(No Model.) 3 Sheets—Sheet 1.

C. HOWELLS.

PAPER TUBE MACHINE.

No. 542,192. Patented July 2, 1895.

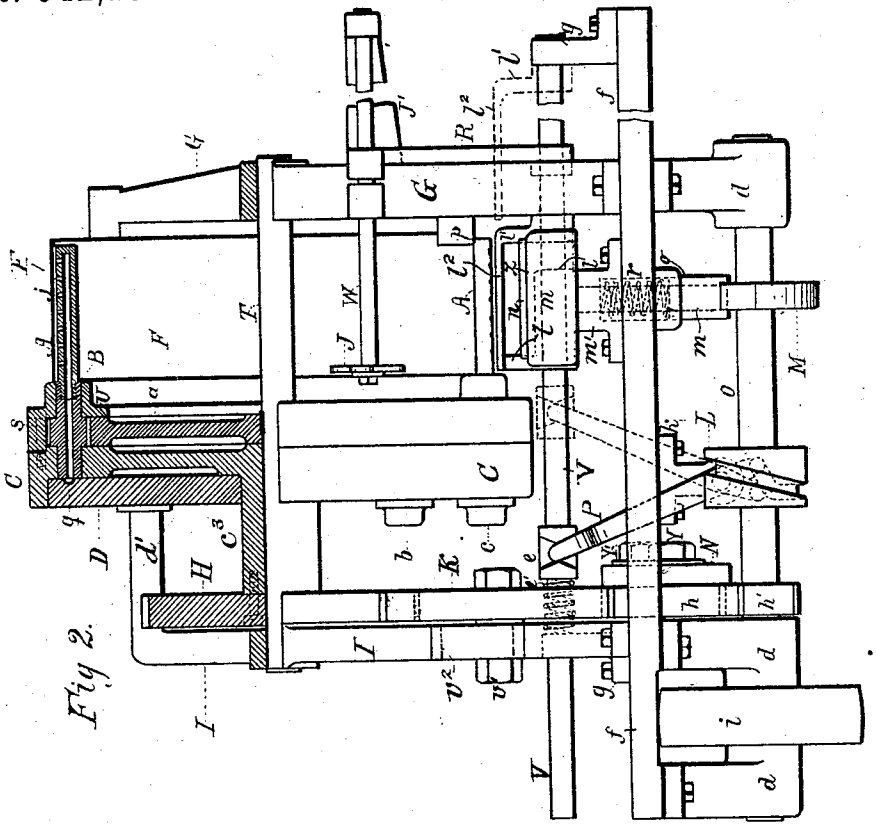

Fig 2.

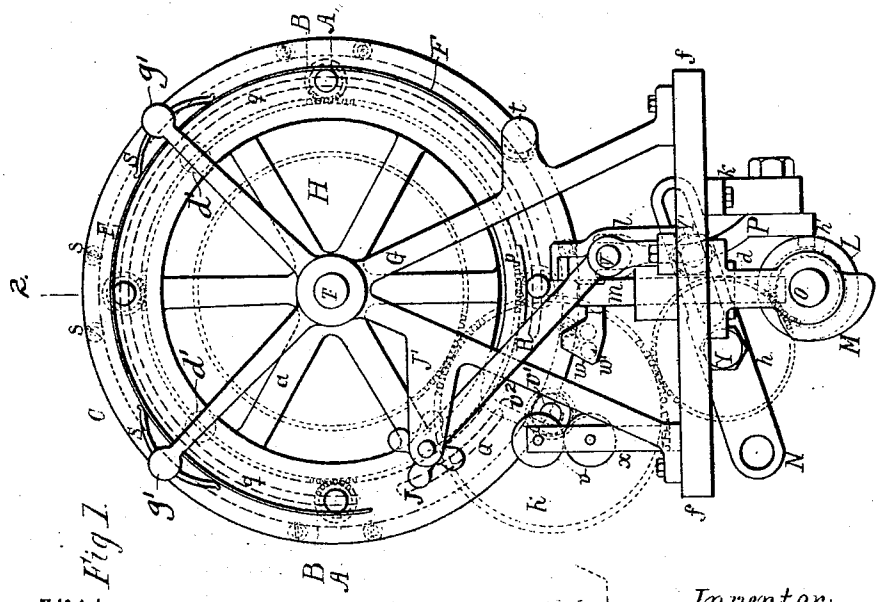

Fig 1.

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(No Model.) 3 Sheets—Sheet 2.

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Fig 4.

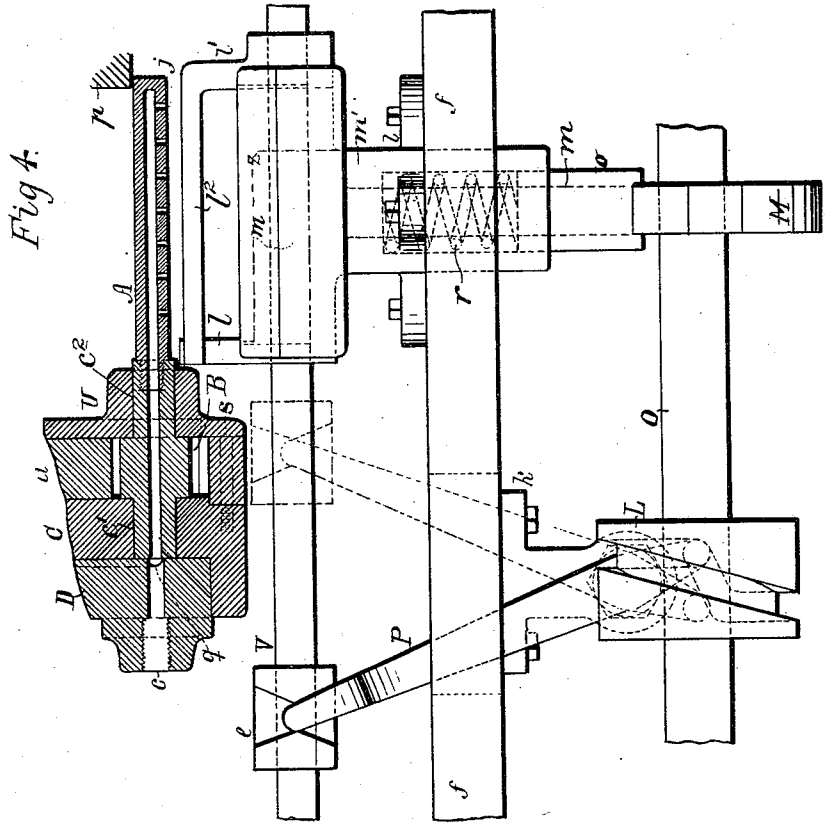
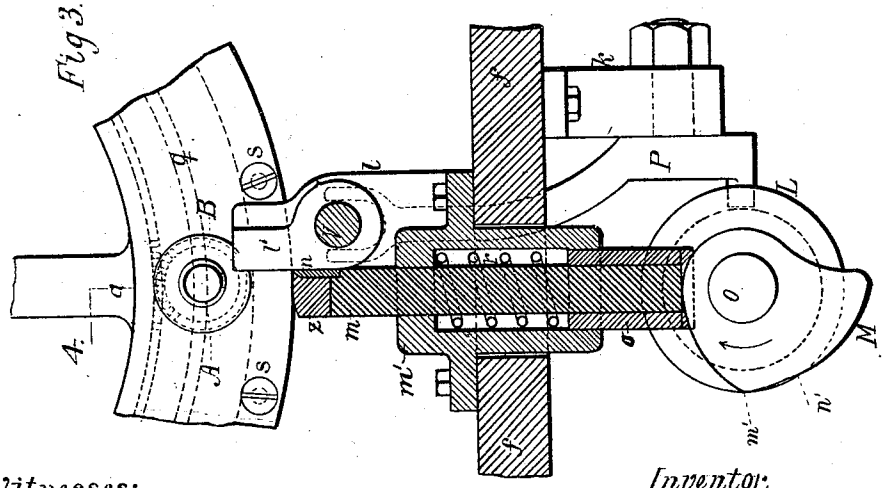


Fig 3.



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(No Model.) 3 Sheets—Sheet 3.

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Fig. 5.

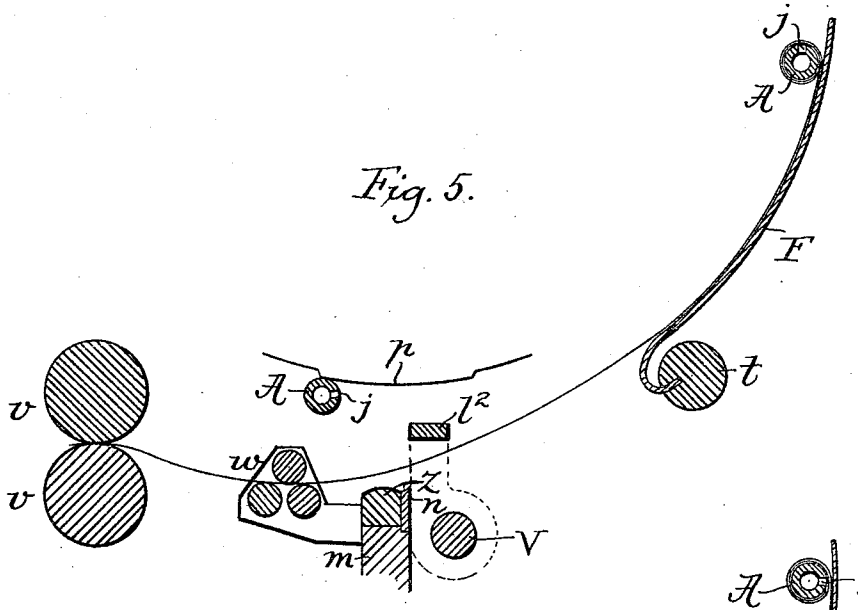
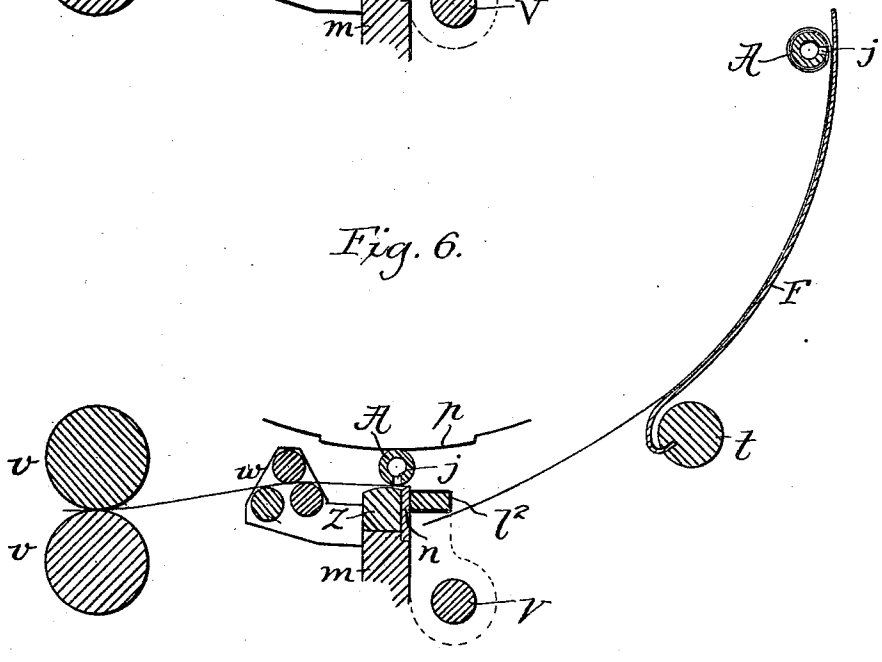


Fig. 6.



WITNESSES:

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INVENTOR

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ATTORNEYS

UNITED STATES PATENT OFFICE.

CHARLES HOWELLS, OF NEW YORK, N. Y.

PAPER-TUBE MACHINE.

SPECIFICATION forming part of Letters Patent No. 542,192, dated July 2, 1895.

Application filed March 17, 1894. Serial No. 504,046. (No model.)

To all whom it may concern:

Be it known that I, CHARLES HOWELLS, a citizen of the United States, residing at the city of New York, in the county and State of New York, have invented certain new and useful Improvements in Paper-Tube Machines, of which the following is a specification.

This invention relates generally to paper-tube-making machines, and more particularly to that class in which the paper is wound upon a mandrel until a tube of the proper thickness is formed.

The present improvements are directed, among other things, to provide an automatic machine for manipulating the paper, forming it into a tube, and discharging the completed tube from the machine. They are also directed to the means of securely holding the end of the paper to the mandrel, so that a tightly and evenly wound tube may be formed, and also to means for releasing the finished tube, so that it may be readily discharged; and to these ends the improvements consist in the novel structure, devices, and combinations of parts hereinafter fully set forth.

The accompanying drawings illustrate a practical embodiment of the invention, in which drawings—

Figure 1 is an end elevation of the machine. Fig. 2 is a side elevation of the same, partly in vertical longitudinal section, on the line 2 of Fig. 1. Fig. 3 is an enlarged end elevation of a portion of the mandrel-carrier with a mandrel and the co-acting paper-guide platen and cutter, the platen and its support being in vertical section. Fig. 4 is an enlarged side elevation of the parts shown in Fig. 3, the mandrel and mandrel-carrier being in vertical section on the line 4 of said Fig. 3. Figs. 5 and 6 are sectional details in two positions, showing the course of the paper, the mode of severing it, and applying its leading end to a mandrel.

The machine is supported by a base-plate *f*, that may, if desired, be carried by brackets on a bench or by standards resting on the floor. From the base-plate rises a pair of uprights G I, in which is secured the opposite ends of a stationary horizontal shaft T, on which is mounted a revoluble mandrel-carrier C, with its gear H and a fixed gear *a*.

The mandrel-carrier C, of any desired form, consists, preferably, of a disk supporting one or more revoluble mandrels A, four being shown, which are journaled in bearings c' in the disk and in bearings c^3 in an annular L-shaped flange U, secured to the outer edge of the carrier-disk by screw-bolts *s*. (See Fig. 4.) The carrier-disk and its flange embrace or straddle the toothed periphery of the fixed gear *a*, and in the space between the two bearings c' c^3 each mandrel A is formed with a pinion B, in constant mesh with the teeth of the fixed gear *a*, so that, as the mandrel-carrier C revolves with the mandrels, each mandrel is individually rotated in its bearings in the carrier. Each mandrel A is hollow, with one or a series of radial openings *j*, a closed outer end and an open inner end arranged to communicate at one time with an exhaust-groove or vacuum-passage *q* and at another time with a pressure groove or passage Q, both formed in the face of a fixed disk D, that is supported in close contact with one face of the mandrel-carrier C by means of one or more arms d', projecting from the upright I. In the preferred form the exhaust-groove *q* extends in a circular direction a little more than three-quarters of a complete revolution of the mandrel-carrier C, so that the hollow of each mandrel is in communication therewith during about three-quarters of its travel; and the pressure-groove Q extends for a short distance and is located between the termination and commencement of the exhaust-groove *q*, a blank being left between the ends of the two grooves, so that there will be no communication between them. The exhaust-groove *q* is connected by a nipple *c* with any suitable air-exhausting or vacuum-forming pump, (not shown,) and the pressure-groove Q is similarly connected by a nipple *b* with an air-pressure supply. (Not shown.)

The sleeved hub c^3 of the carrier C is secured to the driving-gear H, that receives motion through a train of intermediate gears K *h* from a driven pinion h', secured to a rotary driven shaft O, mounted in bearings in brackets *d*, depending from the under side of the base-plate *f*, said shaft O carrying a belt-pulley *i*, receiving motion from any suitable source of power. The intermediate K is mounted on a stud V', secured adjustably in

a slot V^2 in the upright I; and the intermediate *h* is mounted on a stud Y, carried by an adjustable arm N, held in adjusted position by a bolt Y′ passing through a slot in the arm. This adjustable mounting of the intermediates K and *h* adapts the machine for change-gearing to vary the speed of rotation of the mandrel-carrier C with respect to the quantity of paper fed to each mandrel A, as will presently appear.

The paper, preferably in the form of a web, after having paste applied to it, as by a device W, is led to each mandrel A in any desired manner—as, for instance, by a pair of rolls *v*, mounted in a bracket *x*, rising from the base plate *f*—and thence to a series of rolls *w*, that are mounted in a bracket *w′*, carried by a movable feeder or platen *z*. The feeder or platen *z* is fixed to the head of a reciprocating arm *m*, that is mounted in a bearing *m′*, secured to the base-plate *f*, the lower end of the arm having a thimble *o*, forming a seat of a spring *r*, that surrounds the arm and tends to hold it and the feeder in the down position with the end of the arm and thimble against the periphery of a cam M, that is secured to the shaft O, by which cam the arm and feeder are moved vertically. The head of the arm alongside of the feeder also carries a cutter *n*, that co-acts with the upper horizontal cutter-bar l^2 of a paper guide *l′* to sever the paper at the proper time, the rectangular opening between said guide and its cutter-bar l^2, the top of the feeder *z* and a fixed vertical inner side-guide *l* being normally occupied by the paper extending from the mandrel on which it is wound to the supporting-rolls *w*, as in Fig. 5.

The length of paper presented to each mandrel A is preferably determined by the timely taction of he cutter *n* with respect to the speed of travel of the mandrel-carrier C. If the cutter acts relatively soon after the mandrel has commenced to wind the paper, the paper will be severed into a short length and a thin tube will be formed, and, on the other hand, if the cutter is delayed in its action, a longer length of paper will be severed and a thick tube be formed. The period of action of the cutter as the present machine is organized is a constant one, and the speed of the mandrel-carrier G is also constant; but it is obvious change-gearing may be employed to vary the speed of action of the one with respect to the other—as, for instance, by loosening the cams and driving-pulley on the driven shaft O, moving said shaft longitudinally to the right through its bearings to gain access to the driven pinion *h′*, and then changing said pinion for another of different size.

The form of the cam M is such as to cause the cutter to make the proper cutting action at the desired time, and the cam is also shaped, in the present instance, (see Fig. 3,) to cause a short dwell of the cutter *n* and the platen *z* at a raised position, while the cam is moving under the arm *m* from the point *m′* to the point *n′*. (Indicated on said cam.) During this dwell period the mandrel-carrier C, continuing to rotate, is bringing a succeeding mandrel toward the position at which the leading end of the paper resting on the platen *z* is to be applied to said mandrel, and substantially simultaneous with the arrival of said mandrel in position cam M acts to further raise the platen *z*, (and also the cutter *n*, which is inactive at this time,) so that the leading end of the paper on the platen is thereby pressed into contact with the mandrel, covering the radial holes *j* thereof, so that by reason of the air being drawn or exhausted from the hollow of the mandrel through the exhaust-groove *q*, said end of the paper is firmly held in contact with the mandrel by the pressure of the atmosphere on its outer surface and carried along therewith in the travel of the mandrel-carrier C. This additional motion of the platen and cutter is for an instant only, the cam M being shaped to permit the immediate lowering of the platen and cutter to their normal down position under the force of the spring *r*. The paper leading from the mandrel, which has just taken its leading end, is now passing over the top of the horizontal cutter-bar l^2, and hence it is necessary to provide a means of getting the paper again below said bar l^2 to extend through the opening formed by the guides *l′* and *l*. For this purpose the guide *l′* and bar l^2 are arranged to be moved longitudinally from active position adjacent the platen *z* and cutter *n*. Thus the guide *l′* and bar l^2 are fixed to a longitudinally-movable shaft V, that is mounted in bearings in the uprights I G and a bracket *g*. The shaft V is moved at the proper time by means of a cam L, secured to the shaft O, through a lever P, pivoted to a bracket *k*, one end of the lever engaging the groove of the cam and the other being bifurcated to engage a grooved collar *e* fast to said shaft V. The time of action of the cam L is such that immediately the paper end is taken by the mandrel and the cutter *n* and the platen *z* has dropped to its down position the shaft V, with the guide *l′* and bar l^2, are moved longitudinally to the right, assisted, it may be, by a spring *e′*, as indicated by dotted lines, Fig. 2, so that the paper extending from the mandrel to the rolls *w* is free to fall with the platen below the normal active position of the bar l^2, whereupon the cam L acts to return the shaft V and guide *l′* and bar l^2 back to the normal position, with the bar l^2 overlying the paper, as before explained, ready to act as the stationary cutting-edge when the cutter *n* is raised to sever the paper.

In order to support and stiffen the mandrel A at the time the paper is applied thereto by the platen *z*, there is provided a rest or bearing *p*, supported by the upright G in position to meet the upper surface of the mandrel near or at its extreme end and serve as an abutment against which the mandrel bears as it passes across the plane of action of the platen, so as to be able to withstand the upward press-

ure of said platen in the act of pressing the end of the paper onto the mandrel.

As the mandrel A is carried onward by the mandrel-carrier C and is rotated by the action of its pinion B, engaging with the stationary gear *a*, the paper is gradually wound upon the mandrel, as indicated in Figs. 5 and 6; and after leaving the plane of action of the platen *z*, the mandrel with the paper passes in surface-contact with a pressing plate or strip F, that is mounted substantially concentric or parallel with the plane or arc of movement of the mandrel or mandrels A, so that while the mandrel with the paper is traveling onward, and while the paper is gradually being wound around the mandrel, each convolution of the paper is stretched and pressed onto the underlying convolution and a tight and evenly wound tube be formed, the paste which has been applied to the paper serving to unite the convolutions together. This pressing plate or strip F is preferably connected at one end to a stud *t*, (see Fig. 1,) projecting from the upright G with a slight turn in its connected end, so as to be capable of yielding laterally under the pressure of the passing mandrel and paper. From this stud *t* the pressing plate or strip passes upward in a curved path concentric with the axis of the mandrel-carrier C and terminates at a point sufficient to have insured the tube being tightly wound on the mandrel—as, for instance, at about three-quarters around the path of the mandrel-carrier C. At one or more points intermediate between the ends of the pressing plate or strip F the strip is preferably borne upon by springs S, of curved spring-plate form, carried by radial arms *g'*, extending from the upright G, which springs serve to hold the pressing-plate to duty against the tube being formed with spring or yielding pressure. While the pressing plate or strip F is unconnected throughout its major portion, its tendency to spring outward, together with the confining action of the springs S, serve to hold the plate or strip in proper position.

The machine is provided with means for stripping the completed tubes from the mandrels A, preferably during the onward movement of the mandrel-carrier C. The stripper J, Figs. 1 and 2, consists of a fluted disk forming a series of fingers mounted to rotate loosely at the inner end of a longitudinally-movable rod W, that is mounted to slide in bearings in the upright G and a bracket J', which rod and stripper receive motion from the shaft V, through a connecting arm R, or in any other suitable manner. In the movement of the mandrel-carrier C the mandrel A, bearing the completed tube, passes in contact with a finger of the stripper J, which normally lies at its inward position against the face of the mandrel-carrier, so as to meet the inner end of the tube on the passing mandrel, just as the hollow of the mandrel coincides with the pressure-groove Q, and the continued onward movement of the mandrel-carrier causes the mandrel to partially rotate the stripper, so that the mandrel is in a measure straddled by a pair of fingers of the stripper, and the tube is borne upon at distant points thereby. Immediately this occurs, or while it is occurring, the stripper is moved longitudinally by the action of the cam L in moving the shaft V to strip the completed tube from the mandrel and deliver it into any proper receiver. As soon as the stripper reaches the limit of its outward or stripping movement, the cam L, through its connections with the rod W, immediately returns the stripper to its normal inward position, ready to act on the succeeding tube.

The coincidence of the hollow mandrel with the pressure-groove Q at the time, or just prior to the time, and during the action of the stripper, causes the pressure to exert an outward influence on the portions of the tube overlying the radial orifices *j*, so that should such portions have been drawn or made to bulge into said orifices, forming thereby holding teats preventing the free stripping movement of the completed tube from the mandrel, such teats will by the pressure be freed from the orifices, and the tube consequently rendered easy of movement from the mandrel.

As the general operation of the complete machine has been given in describing its parts, no further statement thereof is deemed necessary.

It is to be understood that while I prefer the particular embodiment of the invention described, many changes may be made therein without departing from the essentials of the invention.

What is claimed is—

1. In a tube machine, the herein described movable hollow mandrel having an opening leading outward, a disk having an exhaust passage and a pressure passage with each of which passages said hollow mandrel communicates in succession with means for winding the material on said mandrel.

2. In a tube machine, the herein described movable hollow mandrel having an opening leading outward, a disk having an exhaust passage and a pressure passage with each of which passages said hollow mandrel communicates in succession, means for winding the material on said mandrel, and means for stripping the tube from the mandrel.

3. The combination of a revoluble hollow mandrel having an opening leading outward, a disk having an exhaust passage and a pressure passage with each of which passages said hollow mandrel communicates in succession, and means for presenting the material to said mandrel, as set forth.

4. The combination with a movable mandrel-carrier, and a hollow mandrel carried thereby having an opening leading outward, of a disk having an exhaust passage for communication with the hollow mandrel during a

portion of the movement of its carrier, and also having a pressure passage for communication with the hollow mandrel during another portion of the movement of its carrier, and means for spirally winding the material on said mandrel, as set forth.

5. The combination with a movable mandrel-carrier and a hollow mandrel mounted therein, of gearing for rotating the mandrel during the movement of the carrier, a disk having a passage through which air is exhausted from the mandrel and also having another passage through which air may pass to the mandrel, as set forth.

6. The combination with a revoluble mandrel-carrier and a hollow mandrel mounted therein and having air openings, of gearing for rotating the mandrel during the revolutions of the carrier, a disk having a passage through which air is exhausted from the mandrel and also having another passage through which air may pass to the mandrel, as set forth.

7. The combination with a movable mandrel-carrier and a hollow mandrel mounted therein and having openings leading outward, of gearing for rotating the mandrel during the movement of the carrier, a disk having a passage through which air is exhausted from the mandrel, also having another passage through which air may pass to the mandrel, means for feeding material to the mandrel and a pressing plate along which the rotating mandrel with the material travels, as set forth.

8. The combination with a revoluble mandrel-carrier, and a hollow mandrel mounted therein having openings leading outward, of gearing for rotating the mandrel during the movement of the carrier, an exhaust communication with the hollow mandrel, and a pressure connection also with said mandrel, as set forth.

9. The combination with a revoluble mandrel-carrier and a hollow mandrel mounted therein and having openings leading outward, of gearing for rotating the mandrel during the movement of the carrier, a disk having a passage through which air is exhausted from the mandrel, also having another passage through which air may pass to the mandrel, means for feeding material in the web to the mandrel, and a severing device for the web, as set forth.

10. The combination with a revoluble mandrel-carrier, and a hollow mandrel mounted therein, and having openings leading outward, of gearing for rotating the mandrel during the movement of the carrier, a disk having a passage through which air is exhausted from the mandrel, also having another passage through which air may pass to the mandrel, means for feeding material in the web to the mandrel, a severing device for the web, and a pressing plate against which the mandrel and material rotate, as set forth.

11. The combination with the movable mandrel-carrier and a revoluble hollow mandrel mounted therein and having openings leading outward, a disk having a passage through which air is exhausted from the mandrel, and also having another passage through which air may pass to the mandrel, of means for feeding material to the mandrel and a stationary yielding pressing plate against which the mandrel and material bear in the movement of the carrier, as set forth.

12. The combination with the movable mandrel-carrier and a rotating hollow mandrel mounted therein and having openings leading outward, a disk having a passage through which air is exhausted from the mandrel, also having another passage through which air may pass to the mandrel, of means for feeding material to the mandrel and the curved pressing plate against which the mandrel travels, and springs for holding the pressing plate to duty, as set forth.

13. The combination with the movable mandrel-carrier and a revoluble hollow mandrel mounted therein and having openings leading outward, a disk having a passage through which air is exhausted from the mandrel, also having another passage through which air may pass to the mandrel, of a movable platen for presenting the material to the mandrel and a cutter for severing the material, as set forth.

14. The combination with the movable mandrel-carrier, and a revoluble hollow mandrel mounted therein, and having openings leading outward, a disk having a passage through which air is exhausted from the mandrel, also having another passage through which air may pass to the mandrel, of a movable platen for presenting the material to the mandrel, a cutter bar, a cutter coacting with said bar for severing the material and means for temporarily removing the cutter bar from active position, as set forth.

15. The combination with the movable mandrel-carrier, and a mandrel mounted therein, of a movable platen for presenting the material to the mandrel, a cutter for severing the material, means for moving the platen and cutter simultaneously, and a reciprocating stripper for removing the tube from the mandrel, substantially as described.

16. The combination with the revoluble mandrel-carrier, and a rotating mandrel mounted therein, of a movable platen for presenting the material to the mandrel while the mandrel and carrier are moving, a severing device for the material, and a stripper for removing the tube from the mandrel while it and its carrier are moving, as set forth.

In witness whereof I have hereunto set my hand and seal in the presence of two witnesses.

CHAS. HOWELLS. [L. S.]

Witnesses:
F. J. KRETZER,
A. LANSING BAIRD.