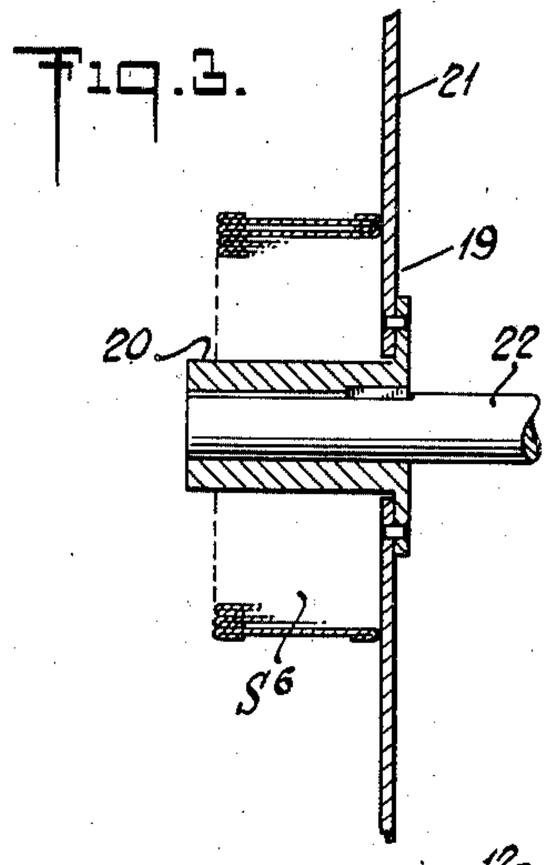
Nov. 11, 1947. A. G. GILBERT 2,430,463

STRIP EDGE INFOLDING MACHINE

Filed March 11, 1944 2 Sheets-Sheet 1

Fig. 1.

Fig. 3.



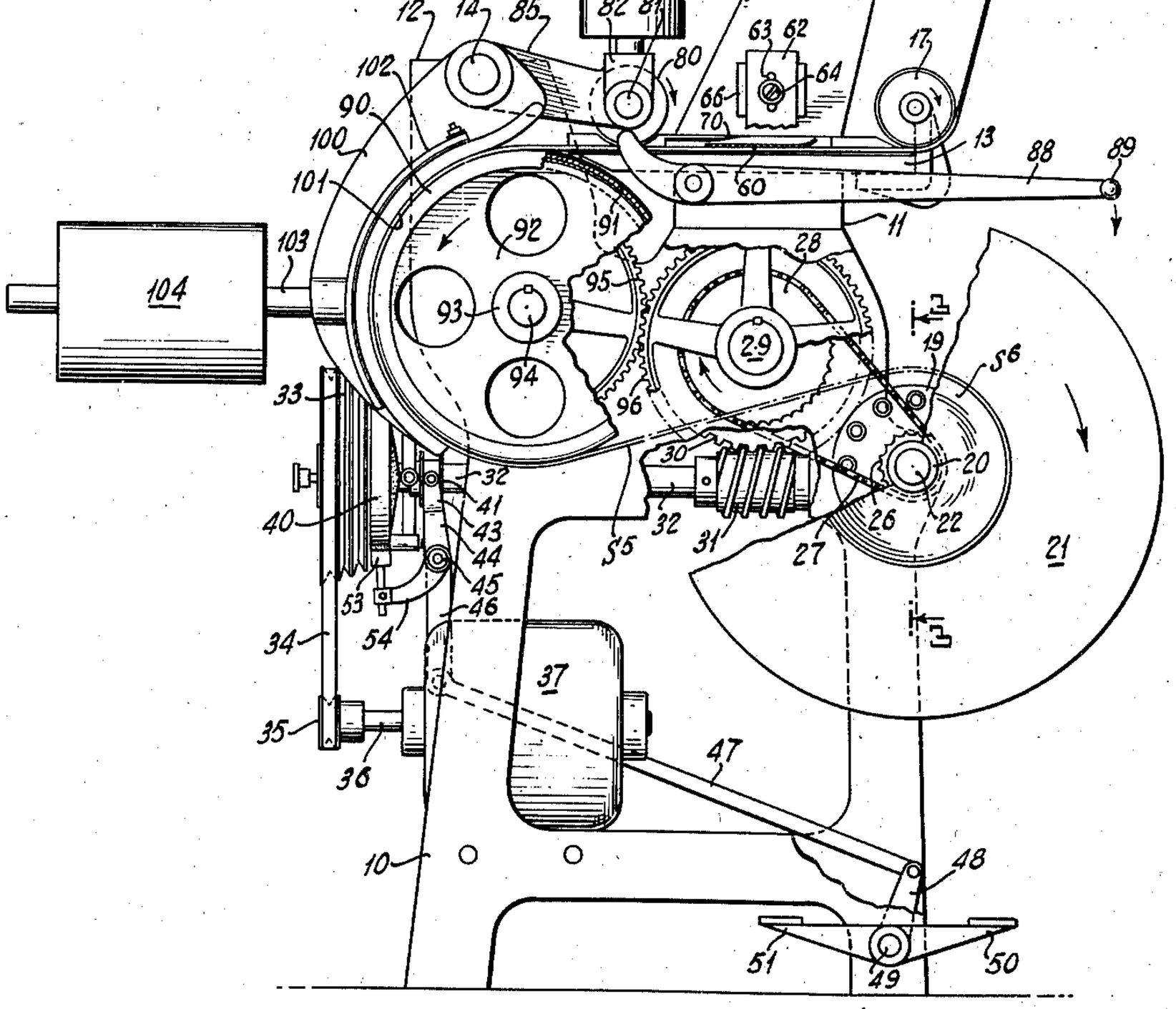


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Fig. 5.

Fig. 2.

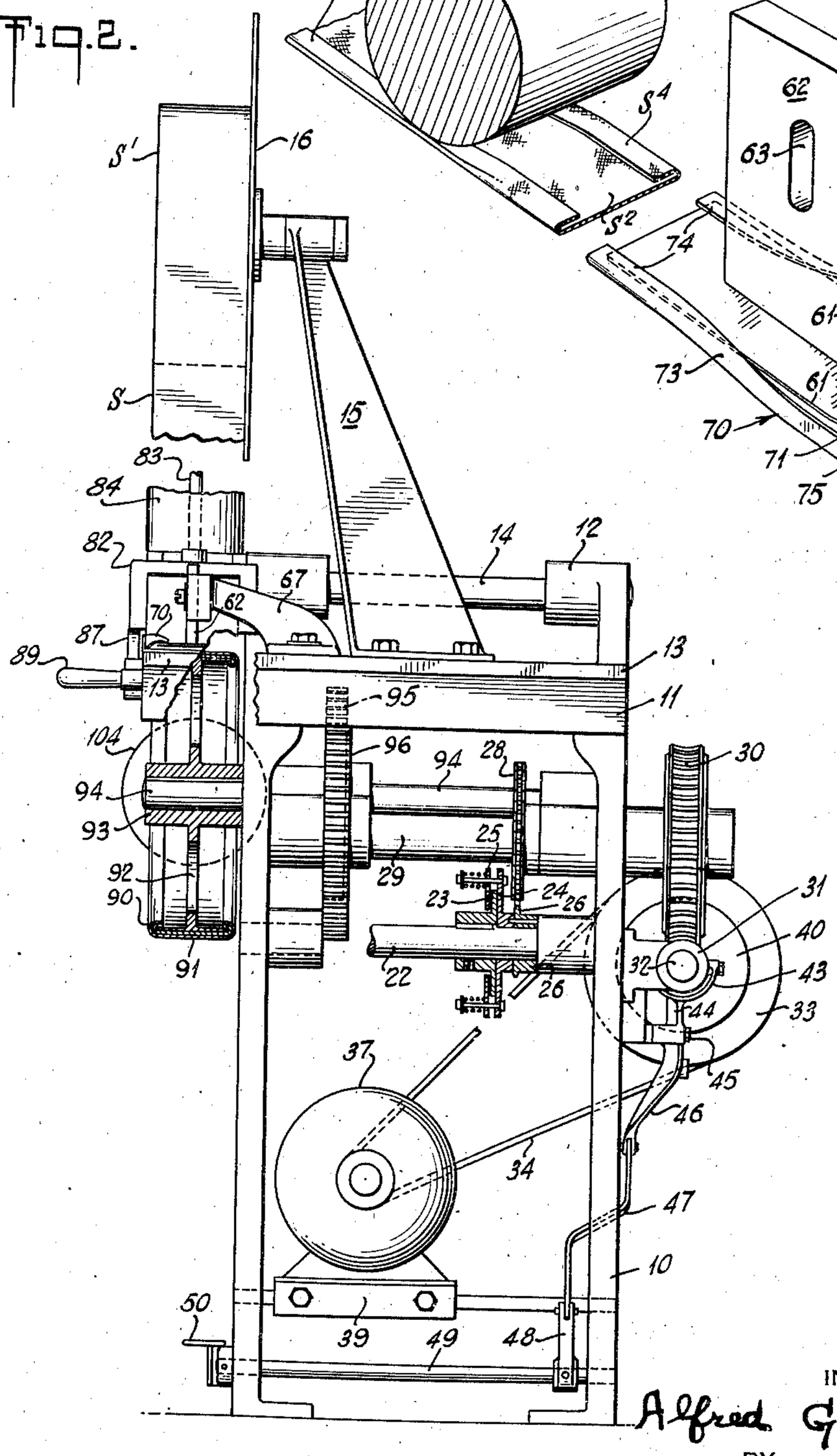
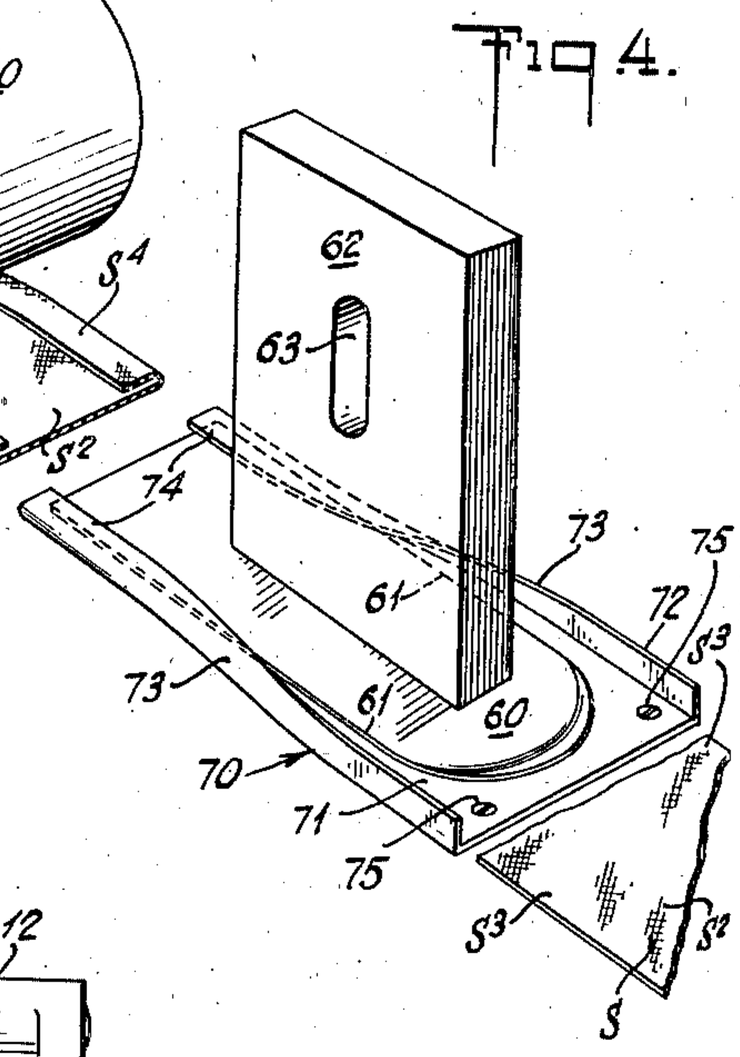


Fig. 4.



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UNITED STATES PATENT OFFICE

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STRIP EDGE INFOLDING MACHINE

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Application March 11, 1944, Serial No. 526,107

1 Claim. (Cl. 270—93)

1

This invention is a novel strip edge infolding machine or power-driven apparatus for turning or folding inwardly and pressing in place at least one, and usually both, of the edges of a continuous strip or band of fabric, leather or similar pliant sheet material.

The general object of the present invention is to afford a machine of the kind referred to which is adapted to operate continuously upon a traveling strip of fabric conducted from a suitable source or supply roll, through the successive operating positions and mechanisms of the machine, with means to fold inwardly the opposite margins, or at least one of them, upon the central portion or body of the strip during travel, and thereafter press or break and fix the folds, from which operations the material may travel continuously onward to a receiving point whereat the completed strip may be accumulated in the form of a roll. A further object is to provide such a machine wherein the operations may be performed by power drive and wherein the driving means and operating mechanisms are combined and arranged in a compact and convenient manner. Another object is to afford successive operating mechanisms each of high efficiency and accuracy, and the whole capable of a substantially high rate of operation, delivering a substantial number of yards of completed strip per minute.

Other and further objects and advantages of the invention will be made clear in the hereinafter following description of an illustrative embodiment of the invention or will be understood by those conversant with the subject. To the attainment of such objects and advantages the present invention consists in the novel strip edge infolding machine and the novel features of combination, arrangement, operation and detail herein illustrated or described.

In the accompanying drawings

Fig. 1 is what may be termed a front elevational view of a strip edge infolding machine embodying the present invention, with several parts broken away to show the construction of parts beyond.

Fig. 2 is a righthand elevational view of the machine shown in Fig. 1, also with some parts broken away.

Fig. 3 shows in central section, looking from the right, the take-up reel omitted from Fig. 2, said section taken on the line 3—3 of Fig. 1.

Fig. 4 is a perspective diagram view on enlarged scale showing the defining die or templet and the infolding member in operative relation thereto and indicating how the traveling fabric strip has

2

its margins progressively inturned at its opposite edges.

Fig. 5 is a similar perspective diagram view of the means or roller which takes part in pressing and creasing the folds produced at the edges of the traveling strip.

The strip of fabric, leather or other pliant material is indicated generally by the reference letter S, and this strip or band, of extended length, is shown as being supplied by a roll S′ thereof, carried on a reel which rotates under frictional restraint as the strip is drawn from the roll to and through the operating mechanisms of the machine. The pliant strip may be of different characters and of various thicknesses, but typically it is a simple woven strip or tape with straight parallel side edges, between which lie the body or central part S^2 of the strip and the margins S^3 which are to be infolded. When infolded these margins are designated S^4, and the infolded, pressed and completed strip S^5 is shown as traveling to a receiving point and accumulated as a roll S^6 of infolded strip.

Before describing the operating mechanisms the machine in general may be described as having a frame with a base portion 10 above which extend a righthand upward extension 11 and a lefthand upward extension 12. Mounted atop the right-hand frame extension is a fixed table 13, and at the upper part of the lefthand extension is a fixed-position axle 14. Attached to the table is shown an upwardly extending bracket 15 at the top end of which is carried a reel 16 which is rotary and gives support to the supply roll S′ of fabric strip.

For a compact arrangement, occupying minimum floor space, the machine has the supply reel 16 located at an elevated point, rotatable at the top of the bracket 15 upstanding from the table 13, while the take-up means is preferably located beneath the table. The supply strip S, traveling down from the upper roll S′ passes first around or underneath an idler or guide roller 17 mounted near the righthand edge of the table 13; and from the underside of the idler roller the path of travel is leftward, the strip passing through the successive mechanisms for defining and infolding the strip, for pressing and breaking the folds and for ironing or smoothing them, beyond which operations the material travels to the take-up roll S^6.

Describing next the take-up means, this comprises a reel 19 shown in Figs. 1 and 3, and comprising a core 20 and a flange 21 which are fast upon or keyed to a reel shaft 22. Preferably the

take-up reel is rotated by a slip drive, so that it winds up the roll of completed strip, in a manner allowing for the gradual decrease in rotary speed as the roll of strip increases in diameter.

For these purposes the take-up reel shaft 22 may be power-driven by suitable connections illustratively shown as follows. On the shaft 22 is keyed a flanged collar 23, and face to face with this is a flanged loose collar 24; and an operative connection between these flanges comprises a spring-pressed disk 25, the flange 23 for example being resiliently squeezed between flange 24 and disk 25, affording a friction drive of the take-up reel. Attached to the loose collar 24 is a sprocket pinion 26 and this is operatively geared through a chain 27 with a sprocket wheel 28 mounted on the horizontal shaft 29 which extends fore-and-aft and may be considered as the main shaft of the machine.

For the power drive of the main shaft 29, and the various mechanisms deriving their motion from it, there is shown, fast on the main shaft, a worm wheel 30, preferably outside of the frame 10, and this worm wheel is driven by a worm 31 carried on what may be termed the drive shaft 32 of the machine. The drive shaft in turn may be power rotated through a pulley 33, shown as a 3-groove pulley, which is loose on the shaft and which operates to drive the shaft when the clutch is closed as will be described. A belt 34 extends to the clutch pulley 33 from a power pulley 35 mounted at the left end of a power shaft 36 which is driven by, and may be the shaft of, a motor 37. The motor may be an electric motor with conventional means of putting it into or out of operation and varying its speed, and it is shown carried on an adjustable base 38 which may be slid along a suitable frame part for applying and tightening the drive belt. The train of driving connections described provides speed reduction, first, at the pulleys 35—33, the latter being of larger diameter, and again through the worm and wheel 31—30, so that the main shaft 29 may rotate at a suitable speed during operation.

The clutch between the pulley 33 and the drive shaft 32 may be of conventional character, preferably with friction engagement. Thus a friction disk 40 may be employed, splined and shiftable upon the drive shaft, this disk being cooperable with the pulley 33 to afford driving engagement between them for clutching purposes. For shifting the clutch disk 40 there is shown a grooved collar 41 attached to the disk and engaged by the pins projecting inwardly from a yoke 43 which straddles the grooved collar and is carried upon a lever arm 44 fulcrumed on an axle 45 and having a downwardly extending arm 46 by which the clutch operations may be performed. The rocking lever 44—46 may be pedal operated for example through a long link 47 extending from the lower end of arm 46 to an upstanding rock arm 48 of a pedal shaft 49 having a righthand pedal 50 which may be depressed to cause the closing of the clutch and operation of the machine, and a left-hand pedal 51 for reversing the conditions and disengaging the clutch. When the stopping pedal is depressed this may also cause a braking of the main shaft and connected parts, for example by means of a braking ring 53 adapted to act upon the periphery of the clutch disk 40, with a connection 54 from the rock lever 44—46 to apply the brake when the pedal 51 is depressed.

Describing next the operating mechanisms of

the machine, the first of these consists of a fold-defining means, die or templet 60 and cooperating therewith an infolding means 70. The die 60 is shown separately in Fig. 4 and consists of a defining plate overlying the path of horizontal travel of the strip, above the machine table 13. The die is shown as having defining edges 61 at its two sides, which may be largely parallel but are initially flared, as shown, so as to facilitate the defining and infolding actions. The die plate 60 is carried at the lower end of a vertical stem or bar 62 suitably mounted in a resilient or adjustable position in the machine. For example the stem 62 may be formed near its upper end with a slot 63 engaged by a set screw 64, thus permitting the stem and die to be adjusted vertically and to be positioned and set initially before the start of operations. Instead of the fixed mounting of a set screw the stem may be resiliently mounted so as to bear down yieldingly upon the traveling strip. The set screw 64 is shown in Figs. 1 and 2 as extending through the slot 63 of the stem and thence into the upper end or head 66 of a curved bracket 67 mounted on the machine table 13.

Cooperating with the die or templet so described is an infolder 70, which may take different forms and which preferably is a passive element operating by reason of the relative advancing travel of the strip, the side margins S^3 of which are progressively turned up, over, inward, and down upon the margins of the die, as the strip material is infolded upon the die into its desired final form. Illustratively the infolder is shown as a single rigid member which may be removably attached by screws or otherwise to the top side of the table 13. Thus the infolder is shown as comprising, in its body portion, a flat plate 71 secured on top of the table and having at its side edges flanges 72. The body of the plate 71 may taper somewhat in the direction of travel, and the flanges 72 may initially stand vertically, sufficiently apart to facilitate the feeding and threading of the strip S between the die and infolder. By reason of the general tapering of the infolder, the margins of the strip are bent upwardly, while the upstanding flanges 72 of the infolder are progressively varied in their disposition, taking a warped form 73 through part of their length, the material of the flanges thus becoming progressively turned inwardly until, near the terminal portion of the infolder the flanges take a flat horizontal position 74 closely above the side edges of the die. The infolder may be fastened down upon the table 13 by means of accessible screws 75 which can be readily removed to permit the sliding away of the infolder and thereby the vertical adjusting of the die.

It is to be understood that the die and infolder, in their design and dimensions, are cooperative, in that the die toward the latter portion of the infolder, while extending into the recesses underneath the infolder flange sections 74 does not extend outwardly to fill such recesses, a clearance being left sufficient to accommodate the thickness of the strip material. Similarly, the infolder recesses beneath flange sections 74 are to be sufficiently deep in a vertical direction to accommodate not only the thickness of the die, but therewith the thickness of the strip beneath the die, and the additional thickness of the infolded strip margins above the die. The result is that the fabric strip may be fed straight into the die-and-infolder device, and its margins gradually turned upwardly and folded over inwardly

and downwardly to a definite position, defined by the die, the material, thus infolded at one or both of its edges, issuing from the latter part of the device with its infolds accurately formed as predetermined by the design and dimensions of the parts.

From the infolding means, as seen in Figs. 1 and 2, the infolded strip material advances with continuous travel to the next mechanism comprising a fold-pressing roller **80**, the operation of which is sometimes referred to as breaking, tending to put a definite pressure upon the folds, to set them while freshly folded. The breaking roller **80** need not be driven except by the travel of the material, and it is therefore shown as an idler roller, turning freely upon a short axle **81** extending across between the two sides of a yoke **82** which in turn has a vertical stem **83** carrying a dead weight **84** designed and applied for the purpose of giving a predetermined downward pressure upon the creasing roller. For the purpose of such pressure a spring could be used but the utilization of gravity avoids the need of a spring.

A simple mounting for the fold-pressing roller **80** is shown as consisting of a carrier arm **85**, rigid or integral with the yoke **82** and having its hub swingable loosely on the axle **14** atop the left-hand frame extension **12**. For the purpose of initially threading the strip into the machine, after it has been passed around the guide roller **17** and beneath the templet **60**, a device is illustrated for lifting slightly the pressure roller **80** from the strip traveling on the table. This device consists of a short lifting finger **87**, suitably pivoted to the frame extension **11**, and having a long rightwardly extending lever arm **88**, the end of which is formed as a handle **89** which needs only to be depressed, causing the finger **87** to bear upwardly against the yoke **82** and thus provide a space for feeding the strip beneath the roller. The creasing roller **80** and the underneath table **13** constitute opposing members for pressing between them the infolded traveling strip.

The next mechanism along the path of strip travel comprises a wheel **90** which both operates to drive the strip and takes part in a strip smoothing or finishing action as the strip advances to the take-up point. The strip feeder wheel **90**, as best seen in Fig .2, is provided with a cushioned rim **91**, the rim flange for example being padded and the padding covered with leather, fabric or other sheet material. The wheel rim is connected by a web **92** with its hub **93** and the latter is keyed upon a counter-shaft **94** parallel to the main shaft **27**, the shafts being geared together by a gear **95** on the countershaft in mesh with a gear **96** on the main shaft. In operation the drive of the take-up reel affords a working tension on the length of strip between the drive wheel and the take-up, so that substantial friction is provided between the padded drive wheel and the strip, so that the drive wheel functions as a strip feeding means, pulling the strip progressively through the infolding and pressing points, carrying it around from the level of the table downwardly around the periphery of the drive wheel, at the left side of the machine, and thence rightwardly to the take-up point.

Preferably the drive wheel takes part in a smoothing or ironing action in cooperation with a smoothing iron **100**, which is of arcuate shape to fit the periphery of the strip driving wheel and is mounted swingingly upon the high axle **14**.

The ironing member **100** is preferably heated, for example electrically by a heater unit **102**, and its inner surface should be highly smooth or polished, so that the strip material, with its infolds facing the ironing member, is dragged around in contact with the hot polished surface **101**, affording an effective finishing action by which any wrinkles are removed from the strip material and the folds are firmly and permanently fixed.

As a convenient means of applying a smoothing and ironing pressure upon the ironing member **100**, this swinging member is shown as provided with an outstanding stem **103**, similar to the stem **83** but in this case horizontal, said stem carrying a heavy weight **104** the gravity of which causes the ironing member to be forced inwardly against the padded or cushioned periphery of the strip advancing wheel **90**.

In reviewing the invention above described in detail it may first be stated that for many practical purposes cloth pieces that have to be stitched must have their edges first folded-in in order to avoid the appearance of raw edges, to prevent raveling, and to give strength to hold the stitches that are to be applied. In the case of elongated strips, belts or bands, which may be supplied in rolls or otherwise, it is therefore necessary to open up at length or unroll the strip in order to permit its edge or edges to be infolded, and the strip then wound or compactly disposed until stitching is to be applied. These operations if manually performed are cumbersome and unwieldly and are subject to inaccuracies as well as slow operation and therefore high cost of production. The present invention performs substantially automatically the necessary operations, and supplemental ones, and can deliver the infolded product in the uniform and compact form of a roll, ready for stitching or other operations.

The present invention comprises the cooperating combination of certain essential means or elements, and in a more specific aspect comprises these together with certain advantageous additional means or elements. A characteristic element is the strip driving or feeding element located intermediate the supply means and the take-up means and shown in the form of a feeder or wheel **90** of substantial diameter having drive mechanism for continuously rotating it to pull the strip progressively from the supply and advance it toward the take-up. This feeder or wheel is shown with its rim padded or cushioned, the covering thereof being more or less rough, according to the material of the strip to be infolded, to give a feeding grip upon the strip without injury to the material. Taking a specific case, merely as an example, the fabric or other strip may be 2 inches wide and required to have ¼ inch folds at its edges. The feeder wheel may be driven at 15 R. P. M. and may have a circumference for example of 3 feet, so that 45 feet of strip may be handled per minute. The strip edge infolding means is intermediate the supply and the feeder wheel and its edge definer or die cooperates with its infolder, the two being operable progressively by reason of the advancing travel of the strip; the die being movable or adjustable toward and from the infolder to take care of variations in thickness of strip. The operations and results are greatly improved by the cooperation of the described pressing or creasing means in advance of the feeder wheel and the smoothing or ironing member facing and cooperative with the feeding wheel.

The pressing or creasing means is shown as consisting of opposed members with means for causing their relative approach, one member being the rotatable roller 80 operating by reason of the travel of the strip between the members, and the other being either a second roller or preferably a stationary member, supplied by the table 13, which is underneath and also gives support to the traveling strip; the creasing pressure between these two members being predetermined by the gravity of the dead weight 84.

The smoothing or ironing member or plate 100 is of arcuate form, adjacent to and facing a portion of the periphery of the feeder wheel, and having means causing this member to bear upon the strip traveling between the wheel and member, thereby to squeeze, smooth and fix the edge infolds, which is considerably aided by the heating of the concavely curved plate, which is preferably polished at its inner contacting surface.

The operation will be understood from the foregoing description. A roll of the raw fabric or strip is loaded on to the reel 16. Its end is then threaded through the machine, being passed around the guide roller 17 and thence, preferably horizontally, to and through the infolding means, the die being lifted for this purpose and then restored and held in its defining position. The material is then threaded through the creasing means, between the table and the pressing roller 80, these being momentarily separated by operating the handle 89 to lift the mountings of the roller, which is then let down upon the strip upon the table. The edge infolds are preferably formed at the upper side of the strip, as specifically illustrated in Figs. 4 and 5, so that the creasing roller 80 presses directly upon the infolds as the strip passes along horizontally upon the table. Enough strip is pulled through initially to enable the feeding or strip driving wheel 90 to receive an extended length of strip and exert a frictional grip thereon for feeding purposes. The folds of the strip rest outwardly as the strip passes around the feed wheel, but later as the strip is wound on the take-up the folds lie inwardly so that when the take-up roll or strip is completed the folds are concealed by the body of the strip. The smoothing or ironing action is by the polished curved plate 100 bearing directly against the infolds at the outer side of the traveling strip; and the cooperation of the feeder wheel and the hot ironing member gives an effective final smoothing and setting of the folded strip. The take-up means affords an action whereby the strip is maintained taut between the feeder wheel and the take-up, so that effective friction and drag are provided between the strip and the cushioned periphery of the wheel. This result is attained by the driving of the take-up reel 19 at a speed which never permits the strip to become slack between the feeder wheel and the take-up. There is a speed multiplication factor in the take-up sprocket drive 28, 27, 26; and this drive of the take-up reel accommodates itself to the peripheral speed of the feeder wheel and the fabric strip by reason of the slip connection 23, 24, 25 in the train of connections from the main shaft 29 to the take-up reel.

The operation as a whole is reliable and substantially foolproof. Any given supply of fabric strip is handled and infolded expeditiously and accurately, with a uniform product. The machine is well adapted to the handling of strips of varying width, for it will be noted that the

reels, supply and take-up, are open at one side, and that the width of the rollers 17 and 18 and of the rim of the wheel 90 give ample latitude for varying the width of the strip; although the defining die and infolder device are preferably interchangeable for strips of differing width. Owing to the accurate infolding of the edge or edges, and their prompt creasing, followed by their passage around part of the periphery of the feeder wheel, and the hot ironing of the folds thereon, the folded strip is put into permanent condition, for all practical purposes, and without the need of any adhesive to cause the infolds to remain set, so that there is no disfigurement of the fabric from liquid adhesives, and no basting or other temporary holding means is required.

The padded wheel 90 and polished concave iron 100 have two joint functions of importance. (1) They cooperate in the pulling feed of the strip, the iron pressing the strip to the wheel rim to create friction and drag while the wheel rotates to pull the supplied strip through the folding means. (2) They cooperate in the final smoothing and fold-setting by the ironing action as the wheel rim and strip pass along the hot concave surface of the iron, which thus relatively slides or wipes over the strip with pressure against the padded surface of the wheel. The action is not comparable with a tangential or line contact between a roller or rollers and a cloth blank, since here the concave iron has face contact over an extended length and area of the wheel rim and strip. This is comparable with the true ironing action of a hot flatiron upon a garment upon an ironing board, but here the iron is concave and stationary while the supporting rim is convex and rotary; in both cases there is pressing contact with frictional rubbing action distributed over a large area, compared with the line contact of an ordinary presser roll. The contact may be over a substantial arc, as 90° to 180° of periphery, contrasted with the negligible contact afforded when a pressing roll is tangential. Herein the ironing member 100, in the sense mentioned is caused to press forcibly against the rim of wheel 90 by the simple means shown, of a shiftable or pivoted mounting near the wheel top, the iron depending therefrom and having the horizontally projecting stem 103 carrying the heavy weight 104, more reliable and durable than a spring device.

There has thus been disclosed an illustrative strip edge infolding machine embodying the principles and attaining the objects of the present invention; but since many matters of combination, arrangement, operation and structure may be variously modified without departing from such principles it is not intended to limit the invention to such matters except to the extent set forth in the appended claims.

What is claimed is:

In an automatic and continuously operating strip edge infolding and fold-setting machine of the kind provided with automatic strip supply means and automatic strip take-up means operable for strip material of indefinite length and therebetween an automatic strip-edge infolding device operable progressively during the advancing travel of the strip; the combination thereof with a provision comprising the following automatic and cooperating elements constituting a strip feeding and fold-setting means to which the strip under tension is automatically conducted beyond the infolding device, namely: a

rotatable strip-conducting feed-wheel of substantial diameter with padded rim to which the strip travels tangentially, and said feed-wheel having drive mechanism for continuously rotating it to pull along and thereby feed under continuous tension the supplied strip by frictional drag progressively from the infolding device and advance it toward the take-up; and a non-traveling polished hot-smoothing iron of concave arcuate form mounted shiftably in opposition to an extended arcuate length of the rim of the padded feed-wheel and having means causing such smoothing iron continuously to bear forcibly upon the strip as the strip travels along upon the advancing feed-wheel rim in concave sliding contact against the non-traveling smoothing iron, thereby continuously to iron and smooth the edge-folded strip effectively to fix and set the infolds thereof by the prolonged relative sliding and frictional wiping action of the polished concave iron against the traveling strip carried upon the convex rotating rim of said feed-wheel; whereby the convex rotatable padded feed-wheel

and the non-traveling concave iron mutually take part both in the continuous tension feeding from the supply through the infolding device toward the take-up and in the progressive smooth-ironing of the folded strip in advance of take-up.

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