Sept. 25, 1934. J. G. BOWDEN ET AL 1,974,859

FELT STRETCHING MACHINE

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Fig. 1

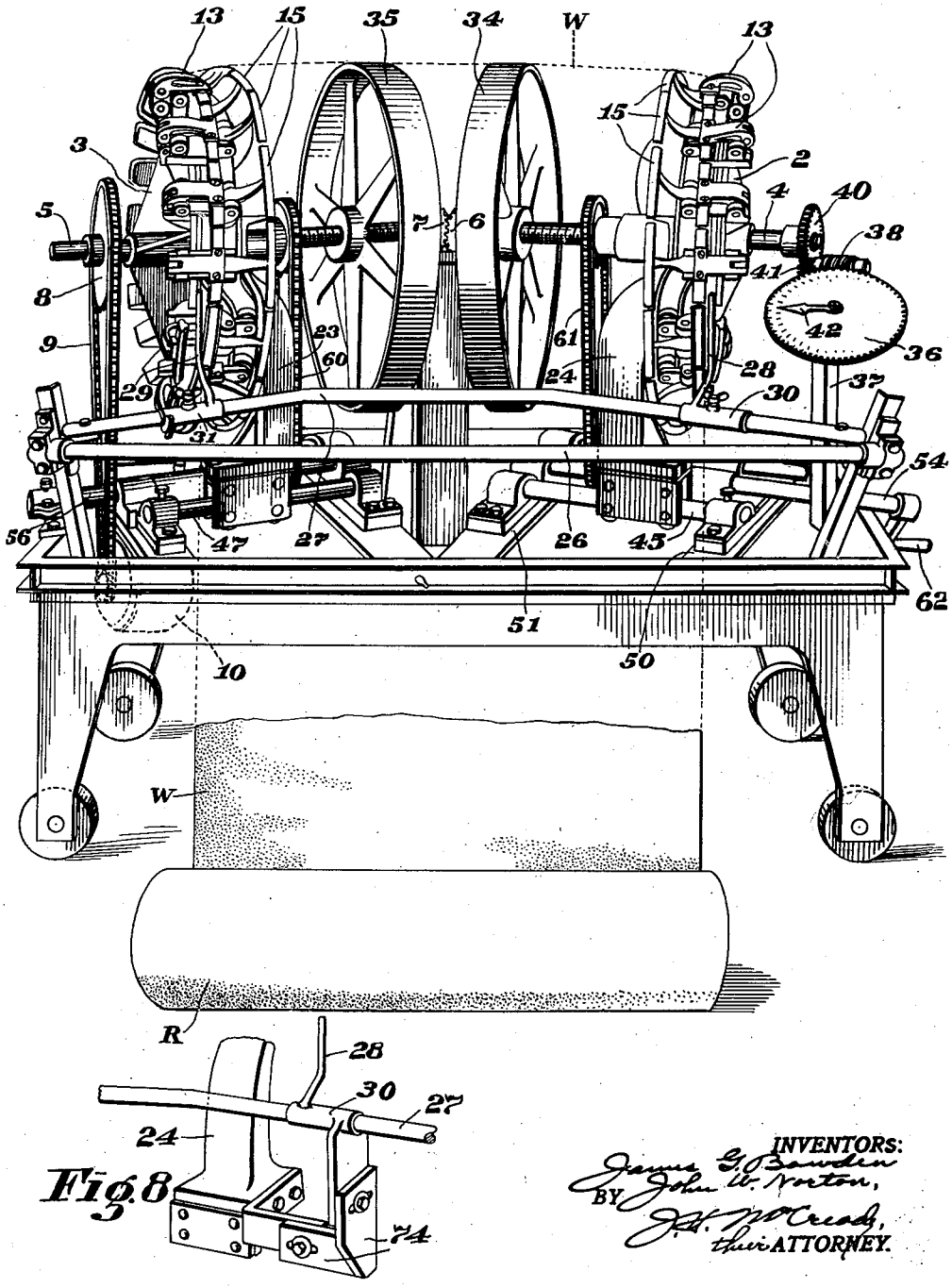


Fig. 8

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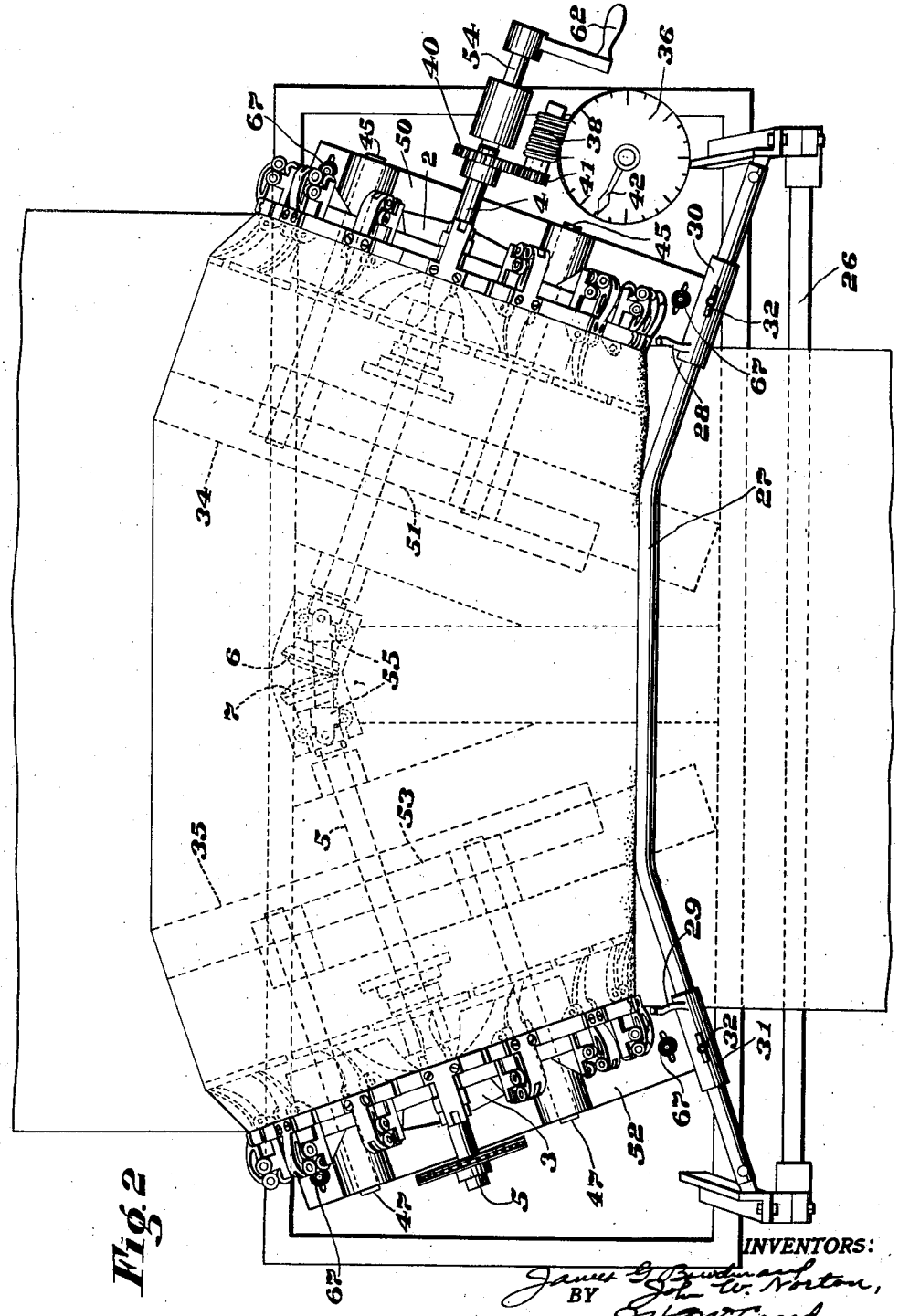


Fig. 2

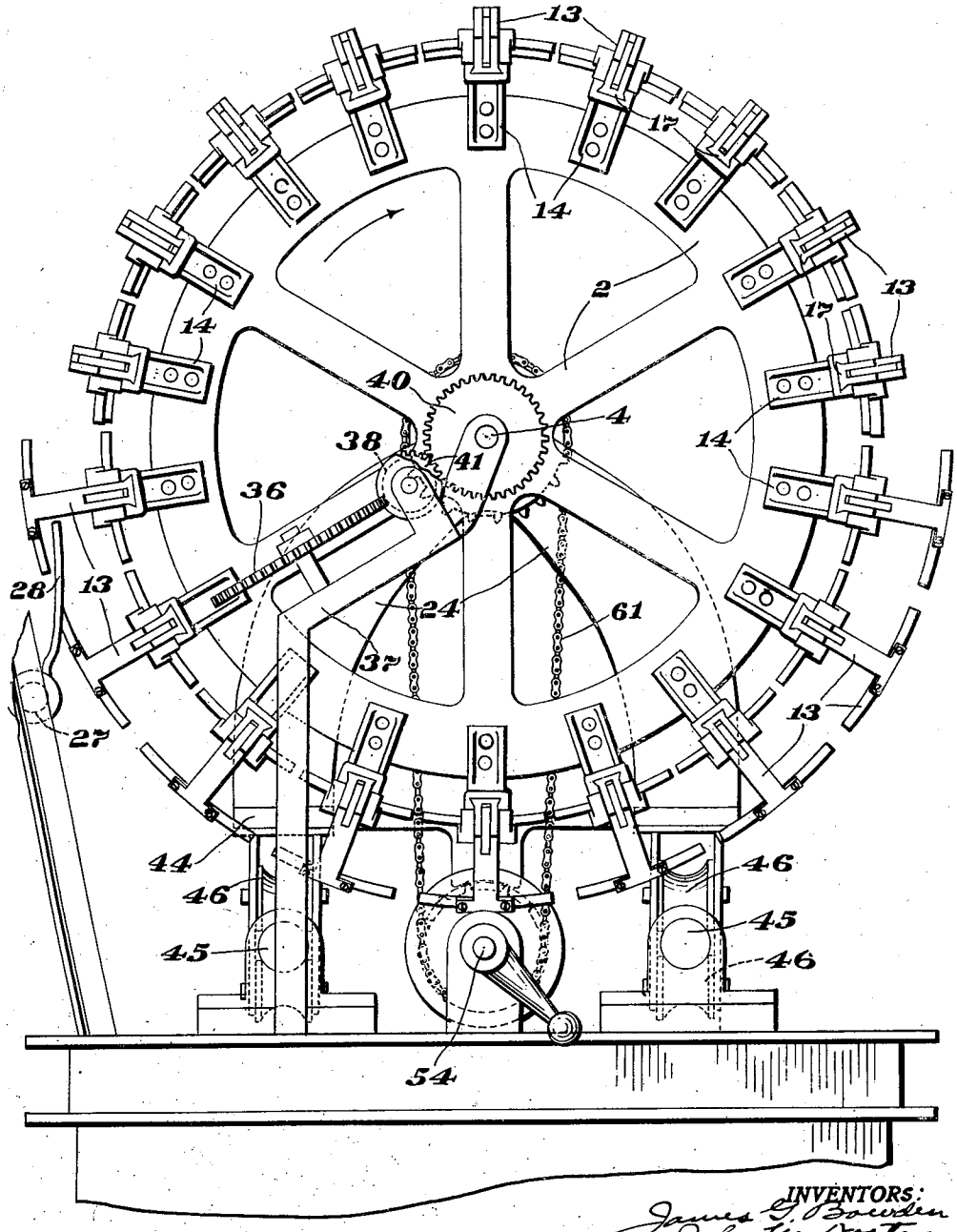
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Fig. 3



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FELT STRETCHING MACHINE

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Fig. 4

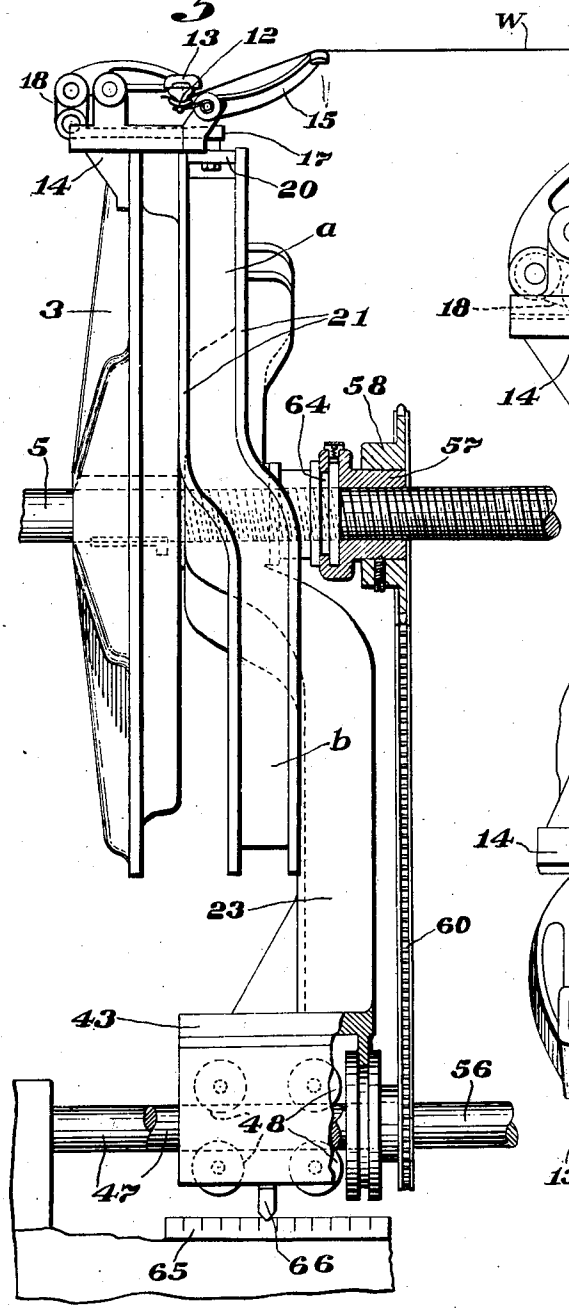


Fig. 7

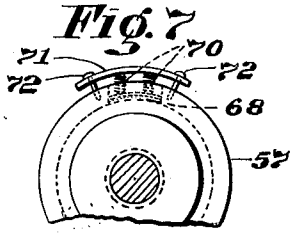


Fig. 5

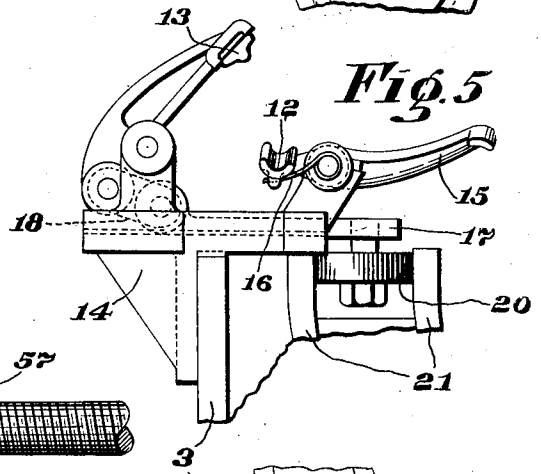
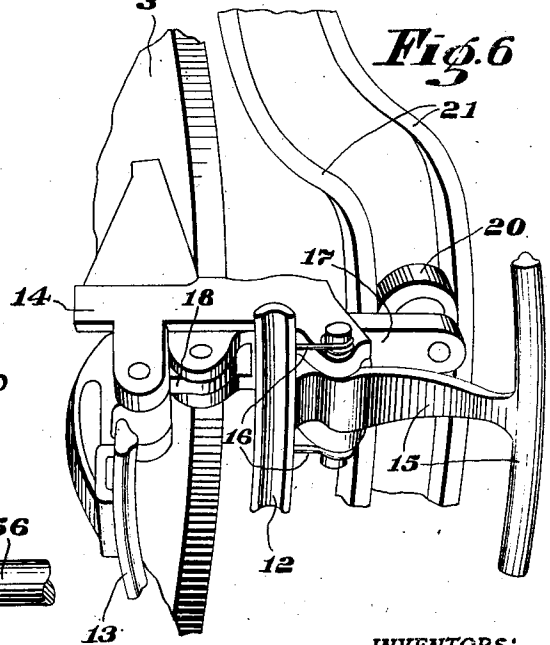


Fig. 6



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UNITED STATES PATENT OFFICE

1,974,859

FELT STRETCHING MACHINE

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Application September 9, 1931, Serial No. 561,852

9 Claims. (Cl. 26—58)

This invention relates to machines for stretching felt and other webs of fabric.

The process of making felt usually involves several fulling operations. A typical apparatus for performing this operation consists of a wooden trough equipped with mallets that pound the felt while it is steamed. In making a good grade of felt the web will be subjected to, say, seven or eight fulling operations. Between these operations the web must be taken out of the trough, the wrinkles pulled out to some extent, and it is then stretched in a direction transverse to the length of the web. This stretching operation is performed by hand. Two men pull simultaneously on opposite edges of the web of felt, pulling against each other, then pass along a short length of it, say two or three feet, and pull again, these operations being repeated until the entire web has been stretched. The amount of stretch given to the fabric in this way varies with the weight and energy of the workmen, the state of the weather, and the time of day. Usually it is customary after the fabric has been pulled to run it through a measuring machine to see whether it has been stretched sufficiently.

Notwithstanding the fact that this method is very crude, laborious and relatively expensive, it is, nevertheless, the method which has always been used, at least for a great many years, and is still the universal practice. In addition to the disadvantages just mentioned, it may also be noted that this operation is extremely hard on the hands, and particularly on the knuckles, of the workmen. It is a common experience to see the skin worn off the knuckles of the workmen who perform this pulling operation.

The present invention aims to devise a machine for performing this work in an efficient and expeditious manner.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claims.

In the drawings,

Figure 1 is a front elevation of a machine constructed in accordance with this invention;

Fig. 2 is a plan view of the machine shown in Fig. 1;

Fig. 3 is an end view of the machine;

Fig. 4 is an edge view, partly in section, of one of the carriers and the adjusting means therefor;

Fig. 5 is a front view on a larger scale illustrating the construction of one of the grippers;

Fig. 6 is a plan view of a gripper and the supporting and operating means therefor;

Fig. 7 is an end view of the friction device used with each of the adjusting nuts; and

Fig. 8 is a perspective view of an arrangement for adjustably supporting an edge guide for the web.

Referring first to Figs. 1, 2 and 3, the machine there shown comprises two carriers indicated at 2 and 3, respectively, both mounted to revolve on horizontal axes and supported in vertical planes which diverge from each other. The carriers are supported on shafts 4 and 5, respectively, which are mounted in suitable bearings and these shafts are connected together adjacent to the point of intersection of their axes by miter gears 6 and 7, Fig. 2. In order to drive these shafts and their carriers the shaft 5 is equipped with a sprocket wheel 8 which is connected by a chain 9 to a similar wheel on the shaft of an electric motor 10, Fig. 1.

Mounted on each of the carriers 2 and 3 are two series of grippers, the construction of which is best shown in Figs. 5 and 6. Referring to these figures it will be seen that each gripper includes a relatively stationary jaw 12, a movable jaw 13, and a bracket 14 on which both of these jaws are pivoted, the bracket being bolted or riveted to the carrier. The jaw 12 has a relatively long grooved face for engagement with the felt while the jaw 13 is provided with a long rib to fit in the groove of the jaw 12, the web gripping surfaces of these parts 12 and 13 being rounded to grip the felt without tearing or cutting it. The relatively stationary jaw also includes an elongated T-shaped arm 15 at the opposite side of the pivot from the groove in the jaw, the bar at the end of this arm being curved around the axis of the carrier and being designed to engage the tensioned portion of the web of felt at a point spaced inwardly from the edge of the web. Normally this jaw is held in approximately the position shown in Fig. 5 by means of a spring 16, Fig. 6, the ends of which are coiled around the pivot, this spring tending to swing the jaw 12 in a clockwise direction, as seen in Figs. 4 and 5. Such movement is limited by the engagement of the arm with a part of the bracket 14. The gripper mechanism also includes a slide 17 which is supported in a dove-tail guideway formed in the bracket 14, as best shown in Fig. 13, and a link 18 which connects this slide with the swinging jaw 13. At the inner end of the slide 17 it carries a roll 20 which runs in the groove of a cam located immediately beside the carrier, the cam for the carrier 3 being shown at

21, and a similar cam being provided for the carrier 2. The cam 21 is secured rigidly to a stationary bearing bracket 23 while the cam for the carrier 2 is secured to a similar bracket 24. It will be clear from an inspection of Fig. 4 that when the roll 20 is in the part *a* of the path of the cam 21, the gripper will be held in its closed position with the movable jaw 13 approximately in contact with the relatively stationary jaw 12, the two being separated merely by the thickness of the web of fabric which they are gripping. It will also be evident that when the carrier 3 is rotated far enough to bring the roll 20 into the offset portion *b* of the cam path, the slide 19 then will be moved inwardly, thus operating through the link 18 to swing the movable jaw 13 outwardly radially of the carrier into an open position, approximately as shown in Fig. 5.

The machine thus includes two circular series of grippers mounted to revolve about diverging axes, the two series being supported in opposed relationship. Also, that the grippers on each series are arranged to be operated by cams which will cause the grippers to open at a certain point in their path of travel and to close at a later period. As indicated in Fig. 3, the carriers rotate in a clockwise direction, and the grippers are opened when they reach an approximately horizontal position at the right-hand side, Fig. 3, of the machine and remain open until they arrive in an approximately horizontal position at the left-hand side of the machine and remain closed while they swing across the upper half of their path of movement.

The web W of felt preferably, but not necessarily, comes to the machine wound up in a roll R, Fig. 1. The web is unwound and led over a guide roll 26 and a guide bar 27, Figs. 1 and 2, and its opposite edges are guided into the open grippers at the forward side of the machine where the grippers of the two series are closest to each other. Immediately after the edges of the web have been entered between the grippers they are closed by their respective cams, thus seizing the margins of the web firmly. As the carriers continue to revolve in unison, the opposed grippers holding a given length of web move away from each other as they travel through the upper portions of their paths of rotation due to the divergent location of the carriers, and they thus stretch the web transversely. This stretching action continues until the grippers are opened at the rearward or delivery side of the machine, these operations continuing until the entire web of felt has been run through the machine and stretched.

In order to assist in guiding the margins of the web into the open grippers at the front of the machine, guide rods 28 and 29 are mounted on the stationary guide bar 27 to engage the edge portions of the web. These rods are carried by sleeves 30 and 31, respectively, which are slidable on the bar 27, each sleeve being equipped with a screw or bolt 32 for securing it in its adjusted position.

The web may be held more tightly in the machine by mounting guide wheels 34 and 35 on the shafts 4 and 5, respectively, where they will rotate with the carriers and will serve to increase the degree of stretch imparted to the felt, as will be evident from an inspection of Fig. 2.

In addition to stretching the felt this machine may also be made to perform the measuring operation at the same time. For this purpose a measuring dial 36 is mounted on a bracket 37, Fig. 3, and is provided with a toothed edge to engage a worm 38 which is driven from the shaft 4 by the gear 40 and pinion 41. A stationary pointer 42 cooperates with a scale on the dial 36 to indicate yardage.

For the purpose of adjusting the two carriers toward and from each other to accommodate webs of different widths, the brackets 23 and 24 which support the carriers are mounted for adjustment in a general direction toward and from each other. The brackets 23 and 24 are supported on or include platforms 43 and 44, respectively, Figs. 3 and 4, and the platform 44 is supported on two rods or shafts 45—45 by means of rolls 46—46, the platform 43 being supported on similar shafts 47 by means of rolls 48, Fig. 4. The rods or shafts 45—45 extend parallel to the shaft 4 and are supported in stationary blocks or brackets mounted on bed plates 50 and 51, Fig. 2. Similarly, the shafts 47—47 extend parallel to the shaft 5 and are supported in bearing blocks mounted on bed pieces 52 and 53. This mounting of the two carriers permits their adjustment toward and from each other in directions parallel to their respective shafts 4 and 5.

In order to adjust the carriers an adjusting shaft 54, Figs. 1, 2 and 3, is mounted below the shaft 4 and parallel thereto and is connected by a universal joint 55 with a similar shaft 56, Figs. 1 and 4, mounted below and parallel to the shaft 5. The latter shaft is screw threaded for a portion of its distance, as clearly shown in Figs. 1 and 4, and a nut 57, Fig. 4, engages this threaded portion of the shaft and is secured rigidly to a sprocket wheel 58 which is connected by a chain 60 with a similar sprocket wheel on the shaft 56. Another sprocket and chain connection 61 is provided between the shaft 54 and a nut engaging the threaded portion of the shaft 4. The shaft 54 also is equipped with a crank 62 by means of which it may be revolved. Rotation of the shaft 54 by the crank 62 also revolves the shaft 56 simultaneously with it. It will be clear from an inspection of Fig. 4 that such rotation of the shaft 56 revolves the nut 57, and since the shaft 5 is stationary at this time, the nut travels along this shaft in a direction depending upon the direction of revolution of the nut, and it slides the carrier 3, cam 21 and bracket 23 longitudinally of the shaft 5 due to the slip connection 64 provided between the nut and the cam 21. Similar connections are provided to adjust the carrier 2, its supporting bracket 24, and its cooperating cam in a direction parallel to the shaft 4. This adjustment also is facilitated by the scale 65, Fig. 4, which is located on a stationary part of the frame and cooperates with a pointer 66 fastened to a part rigid with the bracket 23 to indicate the spacing of the carriers. Consequently, by rotating the crank 62 the carriers may be set for a variety of widths of webs.

When the machine is running the friction between the connection 64 and nut 57 of the carrier 3 added to that between the corresponding parts of the other carrier, should be sufficient to revolve the shafts 54 and 56 since otherwise the carriers will be adjusted in or out automatically and at undesirable times. In order, therefore, to ensure the presence of sufficient friction between these parts to accomplish this object, the nut 57 preferably is equipped with a friction device, such as that shown in Fig. 7. It consists simply of a piece of asbestos brake lining 68 arranged to engage the grooved collar 64 and is pressed against said collar by coiled springs 70—70 which are backed up by a spring strip 71 that is held to the

nut 57 by screws 72—72. The nut for the other carrier 2 preferably is equipped with a similar friction device.

The degree to which any web of fabric will be stretched in the machine depends upon the angle of the carriers 2 and 3 and upon the lengths of the diverging portions of the paths of travel of the grippers during which they grasp the opposite edges of the web. Consequently, adjustment of this extent of stretch can be made either by adjusting the angle of divergence of the carriers, or by varying the point at which the fabric is engaged by the grippers and is released by them. The first mentioned method, however, is simpler and is therefore preferred. Referring to Fig. 2 it will be observed that the bed piece 50 is slotted near its opposite ends to receive bolts 67 which secure it to the main frame of the machine but permit it to be adjusted angularly with reference to said frame. A similar arrangement is provided for securing the bed pieces 51, 52, 53 to the frame. This arrangment therefore permits adjustment of the angle of divergence of the carriers to vary the degree to which the fabric will be stretched as it passes through the machine. If this angle is changed greatly it may be necessary to change the gears 6 and 7 on the inner ends of the shafts 4 and 5, or a universal joint may be provided at this point to connect these shafts to each other.

It will be seen from an inspection of Figs. 1 and 4 that the bar-shaped portions of the gripper arms 15 are curved circumferentially around the axis of the respective shafts on which they revolve and that they are located so close to each other that each series of bars forms approximately a continuous circular support for the web. As the tension on the web is increased by the movement of the two series of grippers away from each other, the grip of the jaws 12 and 13 on the edge of the fabric is increased by this increasing tension due to the fact that the tighter the web is pulled the more strongly it tends to swing the arm 15, Fig. 4, downwardly, thus tending to move the jaw 12 upwardly into firmer engagement with the upper jaw 13 which is held rigidly in a fixed position at this time. In other words, the arm 15 and jaw 12 form a lever through which the tension on the web operates to increase the pressure with which the gripper grasps the margin of the fabric. It should be noted that this upper jaw is locked in its holding or gripping position by its connection with the slide 17. This will be clear from an inspection of Fig. 4, it being observed that any unlocking movement of the upper jaw must be effected by swinging the jaw upwardly, and that such movement is positively prevented by the fact that the link 18 at this time occupies a position at right angles to the slide 17. No substantial effort on the part of the cam 21 and roll 20, therefore, is required to hold the upper jaw in its gripping position.

In adjusting the machine for different widths of fabrics the edge guiding fingers 28 and 29 may be adjusted automatically by connecting them with the respective brackets 23 and 24 so that they will be moved in unison with the brackets. Fig. 8 shows parts 74 connecting the bracket 30 rigidly but adjustably with the bracket 24 so that the finger 28 will be adjusted in unison with the bracket 24 but may also be adjusted relatively to it. A similar construction may be used for the finger 29.

The invention thus provides a machine which greatly reduces the hand labor involved in stretching the webs of felt between successive pulling operations. Not only is the labor reduced, but the stretch imparted to the fabric is far more uniform than it can be when performed by hand. At the same time any substantial danger of injuring the goods is avoided.

While we have herein shown and described preferred embodiments of our invention, it will be evident that the invention may be embodied in other forms without departing from the spirit or scope thereof.

Having thus described our invention, what we desire to claim as new is:

1. In a felt stretching machine, the combination of a carrier, a series of grippers mounted thereon, each of said grippers including a relatively stationary jaw and a movable jaw mounted to swing into open and closed relationship to the relatively stationary jaw, and means for operating said swinging jaw, said relatively stationary jaw being mounted for limited movement toward and from the other jaw and having an arm to be engaged by the web of felt for causing an increase in the tension of said web to move said relatively stationary jaw into firmer engagement with said movable jaw.

2. In a felt stretching machine, the combination of a carrier, a series of independent grippers mounted thereon, each of said grippers including a relatively stationary jaw and a movable jaw mounted to swing into open and closed relationship to the relatively stationary jaw, and means for operating said swinging jaw comprising a cam and a slide operated by said cam and connected with said swinging jaw to operate the latter jaw.

3. In a felt stretching machine, the combination of a carrier, a series of grippers mounted thereon, each of said grippers including a relatively stationary jaw and a movable jaw mounted to swing into open and closed relationship to the relatively stationary jaw, means for operating said swinging jaw to open and close it and to lock it against opening movement when it is in its closed position, said relatively stationary jaw being mounted for limited swinging movement toward and from the other jaw when the latter is in its closed position and having an arm to be engaged by the tensioned web of felt at a point relatively remote from said jaw for causing an increase in the tension on said web to swing said relatively stationary jaw toward the other jaw and thereby to increase the grip of said jaws on the web of felt.

4. In a felt stretching machine, the combination of a carrier, a series of grippers mounted thereon, each of said grippers including a relatively stationary jaw and a movable jaw mounted to wing into open and closed relationship to the relatively stationary jaw, means for operating said swinging jaw comprising a cam, a slide operated by said cam, and a link connecting said slide with said jaw and arranged to be swung into position to lock the jaw against opening movement when the jaw has been closed.

5. In a felt stretching machine, the combination of a carrier, a series of grippers mounted thereon, each of said grippers including a relatively stationary jaw and a movable jaw mounted to swing into open and closed relationship to the relatively stationary jaw, one of said jaws having a rounded groove and the other a rounded rib to fit in said groove, said rounded surfaces serving to grip the web of felt, means for operating said

swinging jaw to open and close it, said relatively stationary jaw being mounted for limited swinging movement toward and from its companion jaw when the latter is in its closed position and having a T-shaped arm 15 extending forwardly and cooperating with the relatively stationary jaw to form a lever, the bar at the end of said arm being curved around the axis of said carrier and being adapted to engage the tensioned web of felt at a point spaced substantially from the jaws.

6. In a felt stretching machine, the combination of two opposed series of independent grippers for engaging the opposite margins of a web of felt, means for supporting the two series of grippers for movement in paths spaced apart and including portions diverging from each other, means for operating said grippers to cause them to grasp the edges of a web of felt as they travel past points in their paths of movement where the opposed grippers of the two series are relatively close to each other and to release said web at points where they are farther apart, whereby the grippers will stretch the felt as they move along said diverging paths, said grippers forming the means for supporting the margins of said web of felt and having rounded surfaces to engage and grip said web, and means engaged by the tensioned web of felt and cooperating with said grippers to cause an increase in the strain on said web to increase the pressure exerted by said grippers on said web.

7. In a felt stretching machine, the combination of two rotary carriers, means for supporting said carriers in spaced relationship and at an angle to each other, whereby the planes of the carriers diverge from each other, two opposed series of independent grippers mounted, respectively, on said carriers for rotation therewith, mechanism for revolving said carriers in unison, mechanism for opening said grippers at a substantially predetermined point in their paths of travel and closing them at another point, means for guiding the edges of a web of felt into position to be seized by opposed grippers while they are open to cause the grippers to stretch the web of felt between them as they are moved by said carriers along diverging paths, said grippers forming the means for supporting the opposite margins of said web of felt and each gripper comprising two jaws relatively movable into open and closed relationship, means tending to hold one jaw of each gripper in a relatively fixed relationship to its supporting means but permitting its movement out of said relationship, and means for engaging the tensioned web of felt between the points at which they are gripped by opposing grippers and causing the tension on the web of felt to operate through said relatively fixed jaws to increase the pressure exerted by the grippers on the margins of felt when the tension on the web is increased.

8. In a felt stretching machine, the combination of a rotary carrier, a series of independent grippers mounted thereon to grasp the margin of a web of felt, each of said grippers comprising two jaws relatively movable into open and closed relationship, a cam mounted immediately beside said carrier, a slide associated with each gripper, a roll carried by each slide and arranged to be operated by said cam, and connections between each slide and one of the jaws of its respective gripper for causing said cam to operate the latter jaw.

9. In a felt stretching machine, the combination of two rotary carriers, means for supporting said carriers in spaced relationship and at an angle to each other whereby the planes of the carriers diverge from each other, two opposed series of grippers mounted, respectively, on said carriers for rotation therewith, mechanism for revolving said carriers in unison comprising two shafts on which the carriers are mounted, a supporting bracket for each of said carriers, guides on which said brackets are mounted for adjusting movement of the carriers toward and from each other, two adjusting shafts for said respective brackets located parallel to said carrier shafts, respectively, and connected together for rotation in unison, two nuts screw threaded, respectively, on said carrier shafts and cooperating with the carriers to move them longitudinally of their respective shafts when the nuts are relatively revolved on the carrier shafts, and driving connections between said adjusting shafts and their respective carrier shafts for producing relative rotation of said nuts on their carrier shafts to effect said adjustment.

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