June 5, 1951 F. W. NOBLE ET AL 2,555,758

WRAPPING MACHINE

Filed May 4, 1948 6 Sheets-Sheet 1

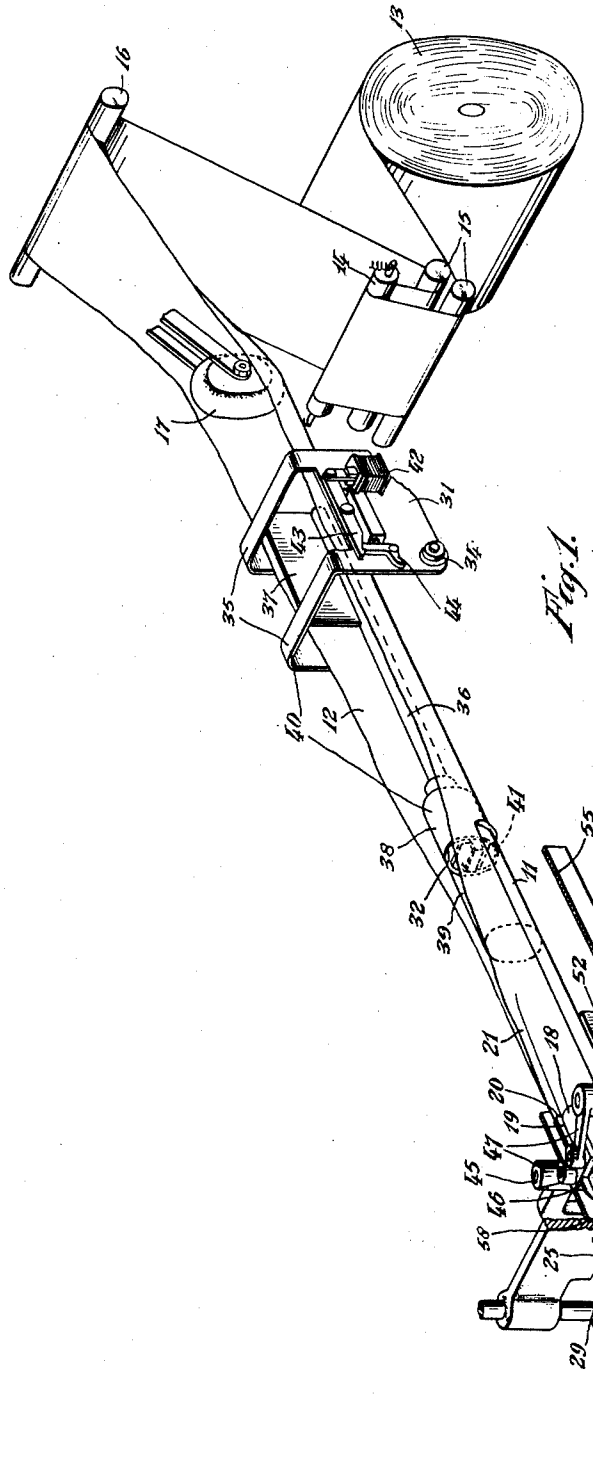


Fig. 1.

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Donald Charles Baker
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WRAPPING MACHINE

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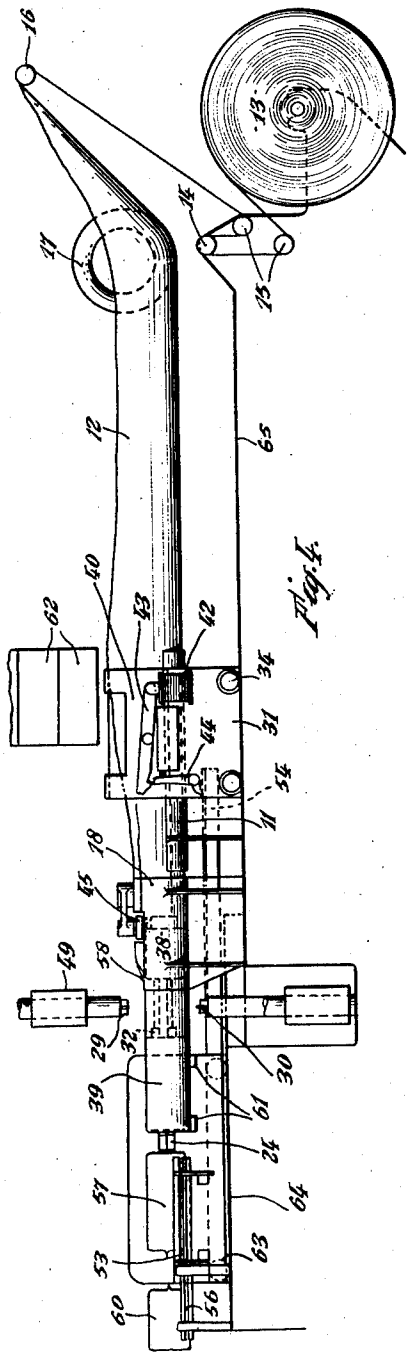


Fig. 4.

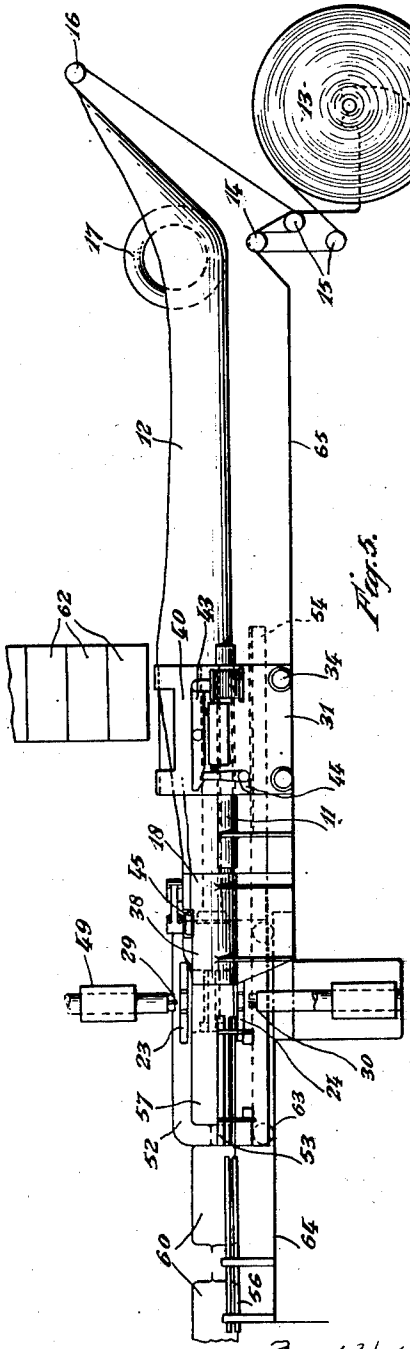


Fig. 5.

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WRAPPING MACHINE

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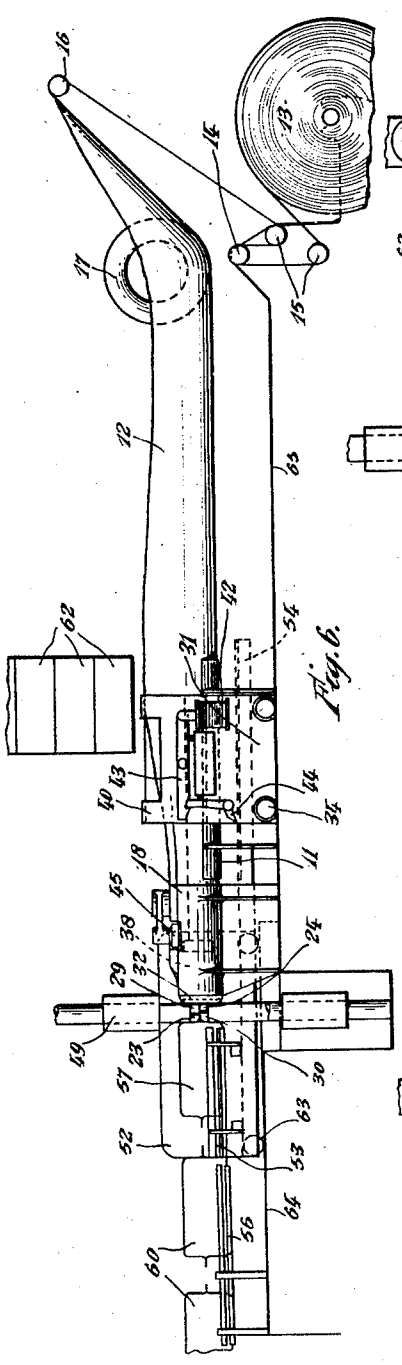


Fig. 6.

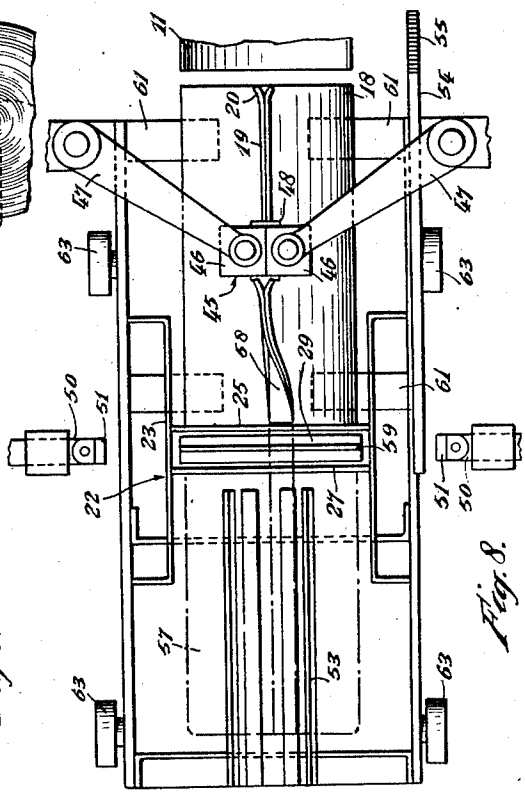


Fig. 8.

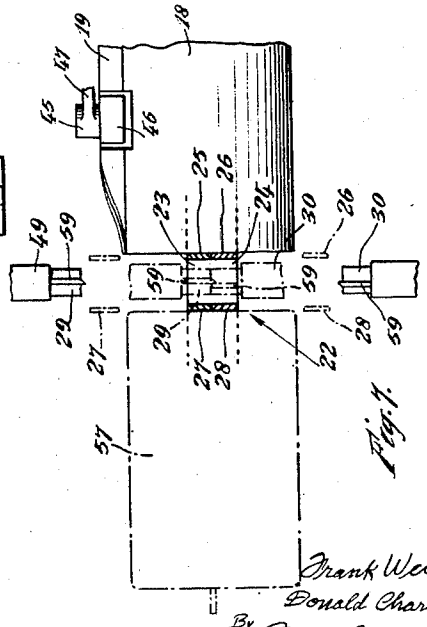


Fig. 4.

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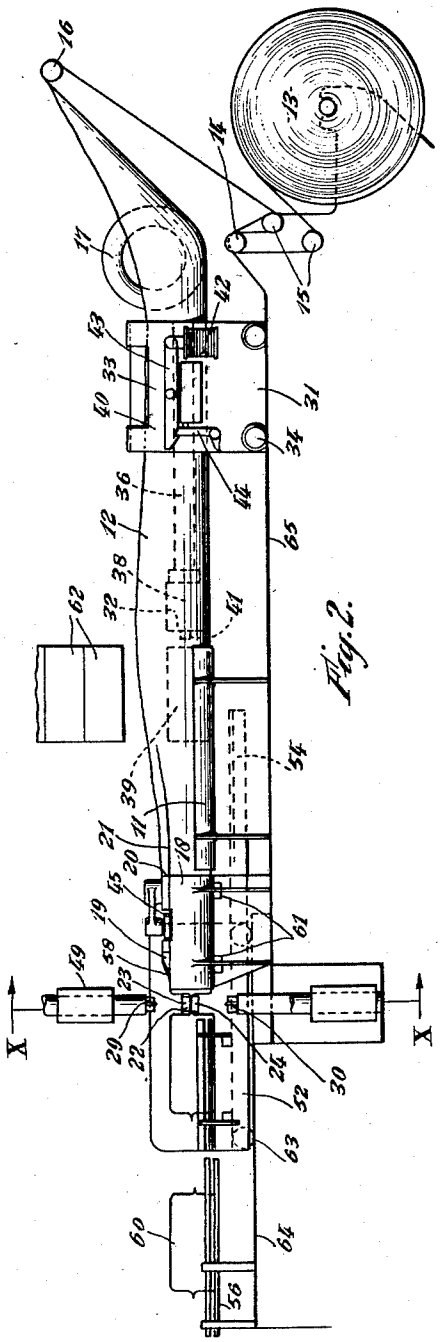


Fig. 2.

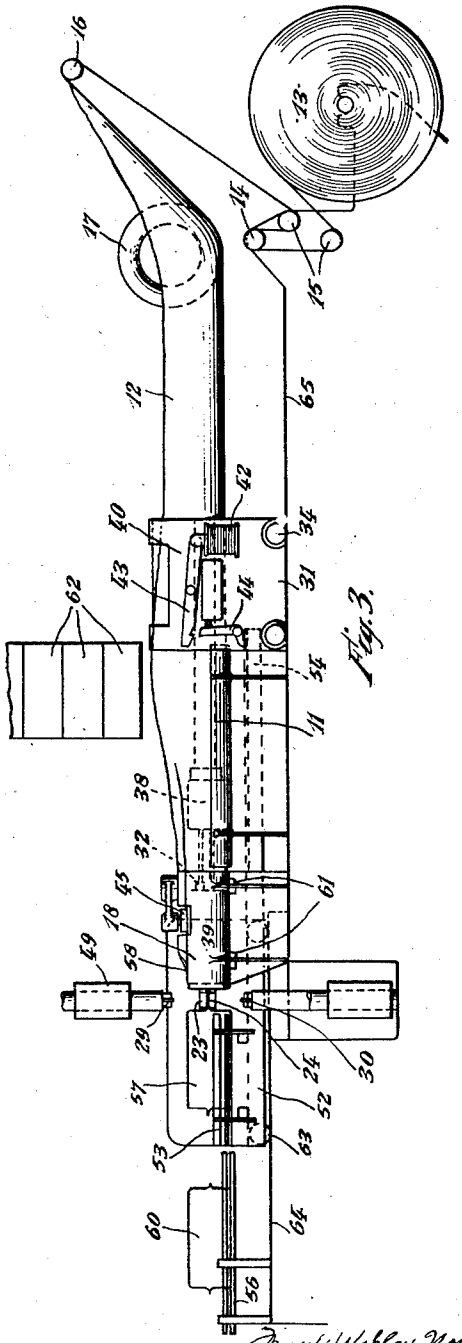


Fig. 3.

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Fig. 9.

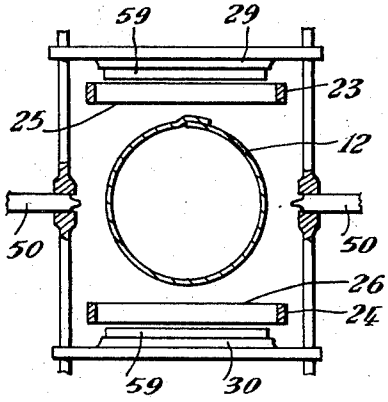


Fig. 10.

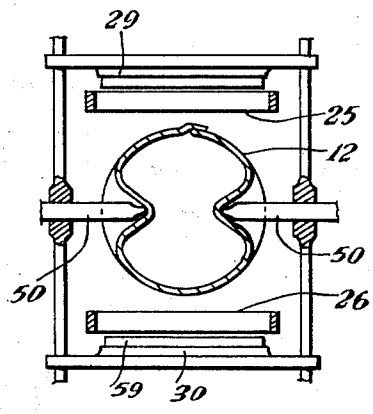


Fig. 11.

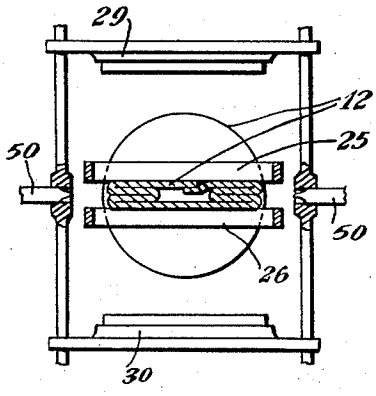
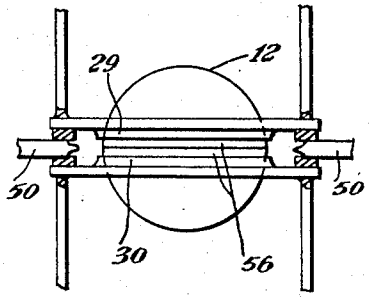


Fig. 12.



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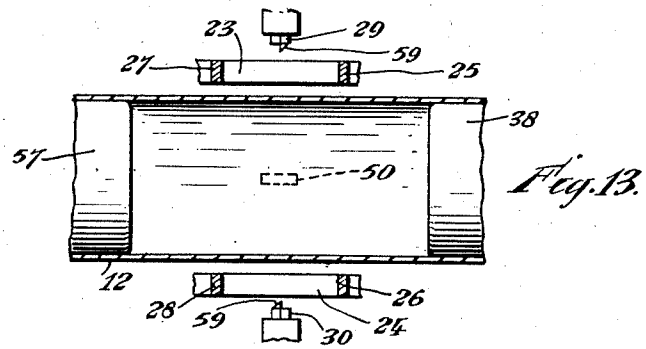


Fig. 13.

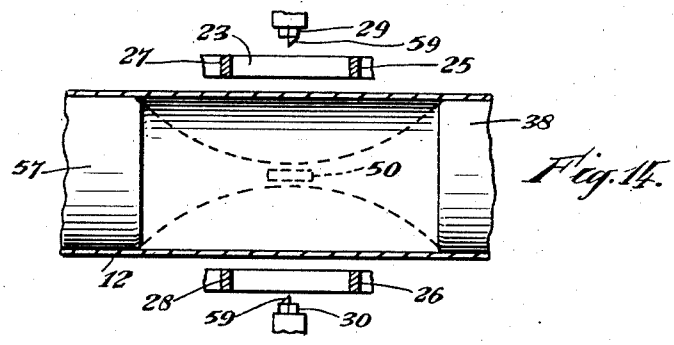


Fig. 14.

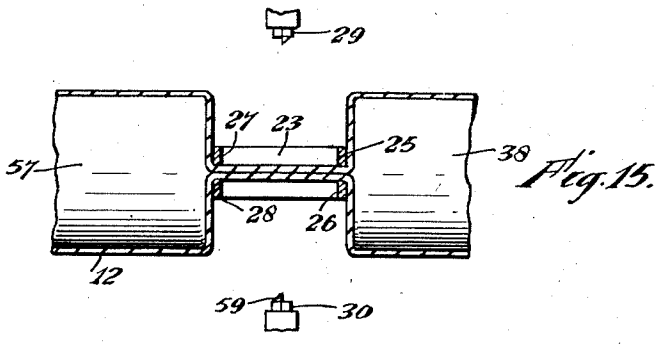


Fig. 15.

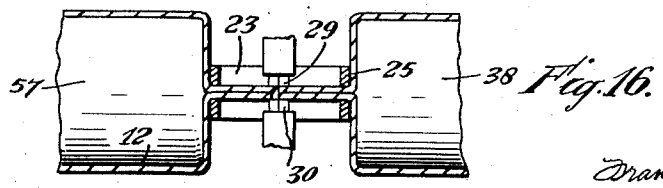


Fig. 16.

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Patented June 5, 1951

2,555,758

UNITED STATES PATENT OFFICE

2,555,758

WRAPPING MACHINE

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Application May 4, 1948, Serial No. 24,994
In Great Britain May 9, 1947

7 Claims. (Cl. 93—3)

1

This invention relates to wrapping machines, the object being to provide improvements therein.

In this specification paper and other wrapping material will, for convenience, be referred to as paper.

A wrapping machine according to this invention comprises means for supplying wrapping paper in continuous web form, a platform adapted to receive said paper web and the article to be wrapped, means for forming the paper web longitudinally into a tube, means for propelling the article along said platform and the paper web into said tube, means for sealing the longitudinal edges of the web to each other to complete the tube, means for forming two laterally opposed longitudinal re-entrant folds in said tube, means for flattening said tube in lateral alignment with said re-entrant folds to bring opposed portions of the wall of the tube into facial contact with each other, means for sealing said facially contacting portions of the wall of the tube to each other, spacing and gripping means adapted to embrace the flattened portion of the tube and provide end abutments for two longitudinally adjacent articles, and means for longitudinally moving said spacing and gripping means.

The means for forming the re-entrant folds in the tube may comprise two fingers adapted to approach each other in a plane containing the axis of the tube and in directions normal to said axis. The means for flattening the tube may comprise jaws adapted to move in a plane normal to the axis of the tube and in directions normal to said re-entrant folding means, and said flattening means may also provide the spacing and gripping means. The means for moving said spacing and gripping means may comprise a carriage on which said spacing and gripping means are mounted, the said carriage being adapted to be moved longitudinally of the machine, and devices adapted to connect said carriage to said means for propelling the article along said platform and paper web. The means for propelling the article along the platform and paper web may comprise a two-part plunger unit comprising an outer shell and an inner plunger adapted for the said plunger to be projected from said shell in an axial direction, the said plunger unit being mounted on a carriage adapted to be moved longitudinally of the machine and the said plunger unit being mounted in axial alignment with said tube forming means. The plunger unit carriage may comprise devices for connecting said carriage to said spacing and gripping means carriage and the plunger unit may comprise abutting means adapted to actuate automatically the said devices.

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The paper for wrapping the articles may be of the type adapted for adhesion by the application of heat and/or pressure, and the sealing means comprised in a machine according to this invention may comprise devices for applying heat and/or pressure to said paper to effect adhesion and sealing. Alternatively, the paper may be of the type adapted for adhesive to be applied thereto for the purpose of effecting a seal, and the invention may further comprise means for applying said adhesive and means for applying heat and/or pressure to said paper to effect said sealing.

One form of the invention, adapted for wrapping packages having a round section, is illustrated in the accompanying drawings, wherein—

Fig. 1 is a diagrammatic perspective view of the machine.

Figs. 2, 3, 4, 5, and 6 are side elevations of the machine showing it in different stages of operation.

Fig. 7 is a sectional side elevation of parts of the machine.

Fig. 8 is a corresponding plan view.

Figs. 9, 10, 11 and 12 are diagrammatic enlarged sectional elevations of line X—X of Fig. 2, showing parts of the machine in various stages of operation, and

Figs. 13, 14, 15 and 16 are diagrammatic enlarged longitudinal sectional elevations corresponding respectively to Figs. 9, 10, 11 and 12.

A cradle 11, providing a platform, is disposed substantially horizontally, and is of straight longitudinal section and part round lateral section. This platform or cradle 11 is hereinafter referred to as the feed cradle. A web of paper 12 is fed to the feed cradle so as to lie longitudinally therein and take up substantially the same section as the feed cradle. Between the original reel 13 of paper and the feed cradle, the web 12 may pass over tension rollers 14, actuated by springs or otherwise, and idler and guide rollers 15 and 16, and in the final run from a guide roller 16 to the feed cradle a forming wheel 17 may ride on the web so as to apply a "belly" thereto to assist the web in conforming to the section of the feed cradle.

A tubular mould 18 of round section is disposed adjacent the end of the feed cradle remote from the web feed, and is provided with a longitudinal slit along the top thereof, the portions of the mould at each edge or side of said slit being turned upwardly to form a pair of substantially

parallel vertical flanges 19 which provide a guide through which the edges of the web may pass during the sealing process, as hereinafter described. The ends of said flanges nearer to the web feed may be splayed outwardly, as at 20, to form an entry for said web edges. At the end of the feed cradle remote from the web feed, the web is formed into a longitudinal tube within the tubular mould 18, the two longitudinal edges 21 of the web being placed together along the top of the mould and projecting outwardly between the guide flanges 19 on the feed cradle tube with the inner faces of the web ,adjacent the two edges, in facial contact The paper may be heat or pressure sealing so that when heat or pressure is applied to the two facially contacting edges of the web they will be sealed together to form a complete tube having the sealed portions forming a longitudinal external rib, or the paper may have adhesive applied to it for the purpose of effecting the seals. Initially, the paper tube may be formed manually, thereafter being formed automatically as the machine operates, as hereinafter described. The extreme end of the paper tube may also initially be closed by hand.

A gripping device 22 is provided, comprising transverse upper and lower horizontal jaw frames 23, 24, adapted to move vertically in opposite directions so as to close on to each other at or about the horizontal plane containing the axis of the tube whereby the web projecting from the closed end of the paper tube may be gripped therebetween; the jaws formed on said frames also provide a rigid abutment for the end of the paper tube. The gripping device comprises two pairs of jaws rigidly spaced longitudinally apart, one pair of jaws comprising a jaw 25 mounted on the jaw frame 23 and a jaw 26 mounted on the jaw frame 24, providing an abutment for the end of the paper tube as hereinbefore described, the other pair of jaws comprising a jaw 27 mounted on the jaw frame 23 and a jaw 28 mounted on the jaw frame 24 providing an abutment for the rear end of a package already wrapped, as hereinafter described. The jaws 25, 26, 27 and 28 are horizontal and disposed transversely of the machine so that the pair 25 and 26, and the pair 27 and 28 can meet separately at the axis of the tube.

Preferably, the longitudinal spacing between the two pairs of jaws of the gripping device is such that the jaws 29, 30 of a transverse sealing device, hereinafter described, may pass vertically therethrough to make contact with the paper tube.

A plunger unit 40 is provided, and comprises a carriage 31 and a plunger 32. The carriage 31 may be substantially of inverted channel formation, comprising longitudinal side members 33 provided with wheels or rollers 34, and transverse top members 35 such that the paper web 12 may pass longitudinally under the top members and between the side members, prior to the web being formed into a tube. The wheels 34 of the carriage may run on longitudinal side rails 65 so that the carriage may move along the web. The carriage 31 is positioned between the web feed and the feed cradle 11, but may run over the said cradle. A hollow ram 36 is suspended from the transverse top members 35 of the carriage 31, for example, by a web 37, so as to lie along and above the paper web 12. An outer plunger shell 38, of circular transverse section, is mounted on the end of the hollow ram 36, adjacent the feed cradle, and the plunger 32 is disposed within said shell, the plunger being mounted on the end of a ram disposed within and adapted to reciprocate in the hollow ram 36 so that the plunger may be projected axially from the shell in the direction of the feed cradle 11.

A package 39 which is to be wrapped is transferred from a pack 62, Fig. 2, to the paper web 12, above the feed cradle 11, and in front of the plunger unit 40. The inner plunger 32 of the plunger unit is moved forward out of the shell 38 so that it pushes the package 39 longitudinally along the web 12 and feed cradle 11 into the paper tube formed within the tubular mould 18, Fig. 3. Whilst the plunger 32 is being projected to the full extent out of the shell 38, the carriage 31 is moved forward so that the complete plunger unit operates to complete the forward movement of the package 39 with the forward end of the package abutting the closed forward end of the paper tube which in turn abuts jaws 25, 26, of the gripping device 22. A detector, which may comprise a transverse rail 41, projects forwardly from the plunger 32, beyond the front face thereof, and is adapted to be pressed axially towards the plunger and forms part of an electric circuit completing device suitably adapted, when the circuit is completed, to cause a solenoid 42 mounted on the carriage 31 to be actuated so that, when the detector is depressed to complete the said circuit, the solenoid operates a lever 43 to release a pawl 44, Fig. 3, for the purpose hereinafter described. When the plunger unit 40 moves the package 39 forward the detector 41 abuts the end of the package, but the detector is sufficiently spring-loaded to prevent it being depressed until movement of the package is restrained. When the package 39 abuts the end of the paper tube and the gripping jaws 25, 26, the axial movement of the package is restrained, the detector is depressed, and the pawl 44 is released. The plunger unit presses the package tightly into the paper tube, but suitable means may be provided for adjusting the pressure of the plunger so that a package containing or consisting of fragile articles may be wrapped without being crushed.

A seam sealing device 45 is disposed above the tubular mould 18 and comprises two jaws 46, 46, mounted on the ends of pivoted arms 47, 47 and adapted to be closed on to each other to grip between them the two edges 21 of the paper tube, which project vertically upwards. The flanges 19 on the mould 18 and the top of said mould may be interrupted or cut away at 48 to enable the jaws 46 of the seam sealing device to make contact with the edges 21 of the paper tube. The seam sealing device applies pressure to the two edges of the paper tube and effects a seal therebetween, and such seal is completed along the whole length of the paper tube as it is pulled axially as hereinafter described, the two edges of the paper tube being drawn longitudinally through the seam sealing jaws.

A transverse sealing device 49 is provided, comprising the two horizontally disposed jaws 29, 30, disposed one above and one below the axis of the machine and adapted to be moved vertically towards each other to grip the paper tube, flattened as hereinafter described, between them and apply pressure thereto to seal the walls of the paper tube together. As hereinbefore described, the transverse sealing jaws 29, 30, pass through the horizontal spaces between the two pairs of gripping jaws 25, 26 and 27, 28, so as to make contact with the paper.

Two fingers 50, 50 are disposed horizontally in the plane containing the axis of the machine, one finger on each side of said axis, and adapted to be moved towards each other and towards said axis. The fingers have thin or substantially sharp horizontal edges 51, 51 on their inner ends; these edges may be provided by blunt blades fitted in the ends of the fingers. When the fingers are moved towards each other they contact opposite portions of the wall of the paper tube in the plane of the axis thereof and press said wall inwardly to form re-entrant folds in opposte sides of the tube.

The gripping device 22 is mounted on a carriage 52, hereinafter referred to as the gripping unit carriage, provided with wheels 63 adapted to run longitudinally of the machine on rails 64. A cradle 53 is provided on the gripping unit carriage, on to which cradle, a wrapped package may be transferred when the carriage is retracted as hereinafter described. The gripping unit cradle 53 may comprise a series of longitudinal laths spaced apart transversely. The gripping unit carriage is provided with a horizontal toothed rack 54, which projects therefrom longitudinally of the machine rearwards towards the plunger unit carriage 31, and the teeth 55 on said rack 54 are adapted to be engaged by the pawl 44 on said plunger unit when said pawl is released as hereinbefore described; such engagement of the pawl with the rack locks the plunger unit carriage to the gripping unit carriage and enables both carriages to be moved simultaneously, Figs. 3 and 4.

A fixed stripper unit is disposed at the end of the machine remote from the web feed, and comprises a cradle 56. The stripper unit cradle 56 may comprise a series of longitudinal laths, spaced apart transversely and gradually inclined upwards from the machine to form a ramp. When the gripping unit carriage 52 is moved towards the stripper unit the gripping unit cradle 53 telescopes into the stripper unit cradle, the laths of the gripping unit cradle lying between and alternating transversely with the laths of the stripper unit cradle, Fig. 4, and a package on the cradle 53 rises up the ramped cradle 56 and is transferred thereto, and the said package is retained on the stripper unit cradle 56 when the gripping unit returns towards the feed end of the machine, Fig. 5.

When the machine is in operation there will be a partially wrapped package 57, hereinafter referred to as the forward package, lying on the gripping unit cradle 53, Fig. 5, the said forward package 57, being wrapped to the extent that the forward end of the wrapping and the longitudinal seam along the top of the wrapping tube are completed. The paper will continue rearwards in tubular form from the rear end of the forward package 57 to the seam sealing device 45 and around the plunger shell 38, which is in its extreme forward position with the plunger 32 projected therefrom, whence the web will deviate rearwards from the tubular formation to the arcuate form on the feed cradle 11. The partially wrapped forward package 57 on the gripping unit cradle 53 is located with its rear end a short distance in front of the forward gripping device jaws 27, 28, the transverse sealing device 49 and the horizontal fingers 50. The plunger 32 is then retracted into the shell 38, the portions of the various parts being as shown in Figs. 9 and 13. The fingers 50 are operated to move inwardly, so

that they make the re-entrant folds in the paper tube between the rear end of the forward package 57 and the forward end of the shell 38 of the plunger unit 40, Figs. 10 and 14, the fingers thereafter being withdrawn outwardly. The gripping device 22 is then operated to cause the jaws 25, 26, 27, 28, to close vertically on to the paper tube and compress the upper and bottom portions of the wall thereof on to the said re-entrant folds, Figs. 6, 11 and 13. Suitably, the forward package 57 will have been moved forward in the manner hereinafter described, so that it is disposed with its rear end spaced from the forward end of the plunger unit a distance approximately equal to the vertical dimension or diameter of the package plus the longitudinal distance across the two pairs of gripping unit jaws, Figs. 13 and 14, so that when the gripping unit jaws compress on to the paper tube the paper is turned vertically over the end of the plunger unit by the jaws 25, 26, passes longitudinally between the said jaws, and on to and between the jaws 27, 28, and then is turned vertically to lie against the rear end of the forward package 57, Fig. 15, the said spacing of the forward package providing sufficient paper to allow said folds to be made without dragging the paper along the plunger shell 38, the forward package 57 being drawn backwards on the cradle 53 whilst said folding is being effected in order that the rear end thereof may abut the gripping unit jaws 27, 28, Fig. 15, and the plunger 32 being drawn forwards so that the forward end thereof may abut the gripping jaws 25, 26. The upstanding flanges 19 on the mould 18, forming a guide for the longitudinal edges 21 of the paper tube, may be turned downwardly near to the end remote from the paper feed, both in the same direction on to the outer surface of the mould 18 as at 58, so as to constrain the sealed longitudinal edges of the paper tube to lie substantially parallel to the wall of the paper tube as the paper tube is drawn through the mould 18. The forward pair of gripping jaws 27, 28, will descend close behind the rear end of the forward package 57 and the upper and lower portions of the wall of the paper tube will be turned downwardly and upwardly, respectively, on the rear end of the forward package, with the two side re-entrant folds forming gussets therebetween. The upper and lower portions of the paper tube wall will continue horizontally and in contact with each other rearwards through and from the front gripping jaws 27, 28, then through the rear pair of gripping jaws 25, 26 and upwardly and downwardly, respectively to form a new end for the paper tube immediately in front of the forward end of the plunger 32, the plunger shell 38 providing a "former" for the paper tube. The transverse sealing device 49 is then operated to cause the jaws 29, 30 to move vertically and close on the horizontal flattened portion of the paper tube between the two pairs of gripping jaws 25, 26 and 27, 28, and effect sealing of the upper and lower walls of the paper tube to each other and to the re-entrant fold gussets, Figs. 6, 12 and 16. The transverse sealing jaws 29, 30 may each incorporate cutters 59, adapted to sever the sealed paper tube between the forward package and the plunger unit.

The transverse sealing jaws, 29, 30 are then withdrawn, and the plunger unit 40 is withdrawn rearwardly to its extreme rear position.

A new unwrapped package 39 is placed on the paper web on the feed cradle 11, Fig. 2. The plunger unit 40 is operated as hereinbefore described to push the new package 39 into the paper tube, the plunger carriage 31 moving forward until the forward end of the new package 39 abuts the new end of the paper tube and the rear pair of gripping jaws, 25, 26, the resistance of said jaws to the new package and plunger 32 causes the detector 41 to be operated as described, whereupon the pawl 44 on the plunger carriage 31 is released to engage the rack 54 on the gripping unit carriage 52, Fig. 3.

The pressure on the seam sealing jaws 46 is relaxed as the new package 39 is pushed into the tube, and whilst the paper web is stationary in the machine, so as to prevent excessive heat being applied to the paper at the stationary point registering with the said seam sealing jaws, but when the said package has been pushed fully home into the paper tube, the pressure on the seam sealing jaws 46 is restored to effect the seal between the two edges 21 of the web. The gripping jaws, 25, 26, and 27, 28 will be retained in position, and forward movement of the plunger unit 40 will be continued, whereby with the gripping unit carriage 52 and the forward and new packages 57 and 39 will be moved forward until the gripping unit cradle 53 co-operates with the stripper unit cradle 56, Fig. 4.

The continued forward movement of the plunger unit 40 causes the inner plunger 32 to push the package 39, wrapped around by the web, out of the forward end of the mold 18, and the web is drawn thereby forwardly through the mold 18. The plunger 32 is projected out of the plunger shell 38 a distance equal to the required spacing of the rear end of the forward package 57 from the forward end of the tubular mould 18 so that when the forward package 57 is received on the stripper unit cradle 56, the new package 39, pressed forward by the end of the plunger 32 in contact therewith assumes the original position of the forward package. As the new package 39 issues from the forward end of the tubular mould 18 it is received on suitable carrier means formed on the gripping unit carriage 52, for example, inwardly directed lugs 61 on said carriage, so as to be carried forward thereby and supported.

The pawl 44 is raised out of engagement with the rack 54 by suitably timed mechanical means (not shown) and the gripping device jaws 25, 26 and 27, 28 are opened. The gripping unit carriage 52 is then retracted, the plunger unit 40 remaining in the forward position, Fig. 5; thereby the gripping unit cradle 53 is withdrawn from under the original package 57 which is transferred to the stripper unit cradle 56 and may hereafter be considered as the completed package 60, and the gripping unit cradle 53 is drawn under the original new package 39 which may hereafter be considered as the forward package 57. When the gripping unit carriage has reached its extreme rearward position the plunger is retracted into the plunger shell 38 by spring or other suitable means and the plunger shell, which has not advanced beyond the forward end of the tubular mould 18, provides a former for the paper tube, Fig. 6, the whole cycle of operations then being repeated.

By the use of a wrapping machine according to this invention packages of varying lengths may be wrapped in the same machine in one and the same run without any adjustment, as the locking of the plunger unit 40 to the gripping unit carriage 52 for simultaneous travel is effected by the forward end of a new package abutting the gripping jaws, 27, 28 the position of the plunger unit 40 in relation to the gripping unit carriage 52 being irrelevant except that the plunger 32 must abut the rear end of the new package; the toothed rack 54 on the gripping unit carriage is of sufficient length to enable it to be engaged by the pawl 44 on the plunger carriage 31 at any position of the plunger unit relative to the gripping unit carriage.

It is obvious that the machine may be adapted for wrapping packages of any cross-sectional shape, a tubular mould and a plunger shell of appropriate cross-sectional shape being assembled in the machine. The machine may be adapted to wrap single articles, or a plurality of articles, for example, biscuits, in one package. The plunger 32 and the plunger shell 38 are formed with means, for example, air passage therethrough, to allow air to pass longitudinally therethrough so that any air which may be trapped between the end of the paper tube and the forward end of the plunger may be released by passing back through the plunger.

Any suitable means may be provided for effecting actuation of the devices comprised in the machine, and for ensuring actuation in correct time relation, and in order that the essential features of the invention may be clearly illustrated in the drawings it is not considered desirable to show examples of such means.

In another embodiment of the invention, powdered or granular materials or liquid may be fed through the hollow plunger and/or the plunger shell 38, the axis of the machine being disposed in a vertical or other plane to permit this.

What we claim and desire to secure by Letters Patent is:

1. A wrapping machine comprising means for supplying wrapping paper in continuous web form, a platform adapted to receive said paper web and the article to be wrapped, means for forming the paper web longitudinally into a tube, means for propelling the article along said platform and paper web into said tube, means for sealing the longitudnal edges of the web to each other to complete the tube, means for forming two laterally opposed longitudinal re-entrant folds in said tube, means for flattening said tube in lateral alignment with said re-entrant folds to bring opposed portions of the wall of the tube into facial contact with each other, means for sealing said facially contacting portions of the wall of the tube to each other, spacing and gripping means adapted to embrace the flattened portion of the tube and provide end abutments for two longitudinally adjacent articles, and means for longitudinally moving said spacing and gripping means.

2. A wrapping machine according to claim 1, wherein the means for forming the re-entrant folds in the tube comprise two fingers adapted to approach each other in a plane containing the axis of the tube and in directions normal to said axis.

3. A wrapping machine according to claim 1, wherein the means for flattening the tube, and the spacing and gripping means comprise jaws adapted to move in a plane normal to the axis

of the tube and in directions normal to said reentrant folding means.

4. A wrapping machine according to claim 1, wherein the means for moving said spacing and gripping means comprise a carriage on which said spacing and gripping means are mounted the said carriage being adapted to be moved longitudinally of the machine, and devices adapted to connect said carriage to said means for propelling the article along said platform and paper web.

5. A wrapping machine according to claim 1, wherein the means for propelling the article along the platform and paper web comprise a two-part plunger unit comprising an outer shell and an inner plunger adapted for the said plunger to be projected from said shell in an axial direction, the said plunger unit being mounted on a carriage adapted to be moved longitudinally of the machine and the said plunger unit being mounted in axial alignment with said tube forming means.

6. A wrapping machine according to claim 1, wherein the means for moving said spacing and gripping means comprise a carriage on which said spacing and gripping means are mounted the said carriage being adapted to be moved longitudinally of the machine, the means for propelling the article along the platform and paper web comprise a two-part plunger unit comprising an outer shell and an inner plunger adapted for the said plunger to be projected from said shell in an axial direction, the said plunger unit being mounted on a carriage adapted to be moved longitudinally of the machine and the said plunger unit being mounted in axial alignment with said tube forming means, and means for connecting said spacing and gripping means carriage to said plunger unit carriage comprising a solenoid actuated pawl on the plunger unit carriage and a toothed rack on the spacing and gripping means carriage, switching means for the circuit of said solenoid being provided on said plunger unit adapted to be actuated when the article has been fully pushed home in the paper tube.

7. A wrapping machine according to claim 1, wherein the means for sealing said facially contacting portions of the wall of the paper tube to each other comprise two platens adapted to be moved in a vertical plane in opposed directions, said means being adapted to register with said spacing and gripping means whereby to close on facially contacting walls when held by said spacing and gripping means.

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