April 19, 1927.

1,625,470

R. J. JAUCH

PAPER TUBE MAKING MACHINE

Filed July 6, 1925

4 Sheets-Sheet 1

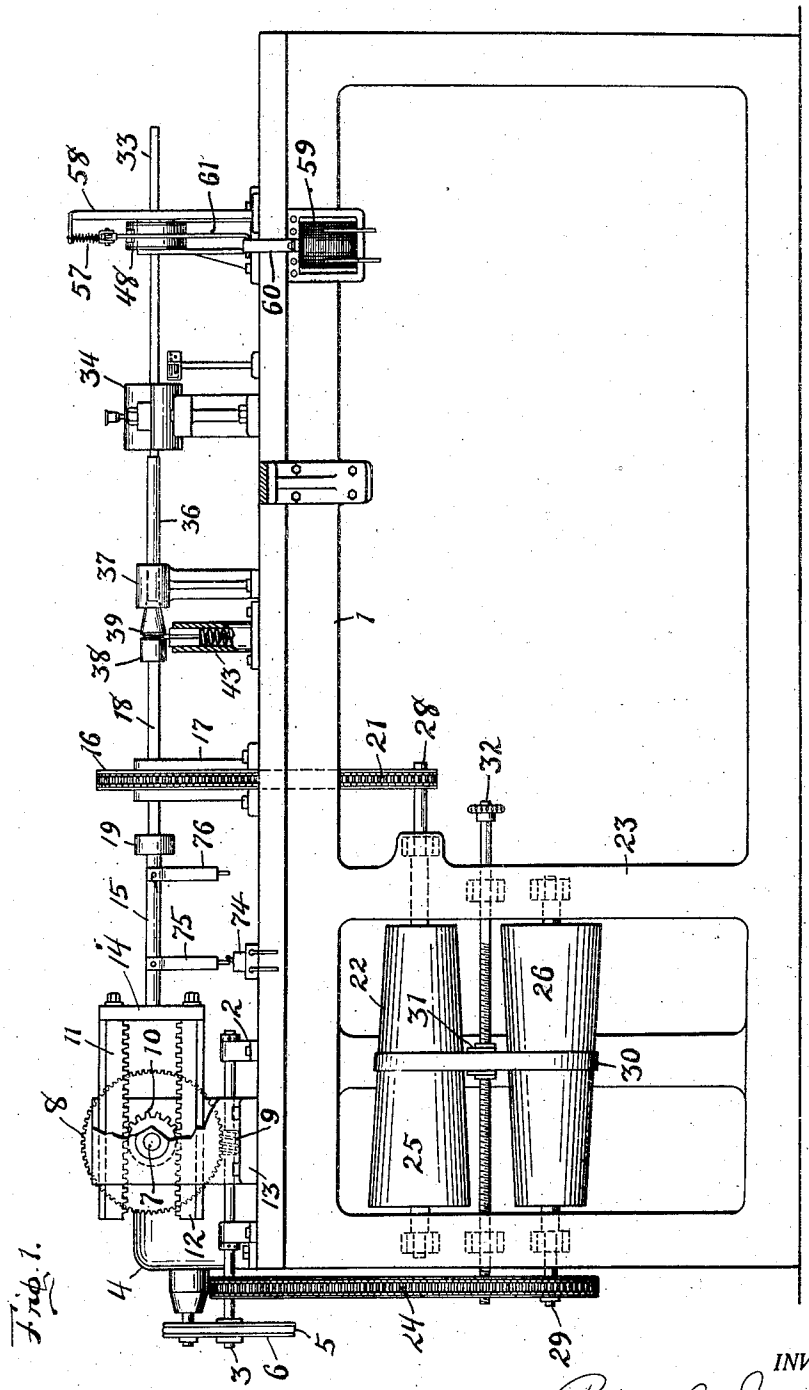


Fig. 1.

INVENTOR.

BY Robert J. Jauch

H. G. Burns ATTORNEY.

April 19, 1927. 1,625,470

R. J. JAUCH

PAPER TUBE MAKING MACHINE

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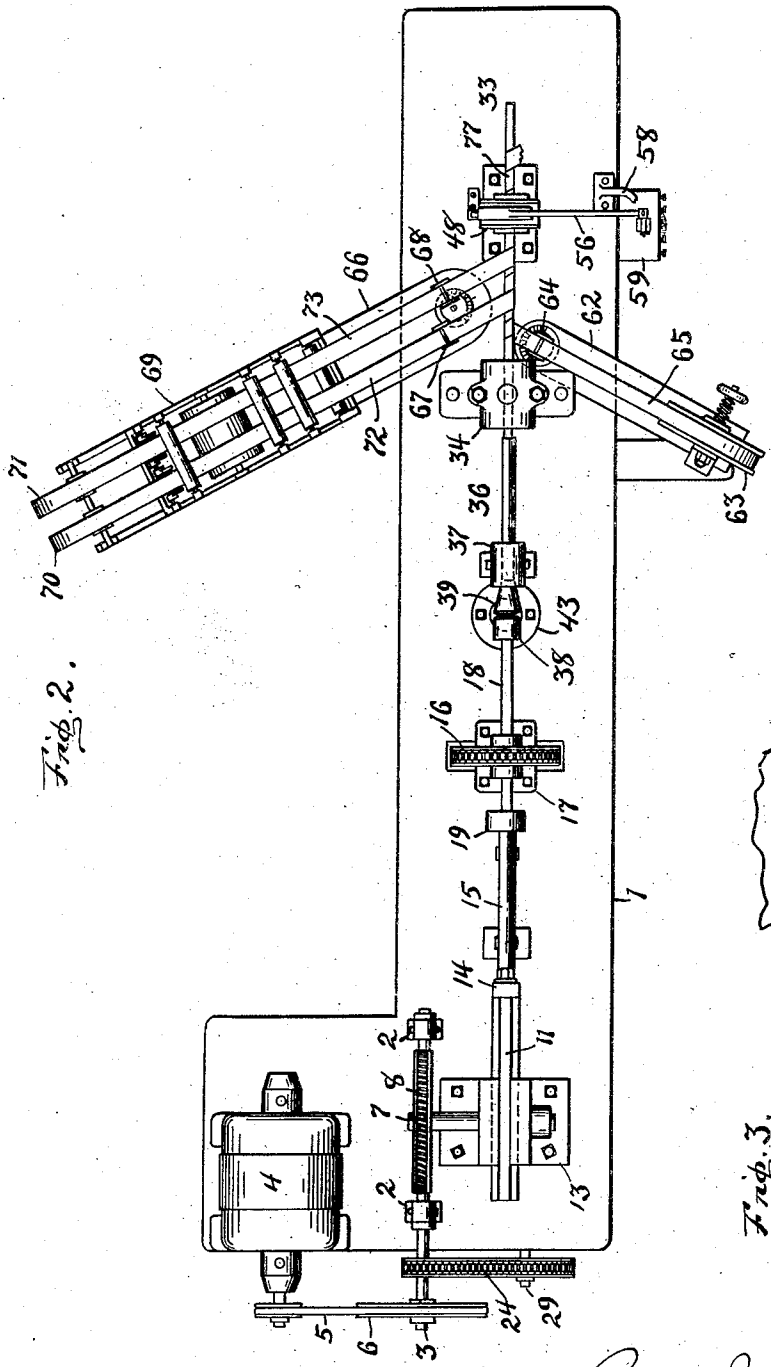


Fig. 2.

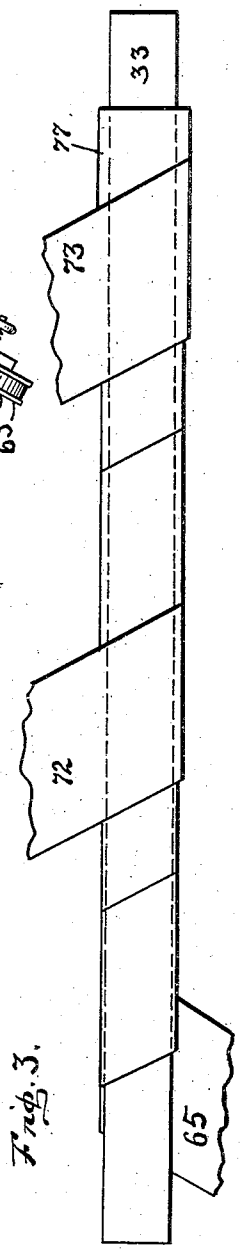


Fig. 3.

INVENTOR.

Robert J. Jauch,

BY

H. G. Burns ATTORNEY.

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R. J. JAUCH

PAPER TUBE MAKING MACHINE

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Fig. 4.

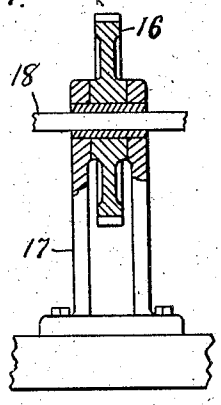


Fig. 5.

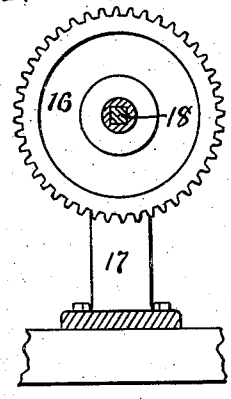


Fig. 6

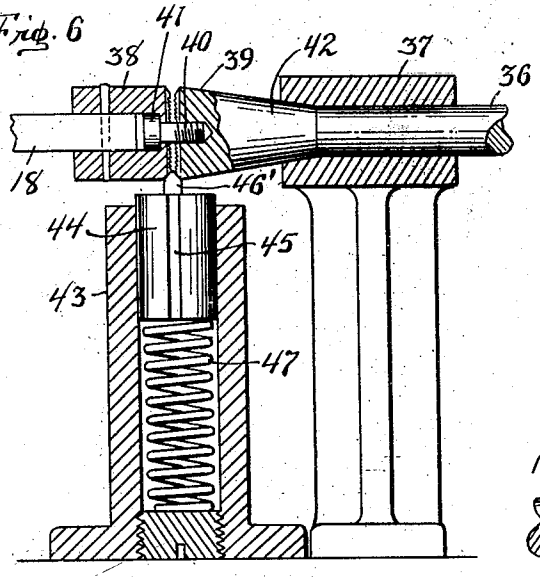


Fig. 7.

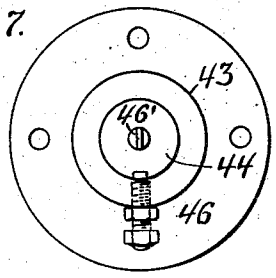


Fig. 8.

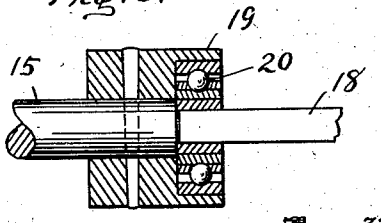


Fig. 9.

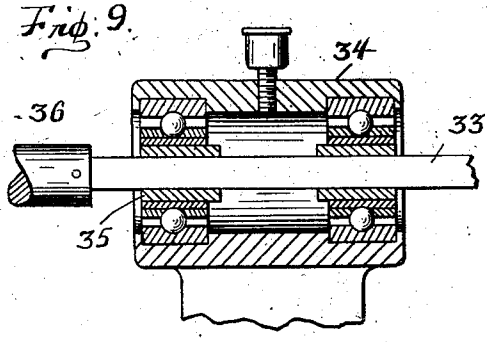
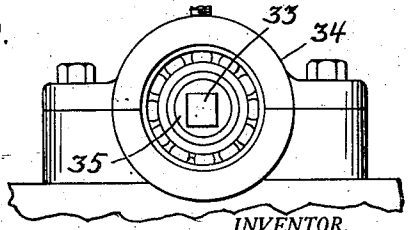


Fig. 10.



INVENTOR.

Robert J. Jauch

BY

A. G. Burns ATTORNEY.

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R. J. JAUCH

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Fig. 11.

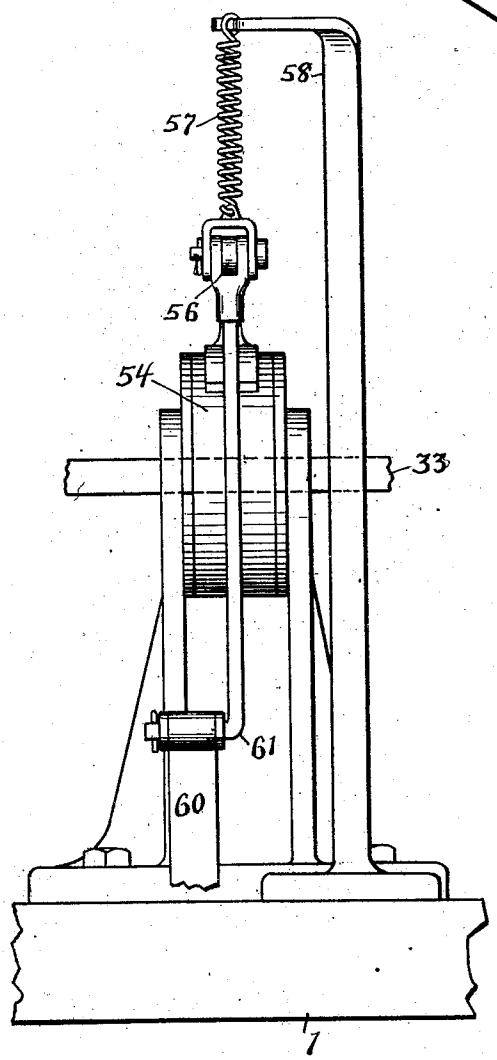


Fig. 12.

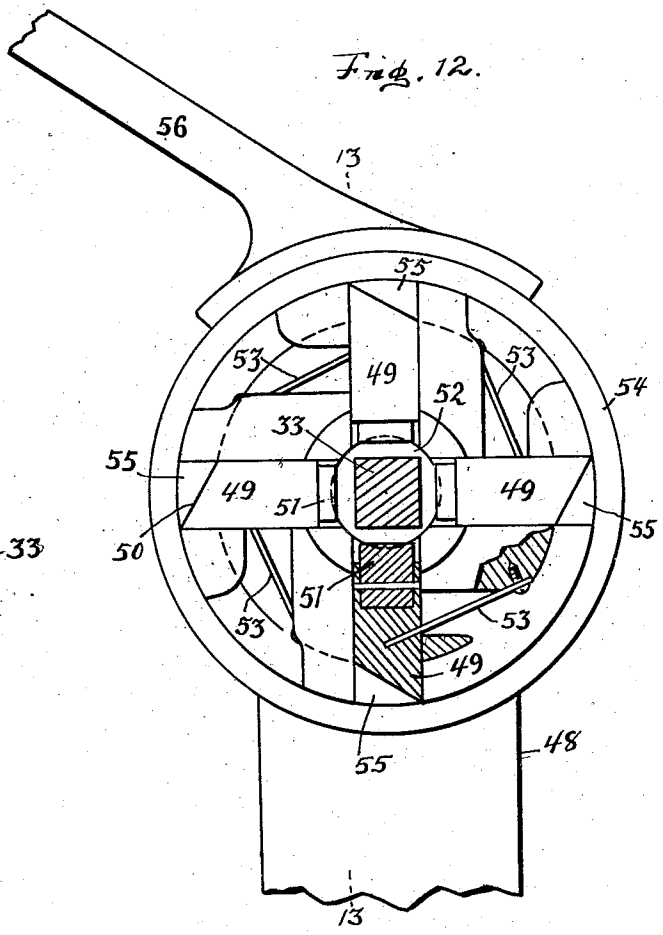
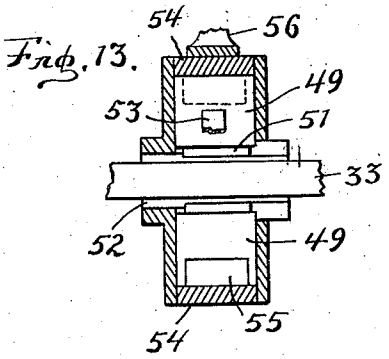


Fig. 13.



INVENTOR.

Robert J. Jauch,

BY

A. G. Burns ATTORNEY.

Patented Apr. 19, 1927. 1,625,470

UNITED STATES PATENT OFFICE.

ROBERT J. JAUCH, OF FORT WAYNE, INDIANA.

PAPER-TUBE-MAKING MACHINE.

Application filed July 6, 1925. Serial No. 41,561.

This invention relates to improvements in paper tube making machines, especially for the manufcature of that type of tubes composed of a plurality of strips of paper disposed in spiral formation and wound in successive order, one upon the other, overlapping and covering the abutting portions of the next underlying layer. The object of the invention is to provide a machine for accurately winding paper strips to form a tube thereof that will be of great strength, and the joints between the strips will be close fitting. Another object of the improvement is to so construct the machine as to facilitate manufacture of paper tubes of indefinite length and polygonal in cross section as well as round.

These objects are accomplished by the construction illustrated in the accompanying drawings, in which:—

Fig. 1 is a side elevation of a machine embodying the invention;

Fig. 2 is a plan view projected from Fig. 1;

Fig. 3 is a detail plan view showing a square mandrel upon which three strips of paper are being wound to form a tube;

Fig. 4 is a side view of the rotary driver, portions thereof being in section;

Fig. 5 is an end view projected from Fig. 4;

Fig. 6, a detail, is a view of the driving clutch and the disengaging member therefor, parts of said clutch being broken away and the remainder shown in vertical axial section.

Fig. 7 is a plan view of the disengaging member shown in Fig. 6;

Fig. 8 is a detail view of a coupling by which the reciprocating member and the rotating connecting rod are united, parts being in section;

Fig. 9 is a detail view of the bearing support for the mandrel, parts being broken away and the remainder of these parts in section;

Fig. 10 is an end view projected from Fig. 9;

Fig. 11 is a side view of the gripping device for preventing retraction of the paper tube on the mandrel;

Fig. 12 is an end view projected from Fig. 11; and

Fig. 13 is a cross section of Fig. 12 upon a reduced scale.

The characters appearing in the description refer to parts shown in the drawings and designated thereon by corresponding characters.

The invention comprises a table 1 to which are secured the various parts of the machine. Upon the table are disposed a pair of fixed bearings 2 in which is rotatably mounted a drive-shaft 3 that is actuated by a motor 4 through the medium of a belt 5 and pulley 6.

A reciprocating driver is mounted on the table so as to be actuated by the drive-shaft 3 and consists of a counter-shaft 7 having thereon a worm-wheel 8 that is actuated by a worm 9 on the drive-shaft. The counter-shaft has fixed thereon a mutilated gear 10 that has engagement alternately with a pair of spaced rack-bars 11 and 12. The counter-shaft 7 and the rack-bars 11 and 12 have bearing support respectively in a standard 13 on the table, and the forward ends of said rack-bars have rigidly fixed thereto a cross-head 14 which has a forwardly extending rigid stem 15.

A rotary driver is mounted upon the table, and consists of a sprocket wheel 16 mounted in a standard 17, and through the hub of which a square connecting rod 18 extends and has longitudinal sliding movement. The square connecting rod 18 is disposed in longitudinal alinement with the stem 15 on the reciprocating driver and is connected to said stem by a coupling 19 having therein a bearing 20 that admits of rotation of the connecting rod 18 relative to the stem.

The rotary driver is actuated by a chain 21 on the sprocket wheel 16 and which is connected with a variable speed motion transmitting mechanism 22 that is mounted in the base 23 of the table, said mechanism being actuated from the drive-shaft 3 by a chain 24. The said motion transmitting mechanism may be of any suitable type by which power may be transmitted from the drive-shaft to the rotary driver at selective speeds. In the present instance is shown as an example, a pair of oppositely disposed cones 25 and 26 mounted upon a corresponding pair of shafts 28 and 29 and upon which is trained an endless belt 30, there being a belt shifter 31 and an adjusting screw shaft 32 therefor by which the belt may be moved on the cones longitudinally to various positions. The chain 24 has actuating relation

with the shaft 29 and the shaft 28 has actuating relation with the chain 21, and movement is imparted through the medium of the belt from the cone 26 to the cone 25 with a speed ratio that is variable according to the longitudinal position of the belt on the cones. By adjustably turning the screw shaft 32 the rotary driver will accordingly be operated with more or less velocity relative to the movement of the reciprocating driver.

A unitary, square mandrel 33 pinned to shank 36 (see Fig. 9) is mounted in a bearing 34 in which the mandrel has longitudinal and rotary movement, there being loose sleeves 35 in the bearing in which the mandrel slides longitudinally while the sleeves rotate in the bearing. The shank 36 of the mandrel is round in cross section and extends loosely through a supporting bearing 37 in which it has longitudinal and rotary movement. The connecting rod 18 and the shank 36 of the mandrel have corresponding clutch members 38 and 39 respectively fixed thereon so as to abut one another, the abutting faces of said members being toothed so that locking engagement between the clutch members is established when the clutch members are brought together. The clutch members are coupled together by a screw 40 which is disposed in axial alinement with the connecting rod 18 and mandrel shank 36, and is fixed in the clutch member 39 while its head 41 is rotatable and has limited longitudinal movement in the clutch member 38, which longitudinal movement is sufficient to admit of disengagement of said clutch members. The clutch member 39 has a tapered portion 42 that fits into the rear end of the bearing 37 when the mandrel is in its forwardmost position, the rear end of the bearing being correspondingly tapered.

Adjacent the rear end of the bearing 37 is positioned a disengaging member for the clutch, which comprises a hollow post 43 having therein a vertically movable plunger 44, there being a longitudinal slot 45 in the plunger, and a screw 46 in the post that extends into the slot so that the plunger is prevented from turning. On the top of the plunger is a projecting wedge 46′ that enters between the clutch members 38 and 39 and effects the separation thereof as the mandrel completes its forward stroke, there being a compression spring 47 in the post acting to move the plunger upwardly.

On the forward end of the table is positioned a gripping member consisting of a frame 48 in which are positioned a series of radially disposed movable jaws 49, each having a slanting outer end 50 and a rubber plug 51 in its inner end. The frame has an opening 52 around which the jaws are positioned and through which the mandrel 33 extends loosely. The said jaws move radially in the frame and have bearing engagement respectively with the mandrel when in their innermost position, and are held normally out of contact with the mandrel respectively by corresponding springs 53. Surrounding the series of jaws 49 on the frame is an oscillating sleeve 54 having a series of internal wedges 55, which wedges have engagement respectively with the corresponding jaws and act to move the jaws inwardly into engagement with the mandrel when the sleeve is actuated in one direction, the sleeve having an arm 56 fixed thereon for its operation. A tension spring 57 is coupled with the arm 56 at one end, and is connected at its opposite end with a bracket 58 so that the arm is held normally in uppermost position and the jaws consequently out of engagement with the mandrel.

An electric solenoid 59 is fixed on the side of the table, and its plunger 60 is coupled with the arm 56 by a connecting rod 61 so that as the solenoid is operated the arm 56 is swung downwardly opposed by the tension of the spring, and the jaws are moved into contact with the mandrel as the sleeve 54 is turned by the action of the arm.

On the table 1, at the forward side thereof, adjacent the mandrel and back of the gripping member is pivoted a horizontally movable arm 62 having mounted thereon a reel 63 and guide 64 that constitutes a feeding device for a strip 65 of paper which forms the underlying stratum or base of the composite paper tube to be formed on the mandrel, the arm being adjustably movable on its pivot so that the strip of paper will be fed to the mandrel at an angle varying in degree accordingly. Upon the table in a position opposite to that of said feeding device is pivoted a horizontally movable platform 66 that has in connection therewith a pair of guides 67 and 68 and also a glue applicator 69 including a pair of reels 70 and 71, the applicator and said pair of guides constituting a feeder for supplying strips of adhesive paper 72 and 73 to the mandrel. The adhesive strips 72 and 73 form respectively the intermediate and outermost strata of said composite tube, and the platform 66 is adjustably movable upon its pivot so that the adhesive strips may be fed to the mandrel at an angle varying in degree accordingly.

The feeding devices and the applicator may be of any suitable construction adaptable to the purpose, their particular construction being immaterial to the present invention.

The solenoid 59 is connected in circuit with a suitable source of electrical energy (not shown) and a switch 74, the switch being positioned so as to be closed at the

end of the forward stroke of the reciprocating member and opened at the end of its backward stroke, there being fingers 75 and 76 spaced apart and fixed in connection with the reciprocating driver and extending in line with the switch so as to have operative relation therewith.

In the operation of the invention the reciprocating driver and the variable speed motion transmitting mechanism are continuously operated through action of the motor, and the rotary driver is continuously operated through its chain connection with said transmitting mechanism and at a rate of speed governed by the belt shifter. In this manner reciprocating as well as rotary movement is imparted to the connecting rod 18. During the forward stroke of the connecting rod the clutch member 38 bears against and has locking engagement with the clutch member 39 so that the mandrel 33 is moved forwardly and simultaneously rotated until the end of the forward stroke of the connecting rod 18 is reached, at which time the clutch members become parted by the engagement of the wedge on the gripping member, which enters therebetween. The wedge also has the effect of pressing the clutch member 39 forwardly so that its tapering body bears with more or less force in the end of the supporting bearing 37 which has the effect of arresting the rotary movement of the mandrel to which the clutch member 39 is fixed. At the end of the forward stroke of the reciprocating member, the finger 75 engages and closes the electrical switch 74 so that the solenoid is actuated. The gripping member is also actuated through its connection with the solenoid so that the jaws thereof are moved into bearing engagement with the mandrel 33.

Upon the return stroke or backward stroke of the connecting rod, the mandrel is drawn rearwardly while being held by the gripping member from rotation, the clutch members being drawn out of engagement from the clutch actuating member and out of locking engagement with each other by the retracting movement of the connecting rod.

The paper strip 65 is coiled upon the reel 63 with one end extending through the guide 64 and initially coiled on the mandrel. The arm 62 supporting the reel and guide is adjustably positioned so that the paper strip 65 is fed to the mandrel at such angle that when the mandrel is rotated and moved forwardly the strip will become wound spirally upon the mandrel with its edges abutting but not overlapping each other. To effect continued evenness in the winding of the paper strip upon the mandrel it is essential that the rotary movement of the mandrel during the forward or winding stroke thereof shall be at a velocity rate consistent with that of the endwise travel of the mandrel and the width of the paper strip, as well as the angle at which the strip is fed to the mandrel. The relative rotary velocity of the mandrel, respecting its longitudinal forward stroke may be varied as may be required by adjusting the belt shifter on the motion transmitting mechanism, while the angle at which the strip is fed to the mandrel may be altered by adjusting the arm 62.

The paper strip 72 which receives a coating of glue upon its under side in the applicator in the usual manner is threaded through the guide 67 and initially wound upon the coils previously formed on the mandrel by the paper strip 65 so that the strip 72 overlaps the abutting edges of the former strip. In similar fashion the paper strip 73, which also receives a coating of glue on its under side in the applicator, is threaded through the guide 68 and initially wound upon the coils on the mandrel previously formed by the strip 72. During the forward stroke of the mandrel, the mandrel also rotates so that all of the paper strips are wound, in successive order, one superimposed upon the other forming a laminated tube 77 on the mandrel, which tube as it continues to be formed passes through the opening 52 in the gripping member and between the series of jaws thereof. At the conclusion of the forward winding stroke of the mandrel, the clutch members are moved out of locked engagement by the clutch actuating member and the switch 74 is closed so that the gripping member is actuated through the medium of the solenoid. Thus, the jaws are brought into bearing engagement with the tube formed on the mandrel. While the tube is thus held gripped between the jaws, the retracting stroke of the mandrel takes place and the paper tube thereon is withheld by the jaws from retracting with the mandrel. Upon the completion of the retracting stroke the switch 74 is reopened by the engagement with the finger 76, whereupon the gripping member is released and the jaws withdrawn from holding engagement with the tube. Upon each forward stroke of the mandrel the winding operation is resumed, the strips of paper passing to the mandrel at an acute angle therewith and being drawn forward and wound thereon by the progressive protrusion and rotation of the mandrel, and upon each retracting stroke of the mandrel the tube is stripped endwise from the mandrel.

In this manner the formation of the tube is continuous with the succession of forward strokes of the mandrel, and the tube may be cut into lengths desired by any suitable means as it passes from the end of the mandrel.

The tube thus made conforms to the cross

sectional shape of the mandrel, which, in the foregoing example is square. However, round triangular, hexagonal or other shaped tubes, having cross sectional form other than square may be produced in similar fashion by substituting for the square mandrel as shown, a mandrel shaped accordingly.

The mandrel is made so as to be removable, replaceable, and the gripping device so as to be relatively adjustable, to the end that various shapes and sizes of tubes may be made on the same machine with little expenditure of time in making new settings.

I do not intend to limit myself to the precise form of mechanism herein shown but conceive as within the scope of my invention any apparatus readable upon the claims.

What I claim is:—

1. In a paper tube making machine, a table; a reciprocating driver; a variable speed motion transmitting mechanism; a power means in connection with said reciprocating driver and transmitting mechanism; a mandrel including supports therefor in which the mandrel is rotatively and longitudinally movable; a rotary driver having actuated relation with said transmitting mechanism; a connecting rod having longitudinal sliding movement in said rotary driver and being rotatively actuated thereby; a loose coupling connecting the driving rod and reciprocating driver; a clutch mechanism connecting the driving rod and mandrel through which rotary and longitudinal movement is imparted to the mandrel from the connecting rod during the forward stroke thereof, and longitudinal movement only during the opposite stroke thereof; an actuating mechanism for disengaging from locked engagement the members of said clutch at the end of the forward stroke of the connecting rod; a gripping member having a series of movable jaws and means for their operation, between which jaws said mandrel extends; automatic means for actuating said gripping member at the end of the forward stroke of said mandrel and sustaining the action of said member during the retracting stroke thereof; and adjustably positioned means for supplying paper strips to said mandrel to be wound thereon in successive order, one upon another.

2. In a paper tube making machine, the combination with a supporting table, of a mandrel mounted to have rotary and longitudinal reciprocating movement; a driving mechanism having rotary and longitudinal reciprocating movement; a variable speed mechanism in connection with said driving mechanism operable to alter the ratio between the rotary and reciprocating movements of said driving mechanism; a clutch mechanism connecting said driving mechanism and mandrel operable to impart from said driving mechanism rotary and longitudinal movement to said mandrel during the forward stroke thereof, and longitudinal movement only during the opposite stroke thereof; an actuating mechanism for the clutch mechanism operable at the end of the forward stroke of said driving mechanism; a gripping member having movable jaws and means for their operation, between which edges said mandrel extends; automatic means for actuating said gripping member at the end of the forward stroke of said mandrel and sustaining the action of said member during the retracting stroke thereof; and means for supplying paper strips to said mandrel to be wound thereon, one upon another.

3. In a paper tube making machine including a supporting table, a mandrel having rotary and longitudinal reciprocating movement; a driving mechanism having connection with the mandrel and operable to rotate and move said mandrel longitudinally during the forward stroke thereof and to impart longitudinal movement only to the mandrel during the opposite stroke thereof; means for supplying paper strips to the mandrel to be wound thereon by the turning and forward movement of the mandrel; and automatically controlled means for engaging said tube on the mandrel and operable to prevent the tube from retracting with the mandrel during the backward stroke thereof.

4. In a paper tube making machine including a supporting table, a rotatable and longitudinally reciprocable mandrel; a driving mechanism operable to impart longitudinal and rotary movements simultaneously to said mandrel throughout its forward stroke and longitudinal movement only during the retracting stroke thereof; means for supplying paper strips to the mandrel so that a tube is formed thereon by said strips during the turning and forward movement of the mandrel; and mechanism engageable with the tube on the mandrel and operable to prevent the tube from retracting with the mandrel.

5. In a paper tube making machine including a mandrel and a paper strip holding means for supplying paper strips for the formation of a tube on said mandrel; a driving mechanism operable to impart longitudinal and rotary movements simultaneously to said mandrel throughout its forward stroke and longitudinal movement only during the retracting stroke thereof; and mechanism engageable with the tube on the mandrel and operable to prevent the tube from retracting with the mandrel.

6. A paper tube making machine having a mandrel including a mount in which the

mandrel is rotatable and longitudinally reciprocable; a mechanism for imparting longitudinal and rotary movements simultaneously to the mandrel during the forward stroke thereof and longitudinal movement only during the retracting stroke thereof; means for supplying paper strips to said mandrel for the formation of a tube thereupon; and means to prevent retraction of the tube with the mandrel.

7. A paper tube making machine including a reciprocally actuated mandrel, the circumferential face of which moves spirally about the axis of the mandrel during the protruding stroke thereof and longitudially only respecting said axis during the retracting stroke thereof; means for supplying paper strips to the mandrel so that said strips become wound into the form of a tube surrounding the mandrel during the spiral movement thereof; and means to prevent retraction of the tube with the mandrel.

8. In a paper tube making machine, a unitary mandrel having sliding support; a mechanism imparting to the mandrel simultaneously rotary and longitudinal movement on its forward stroke and longitudinal movement only on its backward stroke; and means for supplying paper strips to said mandrel so that said strips become coiled upon said mandrel as the mandrel is actuated and a paper tube formed thereby.

9. In a paper tube making machine, a unitary mandrel movably supported; and a mechanism operable to impart to the mandrel simultaneous rotary and longitudinal movement on its forward stroke and longitudinal movement only on its backward stroke, said mandrel being operable to wind thereon paper strips in coiled formation to form a tube.

10. In a paper tube making machine, a unitary mandrel having simultaneous rotary and longitudinal movement on its forward stroke and longiudinal movement only on its backward stroke and being operable to wind thereon paper strips in coiled formation to form a tube thereon.

11. A machine for making paper tubes, comprising a unitary mandrel, means for simultaneously rotating and protruding said mandrel while paper in strip form is being supplied to said mandrel so as to be wound spirally thereon to form a tube, means for arresting the rotation and protrusion of said mandrel, means for retracting said mandrel after it has ceased rotating, and means for holding the tube while the mandrel is being retracted from within it.

12. A machine for making paper tubes, comprising a unitary mandrel, means for simultaneously rotating and protruding said mandrel, means for holding paper in strip form so that it may be supplied to said mandrel and wound spirally thereon to form a tube as said mandrel is protruded, means for arresting the rotation of said mandrel when its protrusion is complete, means for retracting said mandrel after it has ceased rotating, and gripping means to prevent the retraction of the paper tube with the mandrel.

13. A machine for making paper tubes, comprising a unitary mandrel, means for simultaneously rotating and protruding said mandrel, means for passing to said mandrel at an acute angle therewith paper in strip form to be drawn forward and wound thereon to form a tube, means for synchronously arresting the protrusion and rotation of said mandrel, means for gripping the tube formed on said mandrel so as to strip it therefrom upon the retraction of the mandrel, and means for retracting said mandrel.

14. A machine for making paper tubes, comprising a unitary mandrel, means for rotating said mandrel, means for protruding said mandrel at a constant rate while it is being rotated, means for passing to said mandrel at an acute angle therewith paper in strip form to be drawn forward and wound thereon to form a tube while said mandrel is being rotated and protruded, means for simultaneousy arresting the rotation and protrusion of said mandrel at the end of its forward stroke, means for gripping the tube formed on said mandrel so as to strip it therefrom upon the retraction of the mandrel, means for retracting said mandrel, and means for co-ordinating the operation of all said before-mentioned means to ensure their functioning in repeated cycles automatically when the machine is once started and the supplying of paper to the mandrel has begun.

15. In combination with a machine for making paper tubes, a unitary, reciprocating, intermittently-rotating mandrel, to which paper in strip form is supplied and wound spirally thereon to form a tube and means for holding said paper strips to be supplied to said mandrel.

16. In combination with a machine for making paper tubes, a positively driven, unitary, reciprocating, intermittently-rotating mandrel, to which paper in strip form is supplied and wound spirally thereon to form a tube and means for holding said paper strips to be supplied to said mandrel.

17. In combination with a machine for making paper tubes, a unitary detachable, replaceable, reciprocating, intermittently-rotating mandrel, to which paper in strip form is supplied to be drawn forward and wound thereon to form a tube and means for holding said paper strips to be supplied to said mandrel.

18. In combination with a machine for making paper tubes, a reciprocating, intermittently-rotating mandrel to which paper in strip form is supplied and wound spirally

thereon to form a tube, and means for gripping said tube so that upon the backward stroke the mandrel may be withdrawn therefrom.

19. In combination with a machine for making paper tubes, a unitary, reciprocating, intermittently-rotating mandrel to which paper in strip form is supplied and wound spirally thereon to form a tube, and means for gripping said tube so that upon the backward stroke the mandrel may be withdrawn therefrom.

20. A machine for making paper tubes, comprising a unitary mandrel, means for simultaneously rotating and protruding said mandrel, means for varying the speed of rotation of said mandrel in relation to its rate of protruson, means for passing to said mandrel at an acute angle therewith paper in strip form to be drawn forward and wound on said mandrel to form a tube, means for simultaneously arresting the rotation and protrusion of said mandrel, means for gripping the tube formed on said mandrel so as to strip it therefrom upon the retraction of the mandrel, and means for retracting said mandrel.

21. In combination with a machine for making paper tubes, a unitary, reciprocating, intermittently-rotating mandrel upon which the tube is formed, adjustable roll-holders for the paper strips of which said tube is being formed, means for varying the speed at which the mandrel is rotated in relation to its rate of protrusion so as to supply the paper strips to the mandrel at the predetermined angle at which said roll-holders are set.

22. The method of forming tubes from paper strips consisting of setting the strip-holders so as to supply the paper strips at a predetermined angle to a rotating mandrel which is being protruded at a uniform rate, so supplying said paper, and adjusting the speed of rotation of said mandrel in relation to its rate of protrusion.

In testimony whereof I affix my signature.

ROBERT J. JAUCH.