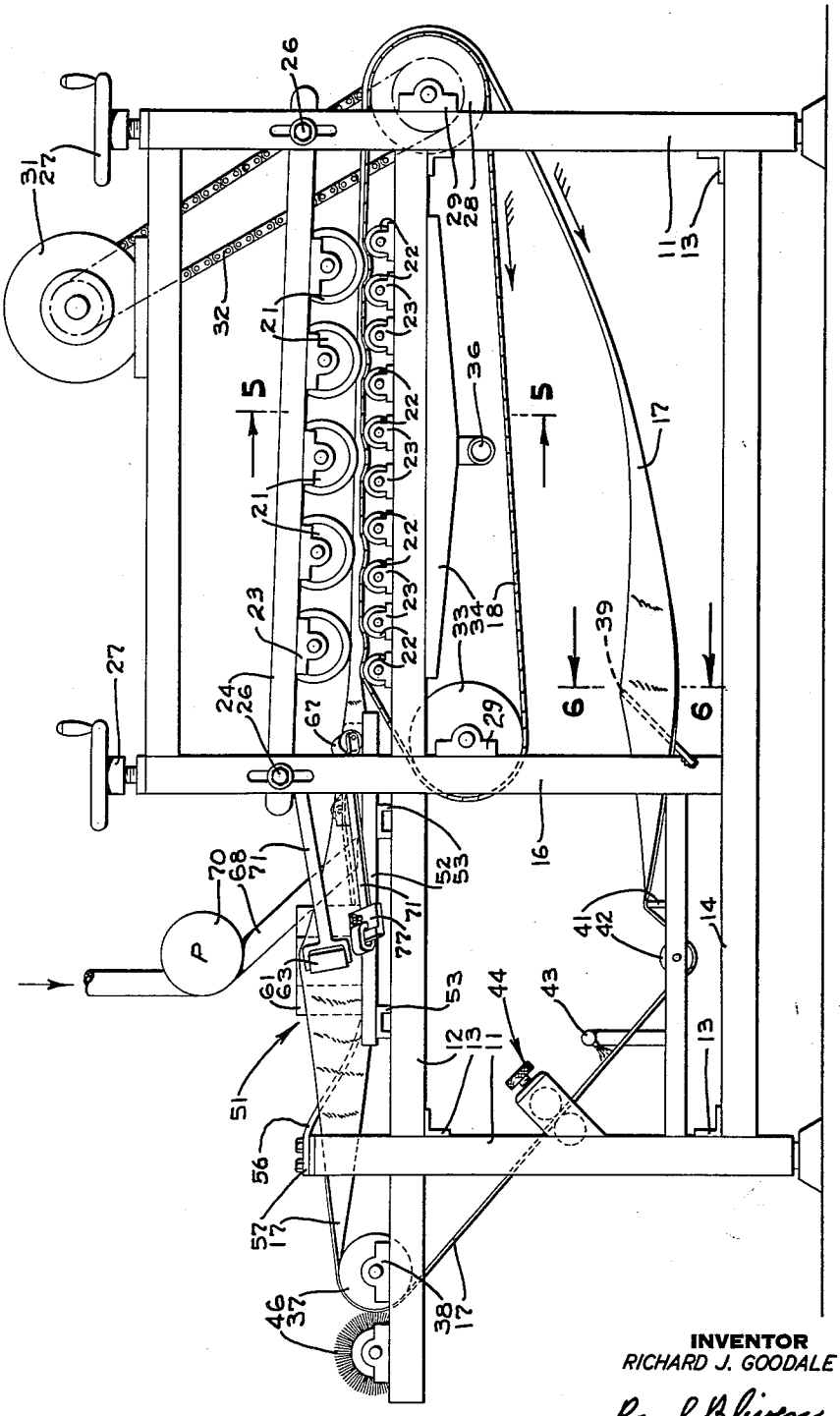
Nov. 12, 1963 R. J. GOODALE 3,110,244

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Fig. 1



INVENTOR
RICHARD J. GOODALE

Paul Bliven

BY

ATTORNEY

Nov. 12, 1963 R. J. GOODALE 3,110,244

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Fig-2

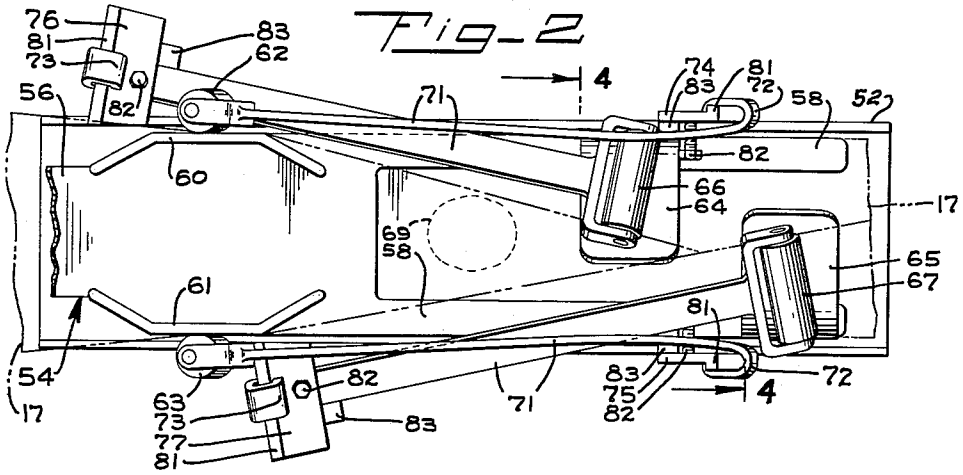


Fig-3

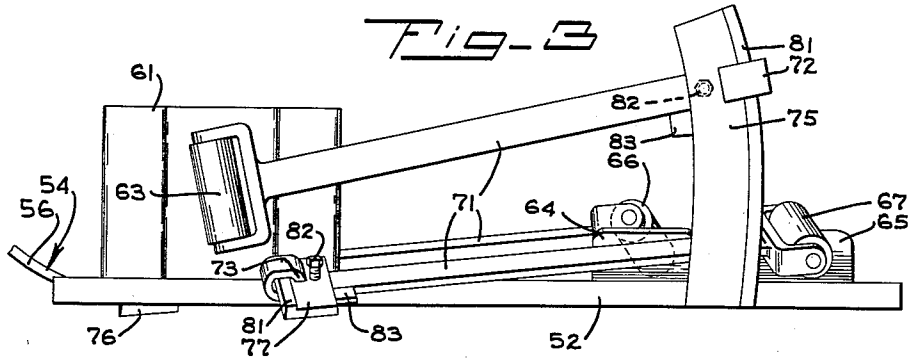


Fig-4

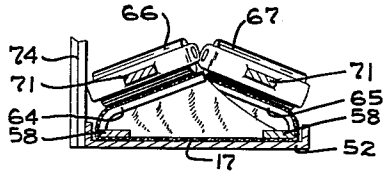


Fig-5

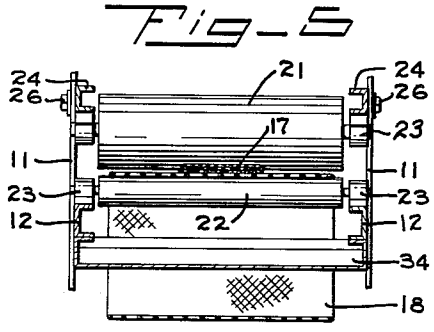
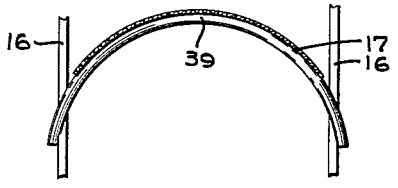


Fig-6



INVENTOR
RICHARD J. GOODALE

BY Paul Bliven

ATTORNEY

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PULP PRESS

Richard J. Goodale, Box 268, Watsonville, Calif.

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4 Claims. (Cl. 100—120)

The present invention relates to a pulp press using an endless press cloth that is folded over on the received pulp and is unfolded to discharge the cake of such pulp after passing between continuously running press rolls.

Batch pressing, using a stack of separate press cloths each with a quantity of pulp folded into each cloth or a looped cloth to form pockets containing pulp, is too slow. The large area under pressure reduces the unit pressure on the pulp to a relatively small value considering the total pressure capacity of the press, which in the larger presses runs into many tons. Further, the usual thick cake of pulp in each cloth means that the percolation time is great, the time for the liquid content of the pulp in a press cloth to reach a uniform practicable minimum amount of liquid thruout the cake. Further, the usual thick cake creates much greater stresses in the cloth than a thinner cake would for a given unit pressure in the cake. This will be readily seen if the rounded edges of the folded over cloth are analyzed for stresses in the manner of a cylindrical pressure vessel. For a given fluid pressure and thickness of cylindrical-vessel wall, the stress in the wall is directly proportional to the diameter of the vessel. These greater stresses mean a short cloth life.

Having in mind many of the obvious defects of the prior pulp presses operating on a batch basis either with a single or a plurality of press cloths, it is an object of the present invention to devise a press that uses an endless belt like press cloth with which it performs a continuous pressing operation.

Another object of the present invention is the use of a plurality of pairs of press rolls, between each pair of which is pressed an endless press cloth carrying pulp.

Still another object of the present invention is to devise means for continuously folding a press cloth onto raw pulp and unfolding such cloth for the discharge from the cloth of the pulp cake after it has been pressed.

A further object is to devise a continuously operating press which will produce a cake that is much thinner than is possible with the prior batch presses for a comparable economic, or cost, operation.

Yet another object of the present invention is the construction of a press using a plurality of pairs of rollers between which pairs an endless folded press cloth is passed containing raw pulp so that the unit pressure of the pressing operation may be gradually increased to a value which is far greater than in a conventional platen press, a batch press employing opposed plates.

A still further object of the present invention is the use with an endless press cloth of an endless fine mesh belt which acts as a support for the cloth and pulp while it is passing between the press rolls.

Among the other objects of the invention as will be apparent hereinafter, is the reduction in size, weight, and cost of press machinery, a reduction in the cost of operation, and an increase in the rate of production on a cost and time basis.

These objects and others are achieved, and the aforementioned defects of the prior art are remedied by means of a press having a continuous feed of pulp and a continuous discharge of pulp cake from an endless press cloth which is in the form of a belt that is lap-folded over the raw pulp and which then passes between a series of pairs of pressure rolls, each succeeding pair squeezing therebetween the cloth and pulp with more pressure than the preceding pair, and by carrying such cloth on a fine mesh belt while it passes between such pressure rolls.

A continuous pulp press constructed and operable in accordance with the above outline is hereinafter described in detail and shown in the accompanying drawings, in which:

FIGURE 1 is an elevational view of a continuous pulp press embodying the present invention.

FIGURE 2 is a detail plan view of the press cloth folding mechanisms.

FIGURE 3 is an elevational view of FIGURE 2.

FIGURE 4 is a sectional view on the line 4—4 of FIGURE 2.

FIGURE 5 is a sectional view on the line 5—5 of FIGURE 1.

FIGURE 6 is a sectional view on the line 6—6 of FIGURE 1.

The continuous pulp press is shown provided with a supporting frame comprising: four legs **11**, one at each corner of the frame; near the upper ends of the legs, a pair of horizontal side channels **12** secured to and inside of the legs to act as the main longitudinal members of the press; cross members **13** tying the sides together; longitudinal base members **14** and further cross members **13** holding the lower ends of the legs in position; and a pair of intermediate stub legs **16** secured to the longitudinal members **12, 14** complete the frame. As seen in FIGURE 1, the left hand end is the inlet end, and the right hand end is the outlet end of the press.

The travel of the endless press cloth **17** and its supporting foraminous endless belt **18** is from left to right during the time the cloth and belt are carrying pulp and it is being pressed. This is the travel of the upper runs of the cloth and belt, parallel to and above the side channels **12**. Between the stub legs **16** and the right hand legs **11**, these upper runs pass between the upper press rolls **21** and the lower press rolls **22**. There are two of the lower rolls for each of the upper rolls. Each of the upper rolls is placed to bear against and between two of the lower rolls, and the upper rolls are about three times the diameter of the lower rolls. All of the rolls are arranged between and with their axes normal to the side channels **12**. The lower rolls **22** are provided at each end thereof with a journal which is in a pillow block **23** secured to the upper flange of a side channel **12**. The upper rolls **21** are similarly provided with journals and pillow blocks **23** which are secured to the lower side of press beams **24**. There is one of these beams above each of the side channels **12**, and the beam extends between the same posts as the lower rolls.

The upper and lower rolls are held with a desired spacing by locking the beams **24** to the legs **11, 16** by means of the clamp bolts **26** between the legs and beams, and/or by the use of press screws **27** which are adapted to exert downward pressure on the beams to move the upper rolls toward the lower rolls. However, the concept is not that of forcing the upper rolls against the lower rolls to effect the pulp squeezing but is that of setting the roll separation, and then of carrying the pulp between the rolls so that the pulp as it passes between the rolls tends to force them apart. The spacing between upper and lower rolls decreases from left to right, as the juice leaves the pulp and the cake forms and compacts.

Both the cloth **17** and the belt **18** pass around and are driven by a live drum **28** at the outlet end of the press. This drum is provided with journals and pillow blocks **29** which are secured to the right end legs **11** adjacent the ends of the side channels **12**. The live drum has its axis parallel to the axes of the press rolls, and its top is close to the plane of the tops of the lower rolls **22** so that it is

in the position to receive the cloth and the belt as they leave the press rolls. The live drum is suitably driven by a motor **31** located above the press rolls and secured to a portion of the press frame, suitable sprockets on the motor shaft and the live roll shaft, and an endless drive chain **32** which passes around and between such sprockets. The belt, also, passes around and in contact with a belt idler drum **33** which is located just ahead of and a little below the lower press rolls **22**. The two belt drums have parallel axes, and the idler drum is journaled in pillow blocks **29** which are secured to the stub legs **16**. The belt **18** may consist of interlocked and flattened coils of wire. The openings in the belt are small so that the belt will provide a good support for the press cloth but still allow for ample drainage therethru of juice from the pulp carried by the cloth. The belt drums may be slightly crowned so that the belt will run centered thereon. The press rolls are flat, no crown. The belt and the cloth may be of the same width or the belt may be substantially narrower than the cloth as the belt is contacted by the cloth only when it is folded, and the belt need be only wide enough to support the folded cloth. Between the upper and lower runs of the belt and below the lower press rolls, there is provided a juice collecting pan **34**. Juice squeezed out of the pulp carried by the cloth between the press rolls, flows and drips from the cloth, belt, and lower rolls into the juice pan **34** from which it may flow by means of an outlet **36**.

The press cloth **17** passes around an idler drum **37** that is placed near the left end of the side channels **12** and is journaled in pillow blocks **38** secured to the top flanges of the side channels. This press cloth idler should have a high crown as the press cloth has stretch both across and lengthwise, and the high crown is needed to keep the cloth centered on the drum. This idler drum's axis is parallel to the axes of the rolls and other drums. The top of this idler drum should be well above the plane of the tops of the lower rolls **22** to aid in the folding of the cloth as hereinafter described. The length of this drum should be that of the cloth width as the cloth is not folded as it passes over this drum, whereas, the length of the previously described drums and rollers may be only that of the folded width of the cloth. The cloth is folded, as seen in section in FIGURE 5, as it leaves the drive drum and begins its lower run. During its lower run, the cloth is unfolded to discharge pulp therefrom by passing over a half-round hoop **39** secured to and between the stub legs **16**. This unfolder, also, acts as a doctor blade to scrape pulp cake from the cloth. Also, pulp cake falls from the cloth as it is opened. This cake may be removed from below the cloth and the press frame by any suitable means; none has been shown or indicated. After leaving the unfolder **93**, the cloth may pass over a straight edged doctor blade **41**, under a tensioning roller **42** and a water spray **43** which washes the cloth, between wringer rolls **44** which will remove excess water from the wash spray **43**, and then back to the idler drum **37**. A rotating brush **46** may be placed adjacent the idler drum in position to brush loose particles of pulp from the cloth. The brush may be driven by any suitable means, none of which have been shown. The brush trunnions are carried in pillow blocks secured to the side channels **12**.

Between the leaving of the idler drum **37** and the first press rolls, wet pulp is fed to the upper face of the press cloth and the cloth is folded so that its edge portions overlap themselves and the pulp as shown in section in FIGURE 5. This feeding of the pulp and the folding of the cloth is done by mechanisms located at a folding station **51** located between the cloth idler drum **37** and the press rolls. The cloth is opened and flat as it leaves the cloth idler drum **37** and passes to an upwardly open fold forming channel member **52** which rests on and is secured to cross pieces **53** placed on and fixed to the side channels **12**. The inside width of the forming channel is about the width of the folded cloth. The flanges of the channel need be only about an inch in height, and are not necessary for the folding operation but provide convenient means for securing other parts of the folder thereto. The right hand end of the channel is close to the first press rolls. The web of the channel acts as a shoe in that a foot plate **54** bears on the upper face of the cloth and holds it against the channel web. A leg **56** is secured to the left end of the foot plate, and extends upward and to the left to a rail **57** which is placed between the upper ends of the left hand frame legs **11** and above the cloth. The right hand end portion of the foot has its center portion removed to form the two toes **58** which terminate adjacent the right hand end of the shoe **52**. The width of the foot determines the folded width of the cloth. Secured to the upper face of the foot, at each edge thereof, opposite each other, and near the leg end thereof, is an upright cloth guide hand **60**, **61**. Each of the to-be-folded-over edges of the cloth is lifted from horizontal position as it comes from the idler drum **37**, and held against an upright hand **60**, **61** by means of a guide wheel, or roller, **62**, **63**. Each of the guide wheels presses against the cloth and the hand, and is held with its axis parallel to the cloth and the surface of the hand, and at an angle to the direction of the cloth travel such that there is a force component upward on the cloth. This pulls the middle portion of the cloth up against the foot **54**. Secured to each of the foot toes **58**, at the outer edges thereof, spaced apart along the travel of the cloth, and near the right hand ends of the toes and shoe, is an inwardly inclined guide hand **64**, **65**, or lapping hand. Each folded-over edge of the cloth is held to its lapping hand by means of a lapping guide wheel **66**, **67**. Each of the lapping guide wheels presses against the cloth and its hand, and is held with its axis parallel to the cloth and the surface of its hand, and at an angle to the direction of cloth travel such that there is a force component toward the edge of the cloth. This, also, pulls the middle of the cloth against the foot and its toes. The lapping hands and their guide wheels are spaced apart along the direction of travel of the cloth so that one of the edges being folded over may be folded before the other without interference between the two edges as they are folded and lapped, one on the other. This longitudinal spacing of the lapping wheels and hands is shown in FIGURE 2 where the far side hand **64** and wheel **66** fold down the far side cloth edge before the near side hand **65** and wheel **67** lap the near side edge of the cloth on top of the far side edge. In this plan view, FIGURE 2, the cloth is shown with phantom lines. The cloth is omitted from the elevational view of FIGURE 3. FIGURE 4 is a sectional view on the line 4—4 of FIGURE 2, and shows the lapping, in end elevation. From the lapping wheels, the folded cloth passes directly to the press rolls which hold it in the folded and lapped condition.

Pulp is fed to the middle of the upper surface of the cloth at a place between the foot toes **58**, just to the left of the far side lapping hand **64**, and just before the sides of the cloth lap each other. Pulp reaches the cloth thru a feed pipe **68**, the outlet opening **69** of which is shown in phantom in FIGURE 2. A pump **70** forces the pulp thru the feed pipe, and the pulp is supplied from any suitable source, not shown.

Each of the four guide wheels **62**, **63**, **66**, **67** is provided with an identical arm **71** for holding its wheel in place and for tensioning it against its cooperating hand. Each arm is resilient to the degree required to tension the wheel against its hand. The end of the arm adjacent the wheel is bifurcated to receive and rotatably hold the wheel. The other end of the arm is bent into a loop **72** with the free end thereof formed as a hook **73**. This loop receives, can slide on, and be secured to a support standard of which there are four **74**, **75**, **76**, **77** one for each of the arms and its wheel. Each of the support standards is curved so that its convex edge is toward the wheel with the center of curvature at the middle of the axis of the

wheel. Thus, as the loop of the arm is slid along the standard, there is a change in the angle which the axis of the wheel makes with the direction of travel of the cloth. The arm 71 is secured against movement transversely of the standard by the loop bearing against the convex edge thereof and by a rib 81 formed on the face of the standard to be contacted by the hook end 73 of the loop 72. The roller is tensioned against its hand by a cap screw 82 threaded thru the arm adjacent the loop so that its end bears against the standard. Swinging of the arm on the standard or about the tensioning screw 82 is prevented by one or more stops 83 secured to the convex edge of the standard and bearing against an edge of the arm. The position of these stops may be adjusted along the standard to the desired position for the arm. The standards are secured to the flanges of the shoe channel 52, and each is in the plane of the axis of the guide wheel associated therewith.

The operation of the press is that of driving the live drum 28 to move the cloth 17 thru the folding station 51; then the folded cloth and the foraminous wire belt 18 between the upper and lower press rolls 21, 22; then over the live drum 28; and then opening and cleaning the cloth before it returns to the folding station 51. Pulp, such as apple pomace, is supplied to the pump 70 and then thru the feed pipe opening 69 to the middle of the upper surface of the cloth between the toes 58 just as the edges of the cloth are lapped and the cloth passes to the press rolls. The spacing between the rolls gradually lessens from roll to roll, from inlet to outlet, and the speed of the belt and cloth is such that as the cloth leaves the press rolls the pulp will be pressed to and will be in the form of a thin cake of the desired dryness, or moisture content. The cake falls from the cloth as it is unfolded and as it is scraped, washed and brushed therefrom by the opener 39, doctor blade 41, water spray 43, and the brush 46. The water spray and the wringer 44 need not be used continuously.

The success of the disclosed device and process is due to the folding and lapping of the cloth to confine the pulp, the relative rates of pulp feed and cloth travel to give a thin cake, a fourth of an inch or less, and the gradual decrease of roll spacing as the cloth and pulp pass between the successive rolls. The pressing cannot be done by only one set of rolls as the pressure on the cloth and pulp would be too high to do the required job and to hold the pulp in the cloth. The pulp would squirt back and accumulate at the folding station. Each set of rolls removes some of the juice until a solid cake is obtained that can be pressed at high unit pressures without squirting back along the incoming cloth, and until the desired cake dryness is reached.

Having described an embodiment of my invention and its construction and operation, I claim:

1. A continuous pulp press, comprising: a plurality of more than two pairs of undriven press rolls in which the rolls in pairs thereof are arranged in opposition, an endless flexible foraminous drive belt having a press run thereof passing between the rolls of each of such pairs, a live drum and a drive belt idler drum around which said drive belt passes and between which drums is located said press rolls, means for rotating said live drum, a press cloth having a press run in contact with said drive belt during its press run, and an idler drum for said cloth separate from said drive belt idler drum, said cloth passing around said live drum and said cloth idler drum, said live drum pulling said belt and cloth between said pairs of press rolls to effect rotation thereof, and said belt and cloth each having a slack run extending between its idler and said live drum, means located adjacent said cloth press run and removed from said live drum by said press rolls for folding said cloth so that the edge portions thereof are folded inward of the cloth into overlapping relationship so that such cloth will be so folded as it passes between said press rolls, means located adjacent said cloth slack run for unfolding said folded cloth, and said cloth passing around its idler drum in unfolded condition, said means for folding having a foot elongated in the direction of travel of said cloth effected by such pulling, said foot being of a width normal to said direction equal to the width to which such cloth is to be folded, said foot having coplanar edges extending in such direction, a hand along each of said foot edges, said hands being inclined to the plane of said foot edges, a wheel in opposition to each of said hands, each wheel and its hand adapted to have an edge portion of such cloth pass therebetween in such direction of travel, each wheel being rotatable by the travel of such an edge portion, and the axis of each said wheel being at such an angle to such direction that each wheel upon rotation exerts a force component on such cloth directed toward the edge thereof so as to tension said cloth against said foot edges, and means for so supporting each of said hands and wheels.

2. The combination of claim 1 in which there are a plurality of said hands and said wheels along each of said foot edges, and in which the inclination of said hands with respect to the plane of said foot edges decreases in such direction of travel.

3. A cloth folder adapted to fold and lap the edges of a strip of cloth having continuous movement lengthwise thereof, comprising: means for supporting and continuously moving a strip of cloth lengthwise thereof, an elongated foot having a width equal to the width to which such cloth is to be folded, said foot having coplanar edges extending in the direction of such foot elongation, means for supporting said foot in contact with a face of such cloth with the elongation of said foot in the lengthwise direction of such cloth, a hand along each of said foot edges, said hands being inclined to the plane of said foot edges, a wheel in opposition to each of said hands, each wheel and its hand adapted to have an edge portion of such cloth pass therebetween in such direction of travel, each wheel being rotatable by such cloth movement, and the axis of each said wheel being at such an angle to the elongation of said foot and the movement of such cloth that each wheel upon rotation exerts a force component on such cloth directed inward of said foot and toward the edge of said cloth so as to tension such cloth against said foot edges, and means for supporting each of said hands and wheels.

4. The combination of claim 3 in which there are a plurality of said hands and said wheels along each of said foot edges, and in which the inclination of said hands with respect to the plane of said foot edges decreases along the elongation thereof.

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