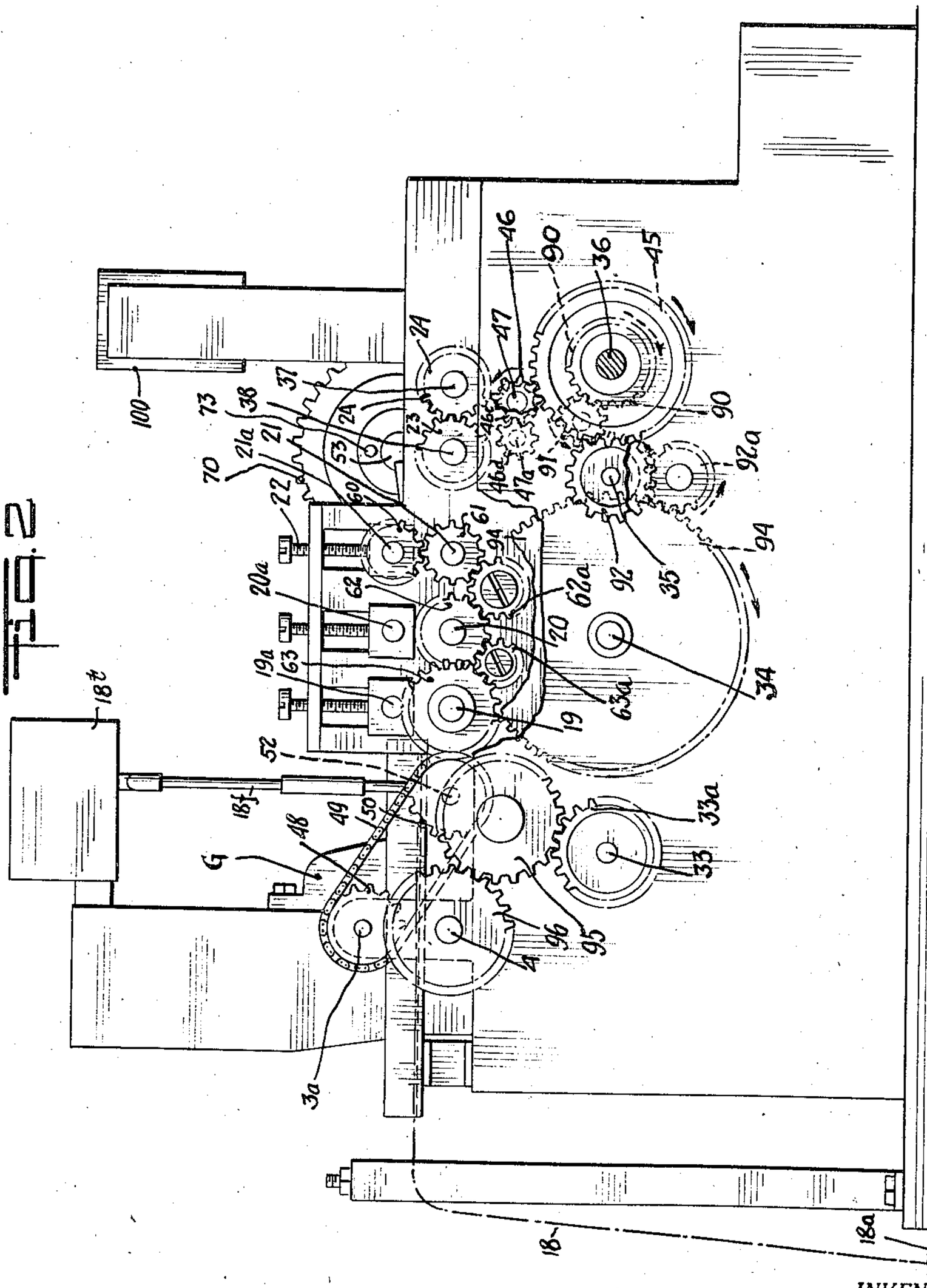
FIG. 2



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MACHINE FOR MAKING SWABS

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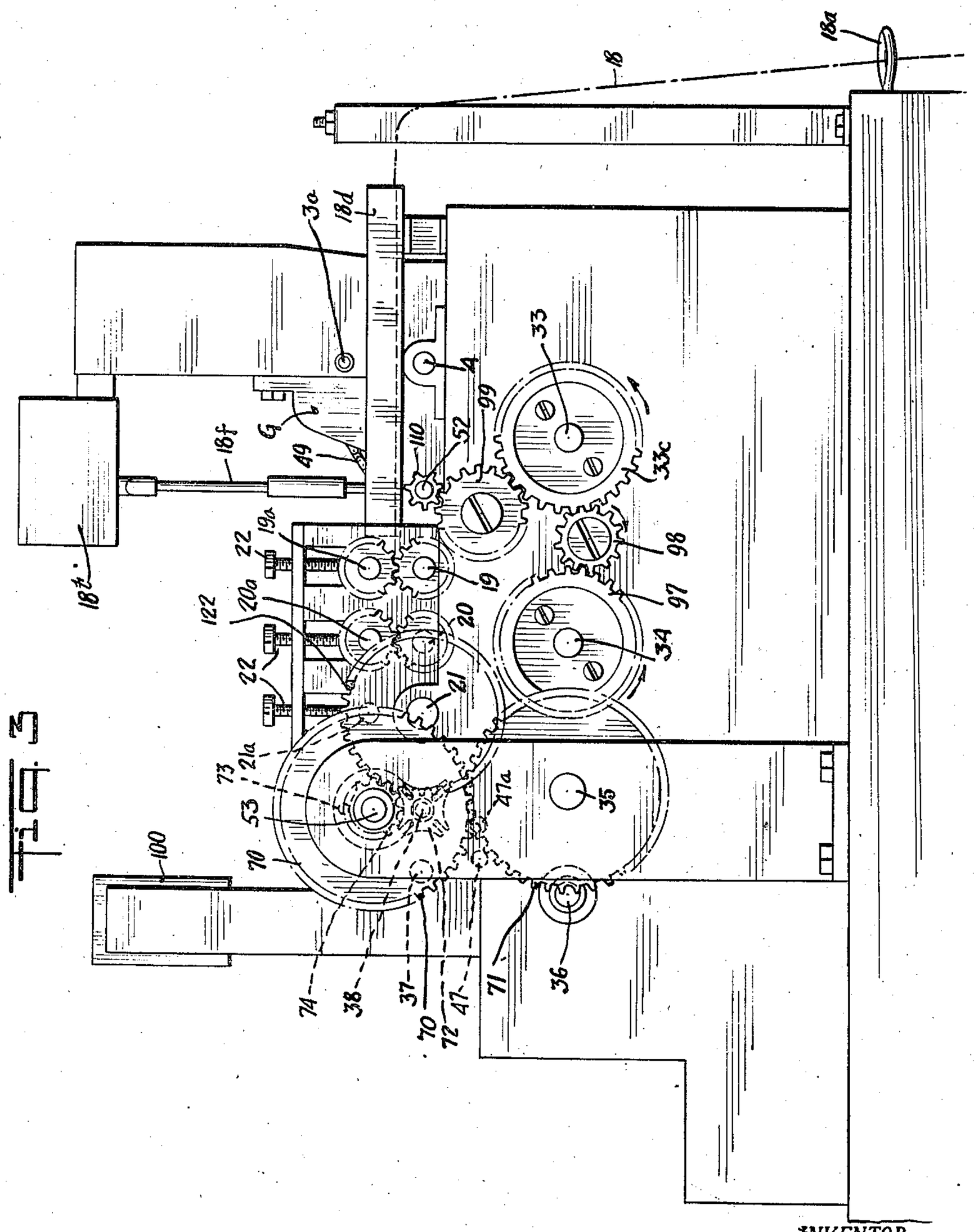

Fig. 3

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Fig. 4

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MACHINE FOR MAKING SWABS

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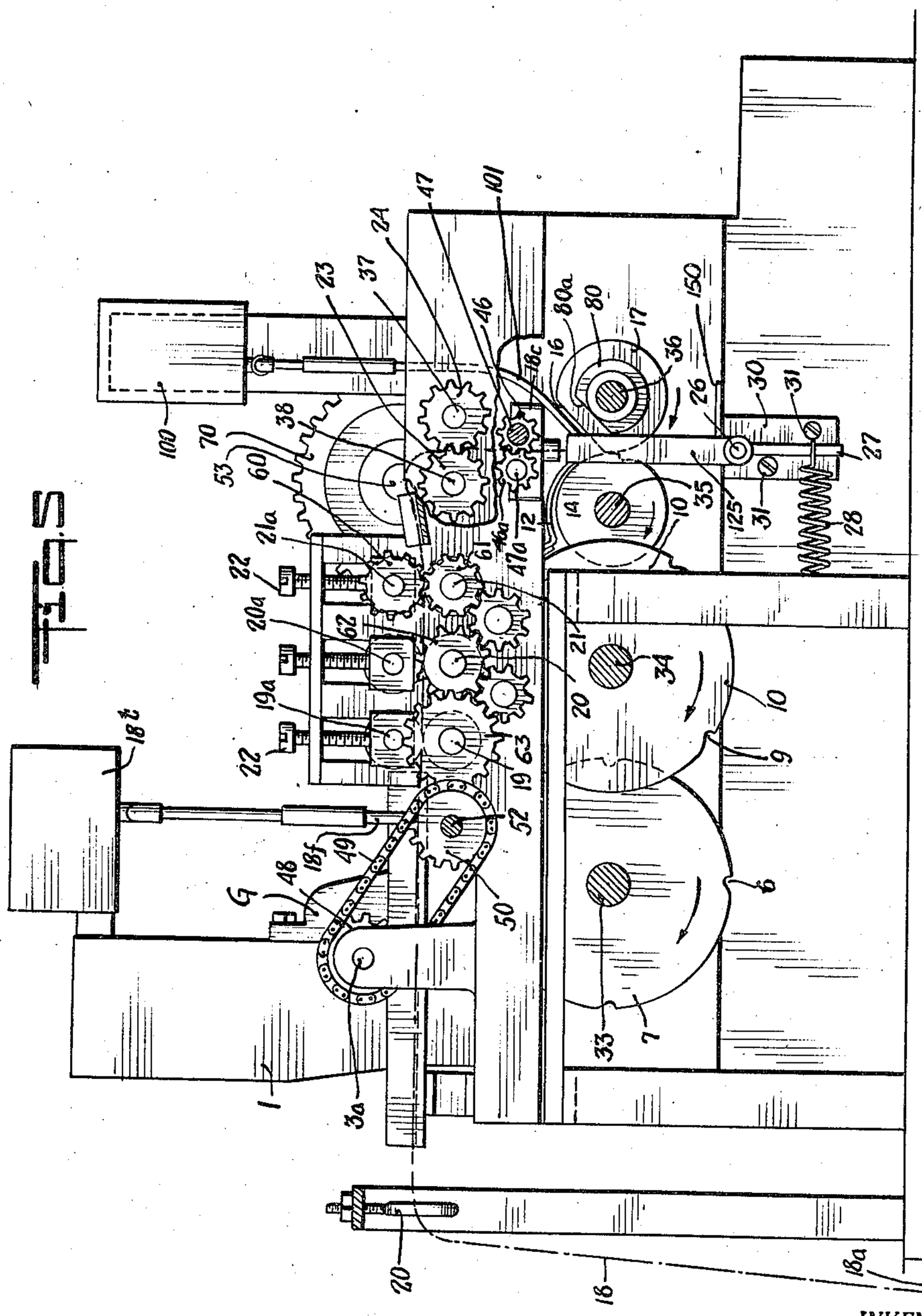
FIG. 5



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MACHINE FOR MAKING SWABS

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FIG. 7

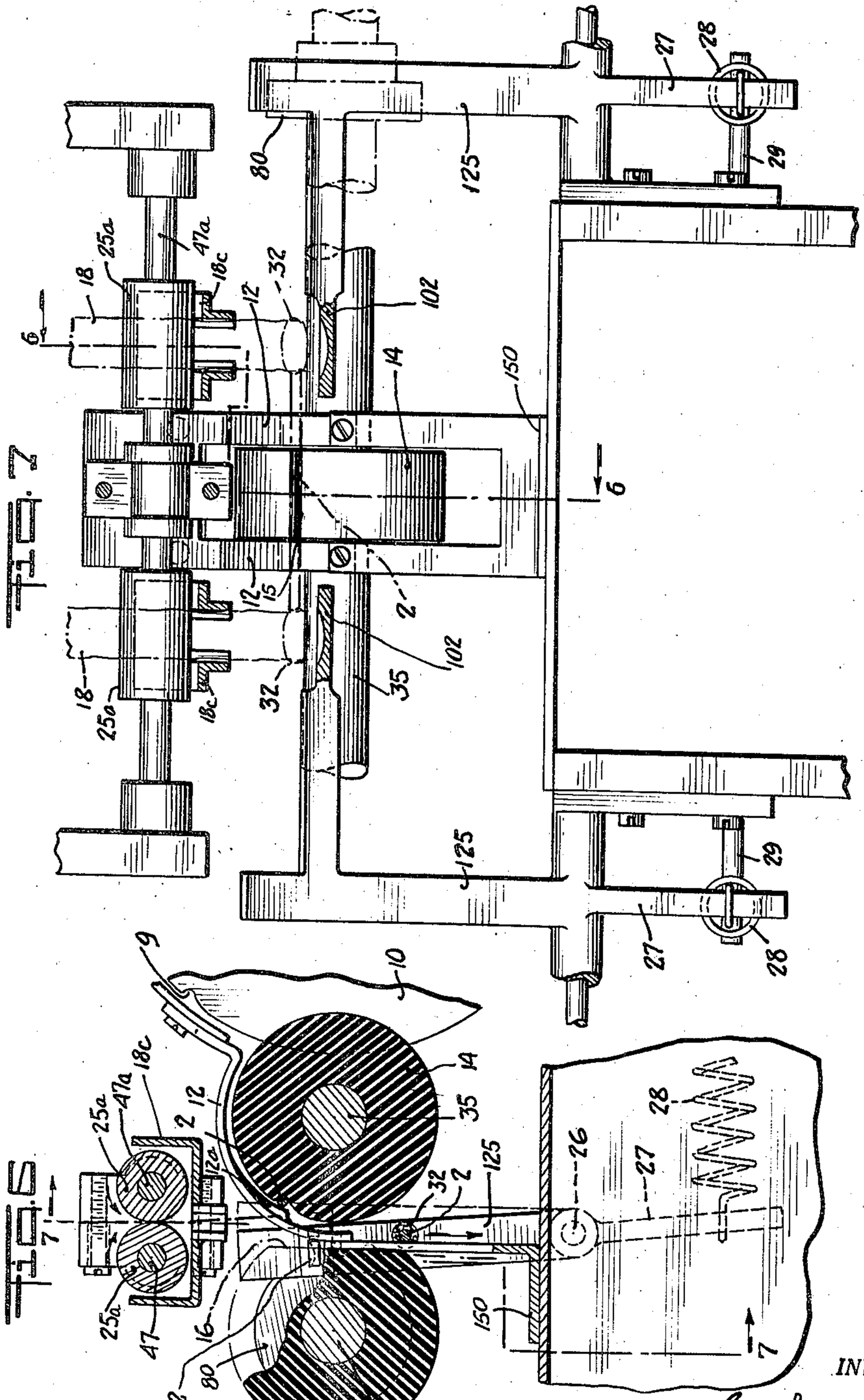

FIG. 8

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MACHINE FOR MAKING SWABS

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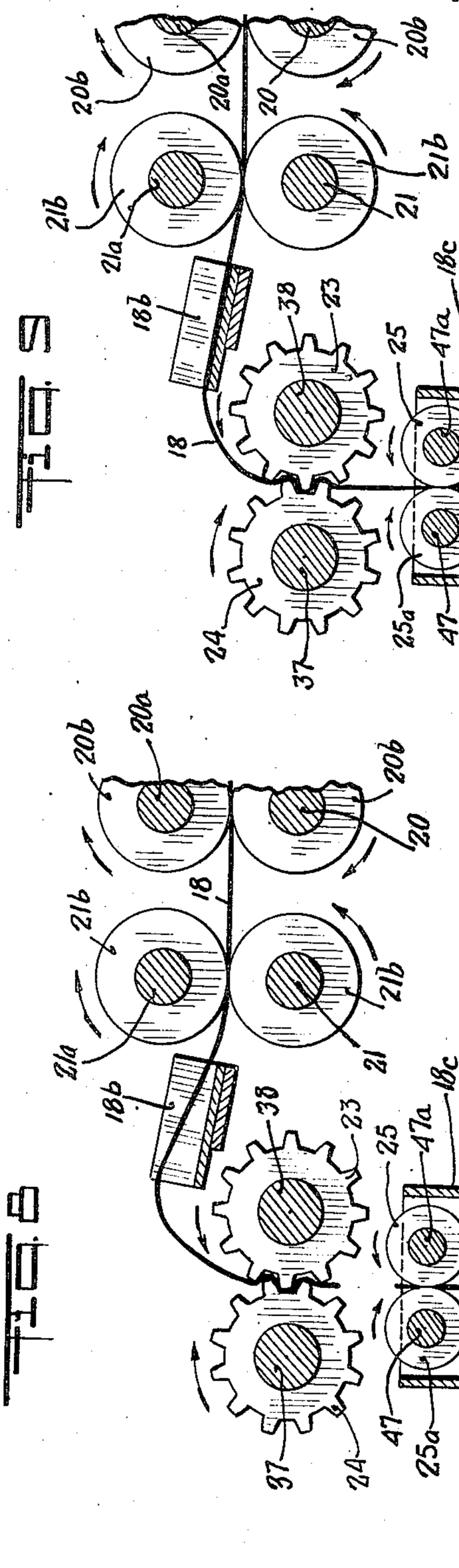

FIG. 9

FIG. 8

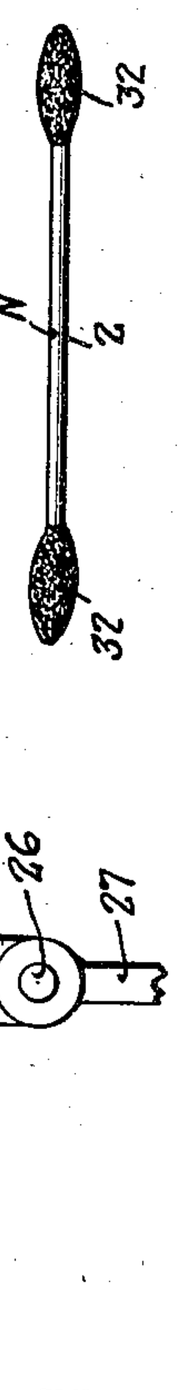

FIG. 10

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2,430,648

UNITED STATES PATENT OFFICE

2,430,648

MACHINE FOR MAKING SWABS

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Application October 8, 1943, Serial No. 505,485

4 Claims. (Cl. 19—149)

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This invention relates to an improved method and machine for making swabs and other articles. Such articles are sticks or rods to which one or more wound masses of absorbent material are applied and connected. Such absorbent applied material may be absorbent cotton, medicated or non-medicated. The invention is not limited to any type of applied absorbent material, and it is not limited to the use of applied material which is absorbent. The applied material can be wound on a mandrel which is made of any material. Said mandrel is preferably cylindrical, but it can have any shape.

It has been well-known for more than fifty years to treat a strand of absorbent cotton by several pairs of drawing rolls, in order to compress and attenuate such a strand without breaking the strand. It has also been well-known, for more than fifty years, to form a spirally wound lap of such attenuated cotton strand, by winding said strand upon a reel or mandrel which rests upon a pair of twirling rolls, which twirl said reel or mandrel around its own horizontal axis. It is also well-known, as in Felice U. S. Patent No. 1,700,584, to form a mass of cotton at the end of a wire mandrel which is rotated around its axis, and to interrupt the feed of the cotton, so that the continued twirling of the mandrel tears the cotton from a strand thereof.

The object of my invention is to apply these old principles to an improved swab-making machine which also has conventional transfer means for picking up the sticks one-by-one from a hopper, and for transferring such sticks to an assembly station, where the stick is assembled with the cotton. Such assembly station is provided with twirling rolls for twirling the stick, of the type shown in U. S. Patent No. 1,175,831, issued to Spinney on Mar. 14, 1916.

According to my invention, I provide one of said twirling rolls with a cut-away face, and I supply adhesive to the stick anterior the assembly station.

Another object of my invention, is to provide feeding-gears for feeding the compressed and attenuated sliver of absorbent cotton towards the assembly station, and to operate said gears intermittently, so that said gears are held fixed between successive feeding movements, and said gears then grip the sliver to prevent the anterior end-portion of the sliver from being fed towards the assembly station, unless the sliver is broken at said gears.

Another object of the invention is to provide

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continuously revolving feeding-rolls between said gears and the assembly station, so that respective lengths of the sliver are successively torn off at said gears, and each respective torn-off length is fed to the stick at the assembly station.

Another object is to provide each said respective length with adhesive, directly at the point where the respective length is spirally wound on the stick, so that the spirally wound layers remain adhering to each other, after the adhesive has dried or set. This prevents the spirally wound mass of cotton from unwinding.

Another object is to provide a method and machine whereby the swab is completed as a finally finished article, at the assembly station, so that the swabs can be directly delivered from the assembly station to packing mechanism.

The invention comprises additional combinations and parts, and it is not limited to the complete combination described herein, as the invention covers numerous sub-combinations.

Additional important objects and features of the invention will be stated in the annexed description and drawings, which illustrate a preferred embodiment thereof.

Fig. 1 is a section, partially in elevation, through the longitudinal, vertical, median plane of the improved machine. The parts which are shown in elevation, are in front elevation.

Fig. 1A is an enlarged detailed section of the means for removing the sticks from the hopper.

Fig. 2 is a rear elevation of the improved machine. The longitudinal succession of the parts in Fig. 2, is therefore shown reversely to the longitudinal succession of said parts in Fig. 1. The longitudinal direction is the horizontal direction in Figs. 1 and 2.

Fig. 3 is a front elevation of the improved machine.

Fig. 4 is an end elevation of the improved machine, taken at the left-hand end of Fig. 1.

Fig. 5 is a section on the time 5—5 of Fig. 4. Fig. 5 is partially in end elevation.

Fig. 6 is a section on the line 6—6 of Fig. 7. This shows in detail, the twirling rolls for revolving each stick around its own axis at the assembly station, and certain adjacent parts.

Fig. 7 is a section on the line 7—7 of Fig. 6.

Fig. 8 is a detail elevation, partially in section, of certain essential parts at the assembly station. These parts are shown in their relative positions, immediately after the twirling of the stick has been started.

Fig. 9 is similar to Fig. 8, showing how the completed swab is discharged from the machine.

Fig. 10 is an elevation of the completed swab, showing two masses 32 of applied material, located on the stick or rod 2. The invention includes a machine which will apply only a single mass of material.

Two dry strands 18 of the applied material, such as dry absorbent cotton, are fed into the inlet end of the machine, by means of respective vertical guides 18*a*, respective horizontal guides 20, and respective longitudinal guides 18*d*. These guides 18*a*, 18*b*, and 18*d* are fixed to the frame of the machine. Each fixed guide 18*d* can have a longitudinal bore or channel, in which the respective strand 18 can be accurately longitudinally guided.

Each of the dry strands 18 passes between respective pairs of drawing or attenuating rolls 19*b*, 20*b*, and 21*b*. The rolls of each said pair are in vertical superposed relation. There are six pairs of said rolls, three pairs being provided for each strand 18. These rolls are made of steel or other suitable material. Such attenuating rolls are well-known per se, because such rolls have been used in attenuating rovings, beginning with the Arkwright spinning machine of 1768.

The respective rolls 19*b* are fixed to respective shafts 19 and 19*a*. The respective rolls 21*b* are fixed to respective shafts 21 and 21*a*. The actuating mechanism for operating the various movable parts, will be later described. Said attenuating rolls are of equal diameter, and the respective pairs are rotated at respective different angular velocities, so that rolls 20*b* have a greater peripheral speed than rolls 19*b*, and rolls 21*b* have a greater peripheral speed than rolls 20*b*. The attenuating rolls of each pair turn at the same constant speed. These consecutive pairs of attenuating rolls therefore exert pressure and also exert a drawing and elongating and attenuating action, upon the dry strands 18. Each strand is permanently compressed and attenuated by the respective attenuating rolls.

The upper shafts 19*a*, 20*a*, and 21*a* are provided with respective vertically slidable bearings, which are vertically guided in respective suitable guides which are fixed to the frame of the machine. Each said bearing has an associated pressure screw 22, whose threaded shank passes through a tapped bore of a wall of the respective guide. The pressure between each said pair of attenuating rolls can thus be regulated.

Each condensed and drawn and attenuated dry strand 18 then passes through a respective fixed guide 18*b*, and each strand 18 then passes downwardly between the teeth of a respective pair of intermeshing feeding and gripping gears 23 and 24. As shown in detail in Figs. 8 and 9, each strand 18 intermeshes with the teeth of the respective pair of gears 23 and 24. Said gears 23 and 24 are intermittently revolved so that each said gear always turns in the same respective direction. Each gear of said pair 23, 24 is turned oppositely to the other gear of said pair. When said gears 23 and 24 are held stationary, they exert sufficient frictional grip on the respective dry and attenuated strand 18, to prevent the movement of said respective strand 18, downwardly away from the respective pair of feeding and gripping gears 23 and 24.

By compressing and attenuating each strand anterior its respective gears 23 and 24, each strand is made dense and strong, so that when a respective pair of gears 23 and 24 are held stationary, said gears can hold the respective strand against downward movement away from said gears.

Each strand 18 then passes downwardly between a respective pair of pull-rolls 25 and 25*a*, which are located in a guide casing 18*c*, which has a vertical outlet guide throat, through which the respective strand 18 passes. The reference letter T in Fig. 8 denotes an anterior end-length of a respective strand 18, which has been torn or separated from the respective strand. This separation is caused by the continuously revolving pull rolls or tearing-rolls 25 and 25*a*, which revolve continuously, thus tearing a predetermined anterior length T off the end of the respective strand 18, during the period in which the gears 23 and 24 are held stationary to hold the respective strand 18 against the downward pulling movement of the pull-rolls 25 and 25*a*.

Each end-portion of the stick 2, to which the respective length T is applied at the assembly station in order to form the respective wound swab-mass 32, is provided with a spot or spots or with a layer of adhesive, prior to the application of the respective length T to the stick at the assembly station. This adhesive may be a solution or dispersion of gum arabic in water. I can use any type of adhesive.

This adhesive is located in a tank 18*t*, which has two vertical and laterally spaced outlet pipes 18*f*. The bottom ends of pipes 18*f* are located directly above the top of applicator rolls 52*g*, which are fixed to lateral shaft 52. The bottom end of each pipe 18*f* is very slightly spaced from the top of the respective roll 52*g*. The flow of adhesive through pipes 18*f* is controlled by any suitable means, such as by making said pipes 18*f* of narrow bore, by providing valves, etc. The end-portions of the sticks 2 project laterally beyond the ends of discs 7, at the station where the adhesive is applied. At the adhesive-applying station, the projecting end-part of each stick contacts with the bottom of the respective revolving roll 52*g*, so that each projecting end-part of stick 2 picks up a thin spot or spots or a thin layer of said adhesive from the respective roll 52*g*.

At this adhesive-applying station, each stick 2 may revolve around its own axis, or the adhesive may be applied without revolving the stick around its own axis.

A liquid adhesive or binder is applied to each dry length T at the assembly station, so that the layers of each length T will firmly adhere to each other. This binder is applied to each length T, directly at the point where the respective length T is wound on the stick 2. I thus apply the binder or adhesive to each length T, during the formation of the swab, so that each swab is completed as a finished and salable article at the assembly station. The adhesive which is applied to the respective lengths T of the dry absorbent cotton at the assembly station may also be an aqueous solution or suspension of gum arabic. The adhesive which is applied to the end-portions of the stick by rolls 52*g* is thick and viscous, and the adhesive which is applied to each length T at the assembly station is thin and fluid. Each mass 32 is provided with sufficient adhesive, to prevent unraveling of said mass 32 when the water of the adhesive has evaporated.

The adhesive which is applied to the respective lengths T at the assembly station, is located in respective tanks 100, which have respective vertical outlet pipes 101, through which the flow of the thin adhesive is controlled at a constant rate.

The adhesive is supplied to the sticks and to the lengths T, in the form of intermittent drops. The delivery of these drops is timed, by control-valves, so that each drop is taken up by the respective end-portion of the stick at the adhesive-applying station or by the respective length T at the assembly station. Hence, there is little or no dripping of the adhesive at either station.

The sticks 2 are located in a hopper 1, at whose outlet a corrugated and continuously rotating roll 3 is located. Said roll 3 agitates the pile of sticks 2, to prevent clogging at the outlet of the hopper, where the sticks are picked up one by one, by the pick-up discs 5.

The respective laterally spaced pick-up discs 5, whose peripheries have notches 5*a*, project partially into hopper 1. Said discs 5 are fixed to a lateral shaft 4. The respective pairs of laterally alined notches 5*a*, pick up the sticks 2, one by one. Each stick 2 is moved out of hopper 1, under a fixed guide G, which is fixed to a wall of the hopper 1, which is fixed to the frame of the machine. Said guide G prevents sticks 2 from shifting laterally relative to discs 5.

Each stick 2 is delivered by the pick-up discs 5 to a pair of laterally spaced transfer discs 7, which are fixed to a lateral shaft 33. Said discs 7 have notches 6, which are arranged in laterally alined pairs. The leg 8 of a guide which is fixed to the frame of the machine, guides the transfer of the sticks 2, from discs 5 to discs 7.

The end-portions of the sticks project laterally beyond discs 7, so that said projecting end-portions are provided with adhesive by rolls 52*g*, while the sticks are located in notches 6. The sticks 2 are then transferred from discs 7 to the laterally alined notches 9 of additional laterally spaced transfer discs 10, which are fixed to lateral shaft 34, this transfer being guided by a leg 11 of said fixed guide.

The front and rear end-portions of each stick 2, project laterally, namely, in a direction perpendicular to the plane of Fig. 1, beyond the respective discs 5, 7 and 10. Each said end-portion of the stick projects equally beyond said respective discs. Suitable guide means, not shown, are provided to prevent the sticks from shifting laterally relative to said discs 5, 7, 10, and the other parts which feed each stick to the assembly station. Such guide means are well-known per se.

Each stick is delivered from discs 10 to a lateral twirling roll 14, which is made of resilient vulcanized rubber, which has a high coefficient of friction. This twirling roll 14 has a single notch 15. The front and rear ends of said twirling roll 14 are located laterally between the discs 10. Said twirling roll 14 feeds each stick 2 between the periphery of said roll 14 and a fixed guide 12, which has a fixed wedge 12*a*, as shown in Figs. 8 and 9, to the assembly station. The lateral notch 15 is parallel to the axis of roll 14. As shown in Fig. 8, while the stick is being twirled, the median part of the stick abuts the bottom end-wall of wedge 12*a*, which exerts sufficient downward pressure on the stick to secure the twirling action.

At the assembly station, which is shown in Fig. 8, the twirling roll 14, which is a continuous cylinder, save where its periphery is interrupted by the single lateral notch 15, is associated with a companion twirling roll 17, whose periphery has the shape of a part of a cylinder. Said companion twirling roll 17 has a resilient periphery, which is made of vulcanized rubber or other suitable material, and which has a planar face 16.

Said twirling rolls 14 and 17 are revolved continuously in the same direction, so that the adjacent portions of their respective peripheries turn continuously in opposite directions.

Fig. 1 shows the stick abutting the bottom end-wall of wedge 12*a*, just after the stick has been released from notch 15, and just before the cylindrical or convex part of roll 17 abuts the stick, to start the twirling of the stick.

The stick is supported upon the roll 14 and upon the cylindrical part of roll 17 during the twirling operation. The parts of said rolls 14 and 17 which support the stick horizontally during the twirling operation, are located above the horizontal axes of said rolls 14 and 17.

It has been well-known for more than fifty years, to wind material upon a mandrel or reel, which rests initially upon the peripheries of two cylindrical twirling rolls, which rotate the reel. However, since I wind the lengths T upon sticks 2 of very small weight, I use the downward pressure of wedge 12*a*, in order to produce the necessary frictional drive between stick 2, the roll 14, and the cylindrical or convex part of roll 17.

The axes of rolls 14 and 17 are parallel to each other, and said axes are located in the same horizontal plane.

As shown in Fig. 7, I provide respective and laterally spaced formers 102 at the assembly station. Said formers 102 have respective recesses, at which the respective masses 32 are wound. The top faces of formers 102 can be planar or of any form. In this embodiment, said top faces are planar, save where the recesses are provided.

At the beginning of the twirling operation, the end-portions of each stick 2 are slightly above the unrecessed parts of the top faces of the formers 102. The stick then rests only upon the roll 14 and upon the convex or cylindrical part of roll 17. As the cotton is wound, the masses 32 become thicker and these masses 32 exert a lifting effect upon the end-portion of the stick 2, because such masses 32 then exert pressure upon the bottom faces of the recesses of the formers 102, thus exerting upward pressure upon the end-portions of stick 2, on which the masses 32 are wound. The end-portions of stick 2 are thus fixed upwardly, while the median part of stick 2 is held against upward movement by wedge 12*a*. The sticks 2 are resilient, so that they return to their straight shape after such flexing. During a part of the twirling operation, a part of the periphery of each mass 32 contacts with a respective former 102, which is held stationary during the twirling operation.

There is always enough frictional contact between each stick and the twirling rolls 14 and 17, to twirl each stick 2 until the masses 32 have been completely formed.

The axis of each stick 2 is kept substantially or wholly horizontal, while said stick 2 is thus supported and twirled by the rolls 14 and 17.

Each rigid former 102 is integral with a respective rigid arm 125, which, as shown in Fig. 1, is turnably connected to the frame of the machine by a shaft 26. Each arm 125 has a rigid depending extension 27. One end of a respective biasing tension spring 28 is fixed to each extension 27. The other end of each tension spring 28 is fixed by a respective pin 29 to the frame of the machine.

Hence, each former 102 is biased by its respective tension spring to move towards shaft 36 of roll 17.

As shown in Fig. 4, said shaft 36 of roll 17 has cams 80, which control the positions of the respective arms 125 and their respective formers

102. A part of the representation of roll 17 has been omitted in Fig. 6, in order to show one of said cams 80. Each said cam 80 has a planar face, which is indicated in Fig. 1. Each said planar face of each cam 80, is parallel to or inclined to, the face 16.

Due to the planar face 16, the periphery of roll 17 is cut away, about 120 degrees.

Each stick 2 is thus twirled about its horizontal axis, while the rolls 14 and 17 turn in unison during an arc of about 240 degrees. The periphery of roll 14 is sufficiently resilient and yieldable, so that its notched portion at the notch 15 releases and moves away from the stick 2, after said stick 2 has been delivered to the assembly station above the formers 102. At the completion of the twirling operation, the planar face 16 of roll 17 is directly adjacent roll 14, so that the stick is no longer frictionally engaged between the rolls 14 and 17.

Fig. 9 shows the respective vertical positions of the planar face 16, after the completion of the respective twirling operation. The planar faces of cams 80 permit the arms 125 to move from their vertical forming or operative positions which are shown in Fig. 1, to the inclined and inoperative positions which are shown in full lines in Fig. 6, and which are also shown in Fig. 9, at the completion of the twirling operation.

Fig. 8 shows how the notch 15 of roll 14 has moved beyond the stick 2, and it illustrates the location of notch 15 just after the beginning of the twirling operation.

The completed swab is thus released by the movement of formers 102 under the force of springs 28, to drop into a collecting box. The stick 2 is prevented from moving away from the assembly station by means of the vertical leg of a fixed guide 150.

The movable parts of the machine are actuated as follows:

As shown in Fig. 4, there is a main shaft 36, which is laterally disposed. Said shaft 36 has a drive pulley 42. There is an idler pulley 41, to which the drive belt 39 can be shifted from pulley 42. The shaft 36 has a handwheel 40.

Roll 3 and rolls 52g

As shown in Fig. 2, a sprocket 48 is fixed to the shaft 3*a* of agitating roll 3. Said sprocket 48 is connected by chain 49 to sprocket 50, which is fixed to shaft 52. Paste-applying rolls 52*g* are fixed to shaft 52.

As shown in Fig. 3, shaft 52 is connected by its gear 110 and idler gear 99, to gear 33*c* which is fixed to shaft 33. Fig. 3 also shows that gear 33*c* meshes with idler gear 98, which meshes with gear 97, which is fixed to shaft 34. As shown in Fig. 2, a gear 94 is fixed to shaft 34. Said gear 94 meshes with idler gear 92*a*, which meshes with gear 92, which is fixed to shaft 35. Said gear 92 meshes with idler gear 91, which meshes with gear 90 which is fixed to main drive shaft 36.

Discs 5

Both discs 5 are fixed to a common lateral shaft 4, said lateral shaft 4 being shown in Fig. 1.

As shown in Fig. 2, a gear 96 is fixed to shaft 4. Fig. 2 also shows that the gear 96 meshes with an idler gear 95, which meshes with gear 33*a*, which is fixed to shaft 33. As previously stated, and as shown in Fig. 3, gear 33*c* of shaft 33 meshes with idler gear 98, which meshes with gear 97 of shaft 34. As previously stated, gear 94 of shaft 34 meshes with idler gear 92*a*, which meshes with gear 92 of shaft 35, and said gear 92 meshes with idler gear 91, which meshes with gear 90 of shaft 36.

Discs 7

Said discs 7 are fixed to the common lateral shaft 33. The drive of said lateral shaft 33 from the shaft 36, has already been described.

Discs 10

The discs 10 are fixed to a common lateral shaft 34. The drive of said shaft 34 from the shaft 36 has already been described.

Rolls 17 and 14

The roll 17 is fixed to the drive shaft 36. The roll 14 is fixed to the shaft 35. As previously described, the gear 92 of shaft 35 meshes with idler gear 91, which meshes with gear 90 of shaft 36. The gears 90 and 91 and 92 are proportioned so that the shafts 35 and 36 make the same number of revolutions per minute. The diameter of the cylindrical part of roll 17 is equal to the diameter of the unnotched part of the periphery of roll 14.

As shown in Fig. 10, the stick 2 may be provided with a depression N, whose cross-section is angular in the axial plane of the stick 2. As shown in Fig. 4, the roll 17 is provided with a median transverse recess which is provided at one part thereof with a projection or tooth N*a*. When the roll 17 is rotated in order to discharge the completed swab, said tooth N*a* passes through the recess N, thus aiding in the discharge of the stick.

Drawing rolls

As shown in Fig. 3, the shaft 21 has a gear 122 fixed thereto. Said gear 122 meshes with a smaller gear 74 which is fixed to the stud shaft 53. A gear 70, which is fixed to stud shaft 53, meshes with gear 71 which is fixed to shaft 35. The primary drive of the drawing rolls is therefore produced by means of the shaft 21.

Fig. 2 shows that the shaft 21 has a gear 61 fixed thereto, and said gear 61 meshes with a gear 60 which is fixed to the shaft 21*a*. Hence, the top and bottom rolls 21*b* are positively driven.

Fig. 2 also shows that the gear 61 of shaft 21 meshes with an idler gear 62*a*, which meshes with a gear 62 which is fixed to shaft 20.

As shown in Fig. 3, shafts 20 and 20*a* are connected by equal intermeshing gears, so that both rolls 20*b* are positively driven.

Fig. 2 shows that gear 62 of shaft 20 meshes with an idler gear 63*a*, which meshes with a gear 63 which is fixed to shaft 19. Fig. 3 shows that the shafts 19 and 19*a* are provided with equal and intermeshing gears, so that the shaft 19*a* is positively driven from the shaft 19.

Hence, all the rolls 21*b* and 20*b* and 19*b* are positively driven. Said rolls have peripheries of equal diameter. The peripheries of each superposed pair are driven at the same speed. The rolls 20*b* are driven at greater peripheral speed than the rolls 19*b*, and the rolls 21*b* are driven at greater peripheral speed than the rolls 20*b*.

Gears 23 and 24

Since these gears 23 and 24 are intermesh, they couple the respective shafts 37 and 38 of said gears.

Fig. 3 shows that a Geneva-stop disc 72 is fixed to the shaft 38. Said disc 72 is of the conventional type, being provided with a diagonal recess at each of its corners and being provided with concave faces intermediate said corners. Figs. 3

and 4 show the usual pin **73**, which is fixed to a disc **73***a*, which is fixed to the stud shaft **53**. Hence, the continuously rotating stud shaft **53** causes the shaft **38** to be intermittently turned, each said turning movement being through an angle of 90 degrees. In this embodiment, each of the gears **23** and **24** has twelve teeth, and during each intermittent movement, each said gear is turned through an arc which corresponds to three of said teeth. The Geneva stop locks the gears **23** and **24** against turning, between successive movements thereof.

Rolls 25 and 25a

Figs. 4 and 2 show that gear **45**, which is fixed to shaft **36**, meshes with a gear **46** which is fixed to shaft **47**. Another gear **46***c* is fixed to said shaft **47**. Fig. 2 shows that said gear **46***c* meshes with an equal gear **46***d*, which is fixed to shaft **47***a*.

Operation of the machine

The sticks are withdrawn from the hopper, one by one, by means of the discs **5**. Each stick is then delivered to the discs **7**, then only the end-portions of each stick are provided with adhesive by rolls **52***g*, and each stick is then delivered to the discs **10**, and then to the notch **15** of the roll **14**.

The drawing rolls operate to condense each dry strand of absorbent cotton or the like, and also to elongate and attenuate each said strand, but without breaking said strand. The strand is then fed continuously towards the intermittently operated gears **23** and **24**, and in intermeshing relation with the teeth of said gears. Each strand is pulled forwardly and continuously, by means of the rolls **25** and **25***a*. Due to the intermittent stopping of the gears **23** and **24**, the rolls **25** and **25***a* operate to break off successive predetermined lengths of each said strand. The lower end of each dry strand is brought into contact with the projecting end-portion of the stick at the assembly station, while the strand is supplied with adhesive at the assembly station. The length of absorbent cotton which is to be wound up may be slightly inclined from the vertical direction, when the bottom end of said sliver of cotton touches the end of the stick. While the gears **23** and **24** are held stationary, the drawing rolls **19***b*, **20***b*, and **21***b* forwardly feed the sliver, which forms a bight above gears **23** and **24**. When said gears **23** and **24** are operated, they take up the bight and feed the material of the bight to rolls **25** and **25***a*. Each stick is then twirled about its own axis, in order to form the rolls or masses **32**.

After the twirling has been completed, the planar face **16** of the roll **17** is presented to the assembly station, thus stopping the twirling. The continued rotation of the roll **17** and of the cams **80** on the shaft **36**, finally permit the formers to be moved to the discharge position. Each completed swab then drops into a suitable collecting chute.

While the stick is being twirled at the assembly station which is provided with the rolls **17** and **14**, the feed of each length T towards the twirling stick is regulated by the rolls **25** and **25***a*, so that each length T is wound under zero back tension, to produce a spiral mass **32**.

The space between the tearing-rolls **25** and **25***a* is only about 0.003 inch to 0.004 inch. The absorbent cotton is fed into the machine, in the form of a thin strand, whose width is about 0.625 inch to 0.75 inch. The thickness of such strand,

when it is fed into the machine, is about 0.125 inch, and such thickness is reduced to about 0.007 inch by the gang of drawing rolls, which produce a sliver of the absorbent cotton. In this machine, I have illustrated only three pairs of drawing rolls, so that the absorbent cotton is attenuated in two successive passes. I can use any number of pairs of drawing rolls, depending upon the thickness of the cotton which is fed into the machine. The original width of the cotton strand which is fed into the machine, is reduced by the attenuating and stretching action of the drawing rolls. Hence the initial width of the cotton strand is reduced to about 0.5 inch by the drawing rolls. Hence the length T of the cotton sliver which is wound around the stick **2**, has a width of about 0.5 inch and a thickness of about 0.003 inch to 0.004 inch. These dimensions and the attenuating and drawing action of the drawing rolls, are important in order reliably to tear the cotton into lengths T, by means of the intermittently locked gears **23** and **24**, and the continuously revolving tearing-rolls **25** and **25***a*.

If desired, the screws **22** can be adjusted, so that the thickness of the cotton which is fed to the tearing-rolls **25** and **25***a*, is substantially thicker than the clearance between said rolls **25** and **25***a*. In such case, the rolls **25** and **25***a* will substantially compress the cotton, in addition to tearing off successive lengths T. Therefore, I can adjust the machine so that rolls **25** and **25***a* either do not compress the sliver, or else said rolls **25** and **25***a* substantially compress the sliver. If the rolls **25** and **25***a* substantially compress the sliver, then the thickness of the wound masses **32** is increased. That is, the drawing rolls impart a substantially permanent set to the sliver. If the rolls **25** and **25***a* compress the sliver, the set of the sliver is not permanent, so that the thickness of the sliver increases directly after the rolls **25** and **25***a*.

I claim:

1. In a swab-making machine which has an assembly station, a first roll and a second roll located at said assembly station, the first roll having a cylindrical periphery, the second roll having a partial cylindrical periphery and also having a cut-away face which is closer to the axis of said second roll than its partial cylindrical periphery, means adapted to revolve said rolls in the same direction, the partial cylindrical periphery of the second roll and the cylindrical periphery of the first roll being sufficiently close to support a stick in twirling position and to twirl said stick around its own axis while the stick is in said twirling position, said machine also having swab-formers, the tops of said rolls being located higher than said swab-formers, said swab-formers being located below the end-portions of the stick while the stick is being twirled, said swab-formers being movable towards the axis of the second roll, biasing means biasing said swab-formers towards the axis of the second roll, automatic means holding said swab-formers against said biasing movement until said cut-away face is directly adjacent the periphery of the first roll.

2. A machine according to claim 1, in which said automatic means are cams which are fixed to the shaft of said second roll, said machine having a fixed guide which guides the movement of the stick away from said rolls when said face is directly adjacent the periphery of the first roll.

3. In a machine for winding a mass of flexible material on a mandrel, a first twirling roll, a second twirling roll, said twirling rolls having re-

spective resilient peripheral portions, a first part of the peripheral portion of the first twirling roll having the shape of a part of a cylinder, said peripheral portion of said first twirling roll also having a cut-away face, the peripheral portion of said second roll being of cylindrical shape which has a notch therein, said rolls having parallel longitudinal axes, said notch being parallel to said axes, means for rotating said rolls in respective opposed directions, said peripheral portions being sufficiently close to each other to support and to twirl a mandrel when said first part of the peripheral portion of the first twirling roll is in registration with the peripheral portion of the second twirling roll, said rolls releasing said mandrel when said cut-away face registers with the peripheral portion of the second twirling roll.

4. In a machine for winding a mass of flexible material on a mandrel, a first twirling roll, a second twirling roll, said twirling rolls having respective resilient peripheral portions, a first part of the peripheral portion of the first twirling roll having the shape of a part of a cylinder, said peripheral portion of said first twirling roll also having a cut-away face, the peripheral portion of said second roll being of cylindrical shape which has a notch therein, said rolls having parallel longitudinal axes, said notch being parallel to said axes, means for rotating said rolls in respective opposed directions, said peripheral portions being sufficiently close to each other to support and to twirl a mandrel when said first part of the peripheral portion of the first twirling roll is in registration with the peripheral portion of the second twirling roll, said rolls releasing said mandrel when said cut-away face registers with the peripheral portion of the second twirling roll, and means to hold said mandrel against said peripheral portions when said first part of the peripheral portion of the first twirling roll is in registration with said peripheral portion of the second twirling roll.

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