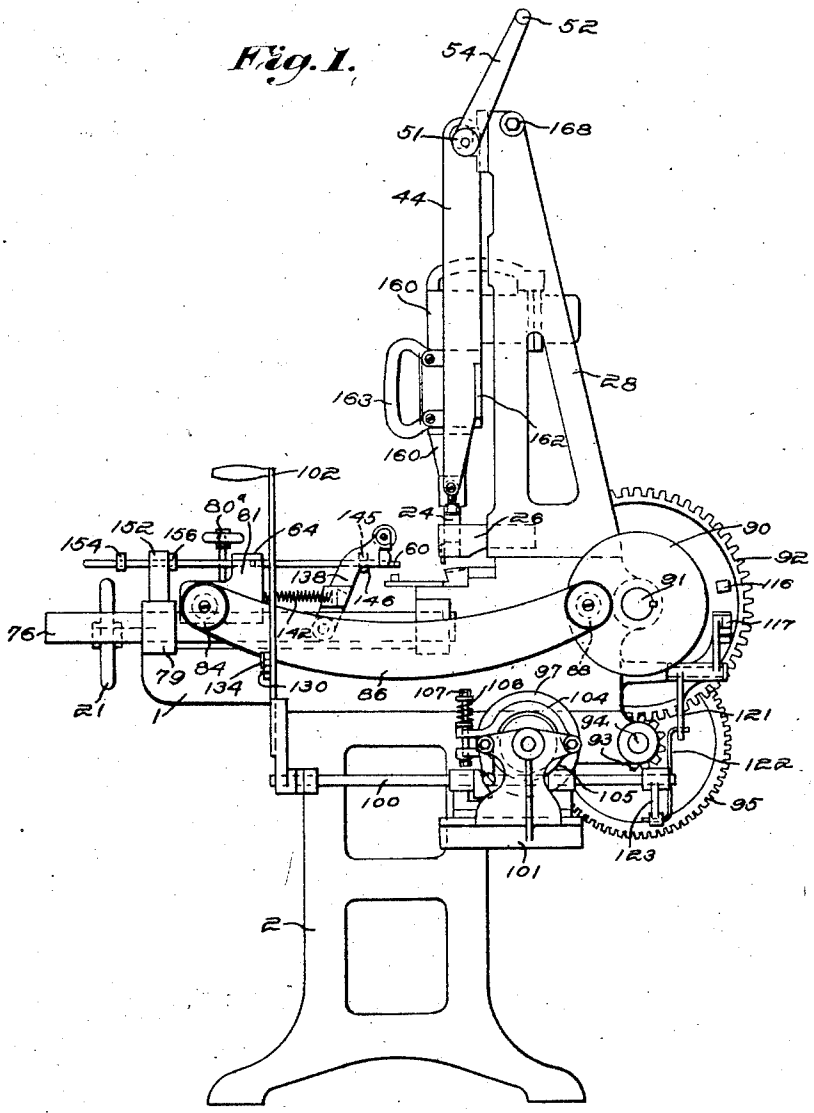
Oct. 19, 1926. 1,604,045

E. F. HATHAWAY ET AL

MECHANISM FOR AND METHOD OF STRAIGHTENING TUBE FRAMES FOR AXMINSTER LOOMS

Filed July 16, 1925 9 Sheets-Sheet 1

Fig. 1.



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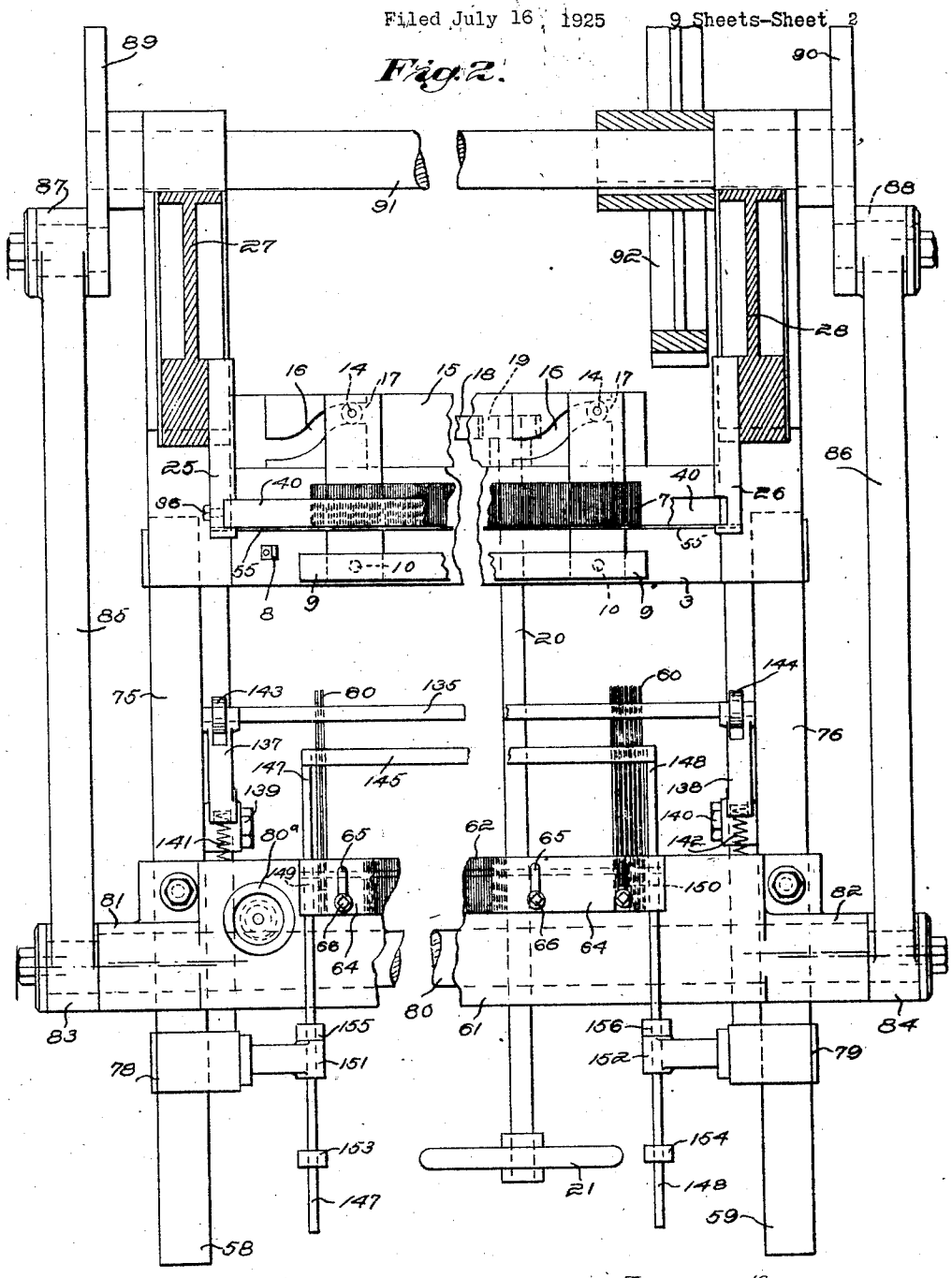
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MECHANISM FOR AND METHOD OF STRAIGHTENING TUBE FRAMES FOR AXMINSTER LOOMS

Filed July 16, 1925 9 Sheets-Sheet 2

Fig. 2.



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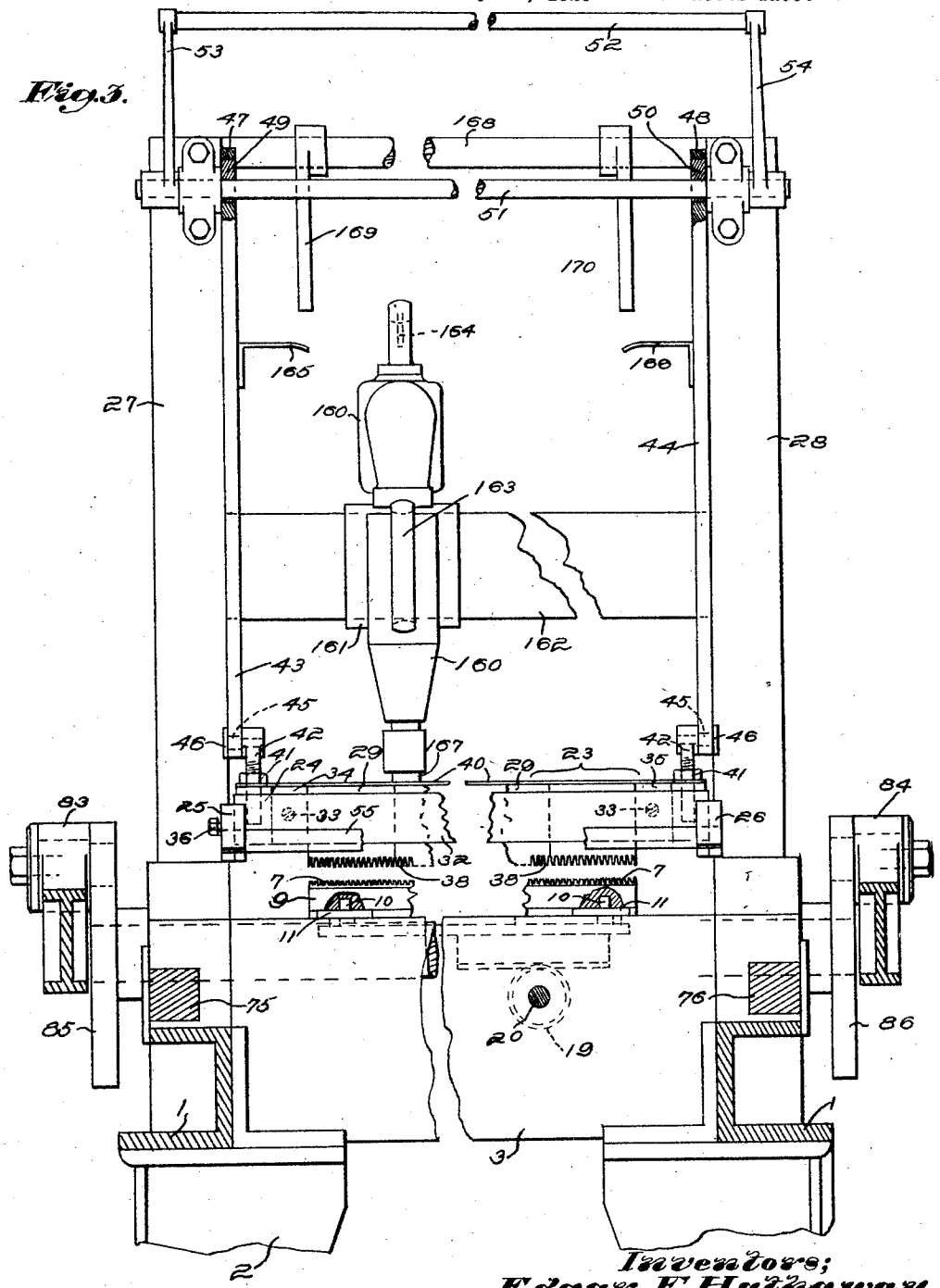
Oct. 19, 1926. 1,604,045

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MECHANISM FOR AND METHOD OF STRAIGHTENING TUBE FRAMES FOR AXMINSTER LOOMS

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Fig. 3.



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MECHANISM FOR AND METHOD OF STRAIGHTENING TUBE FRAMES FOR AXMINSTER LOOMS

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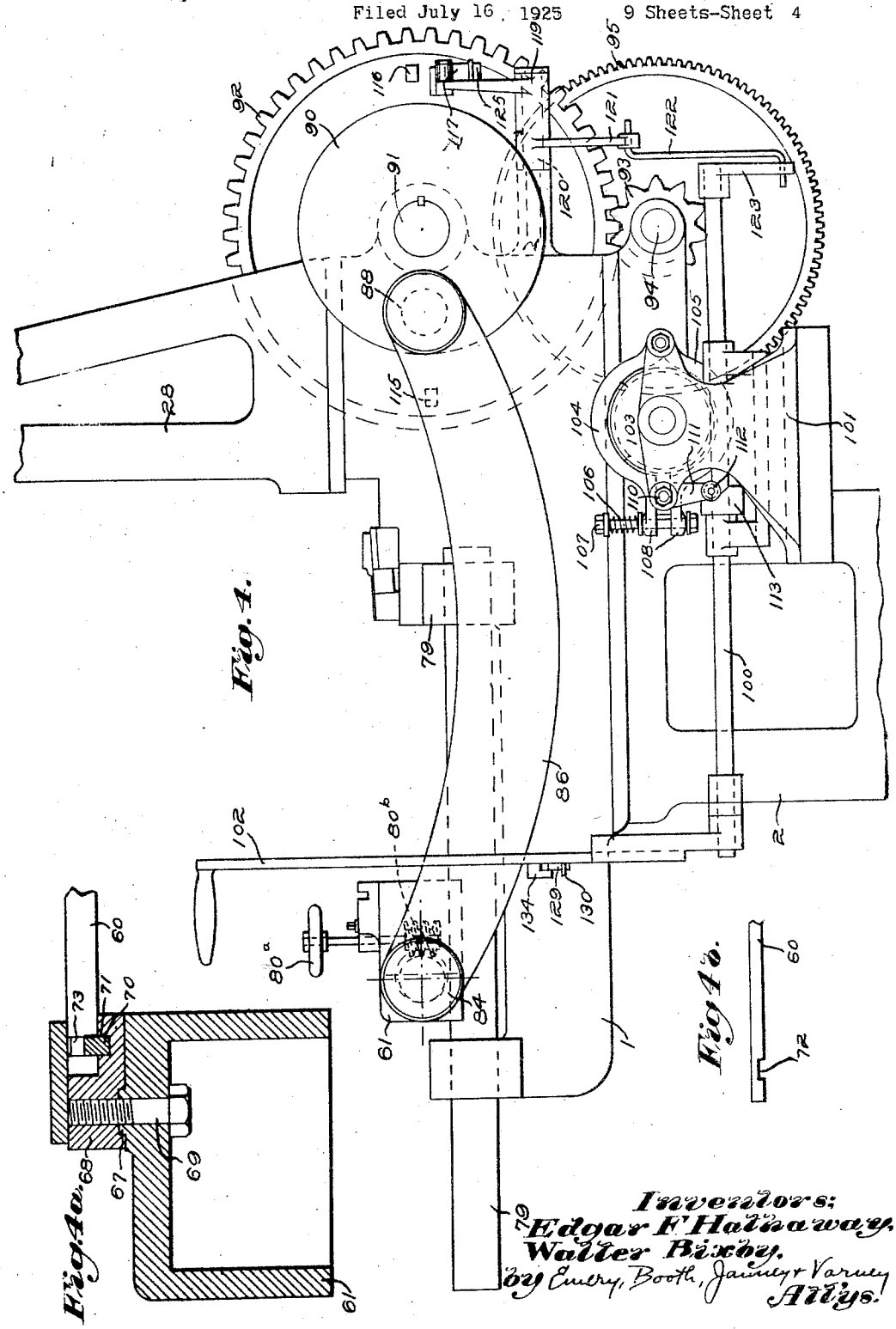


Fig. 4.

Fig. 4a.

Fig. 4b.

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MECHANISM FOR AND METHOD OF STRAIGHTENING TUBE FRAMES FOR AXMINSTER LOOMS

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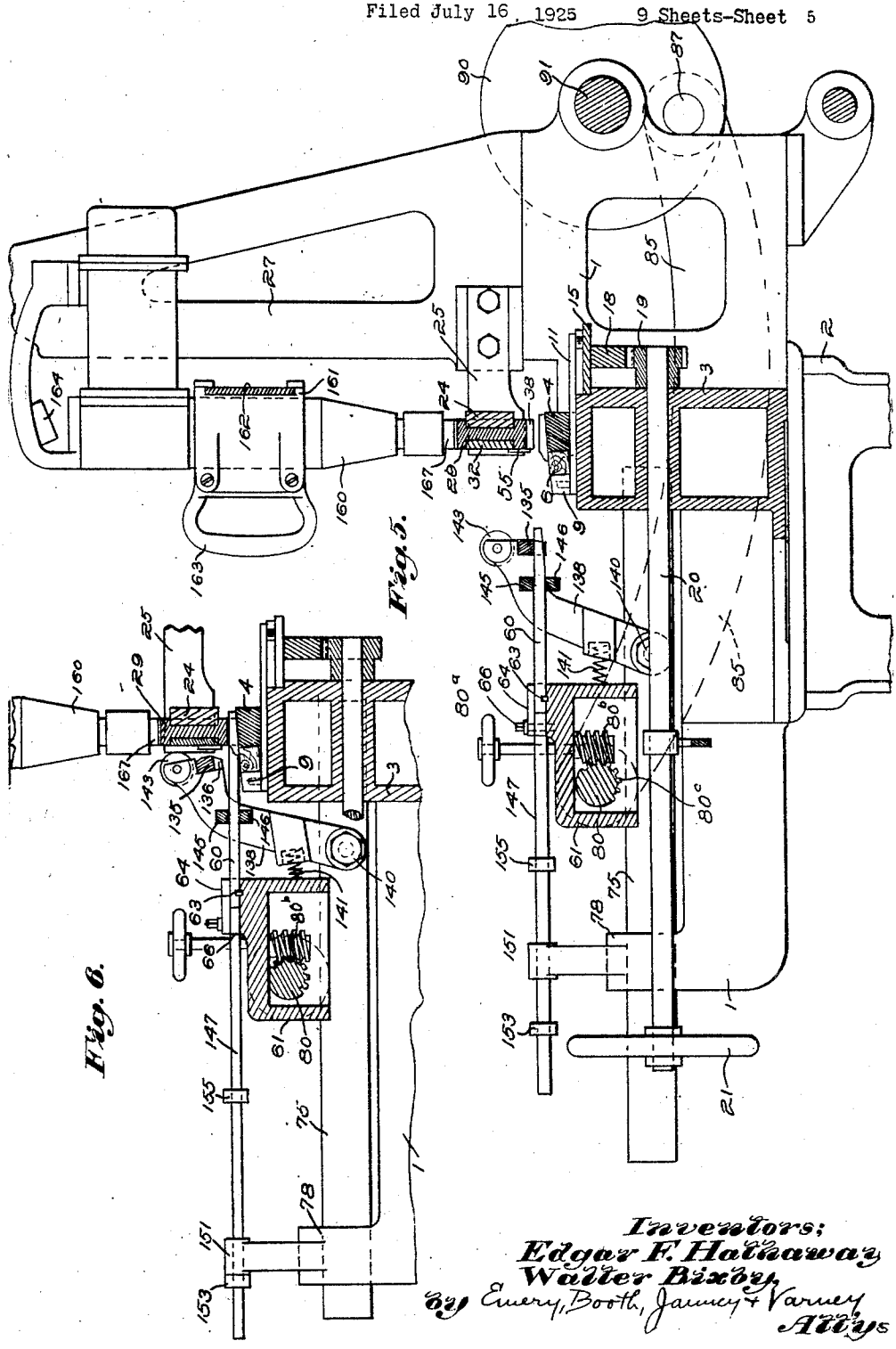


Fig. 5.

Fig. 6.

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MECHANISM FOR AND METHOD OF STRAIGHTENING TUBE FRAMES FOR AXMINSTER LOOMS

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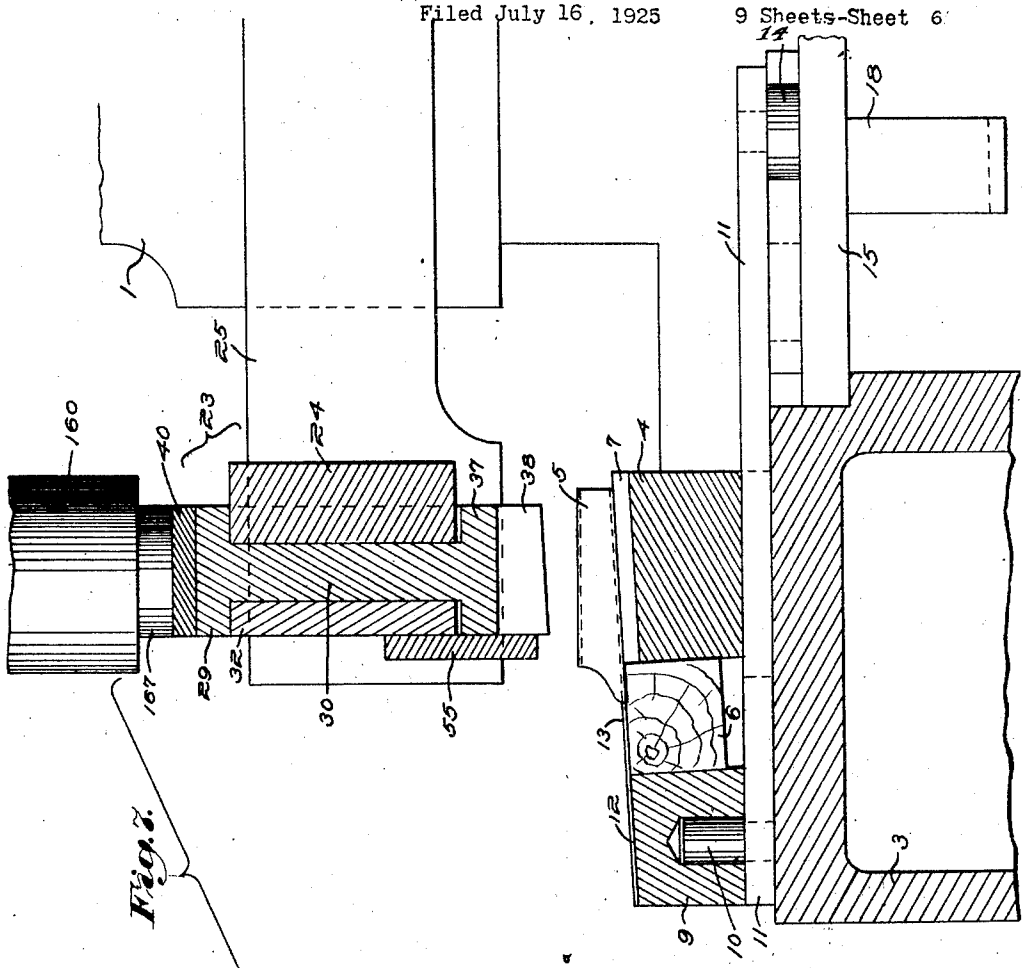


Fig. 7.

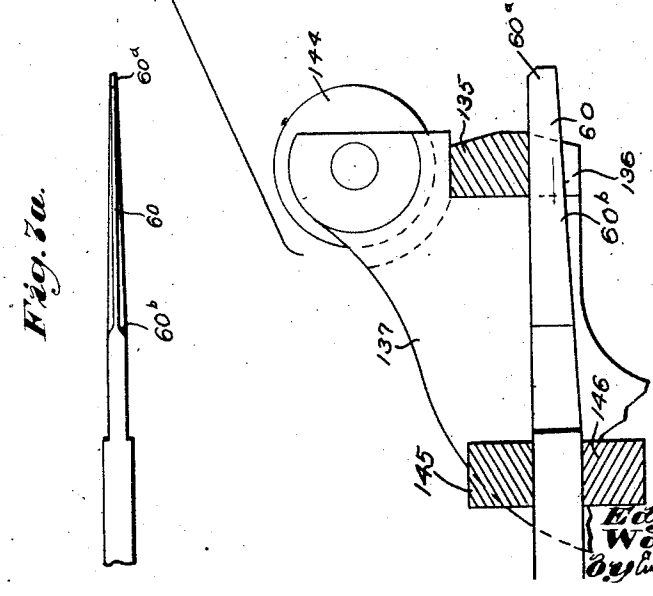


Fig. 7a.

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MECHANISM FOR AND METHOD OF STRAIGHTENING TUBE FRAMES FOR AXMINSTER LOOMS

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Fig. 9.

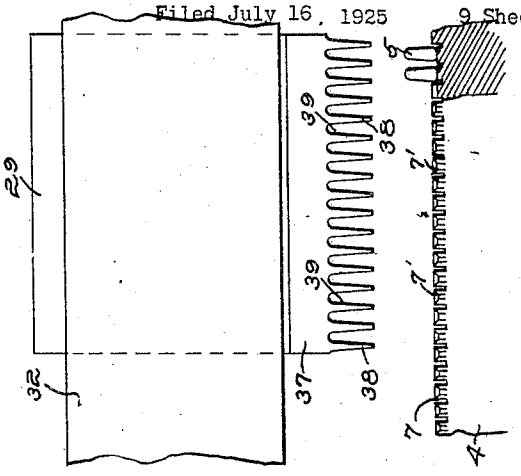


Fig. 10.

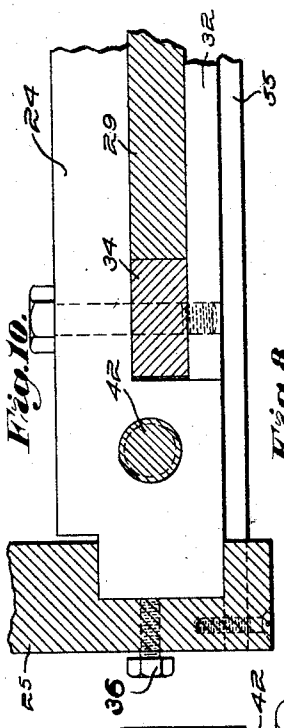
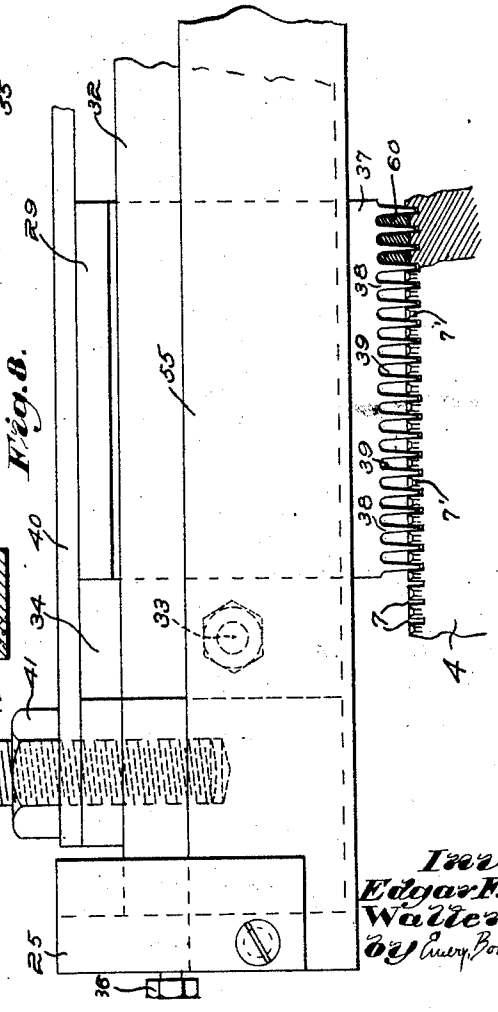


Fig. 8.



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MECHANISM FOR AND METHOD OF STRAIGHTENING TUBE FRAMES FOR AXMINSTER LOOMS

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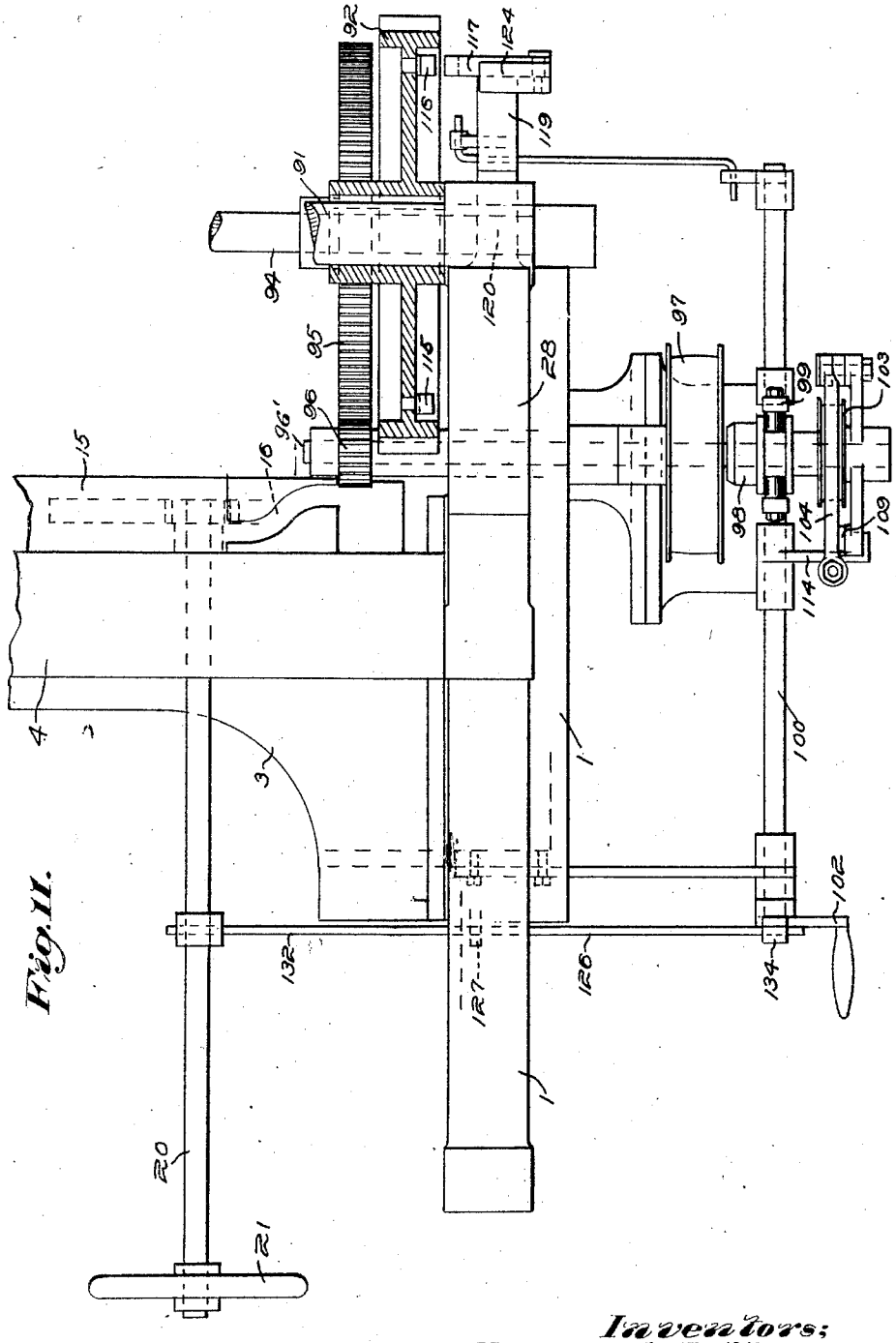


Fig. 11.

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Oct. 19, 1926. 1,604,045

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MECHANISM FOR AND METHOD OF STRAIGHTENING TUBE FRAMES FOR AXMINSTER LOOMS

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Fig. 11.

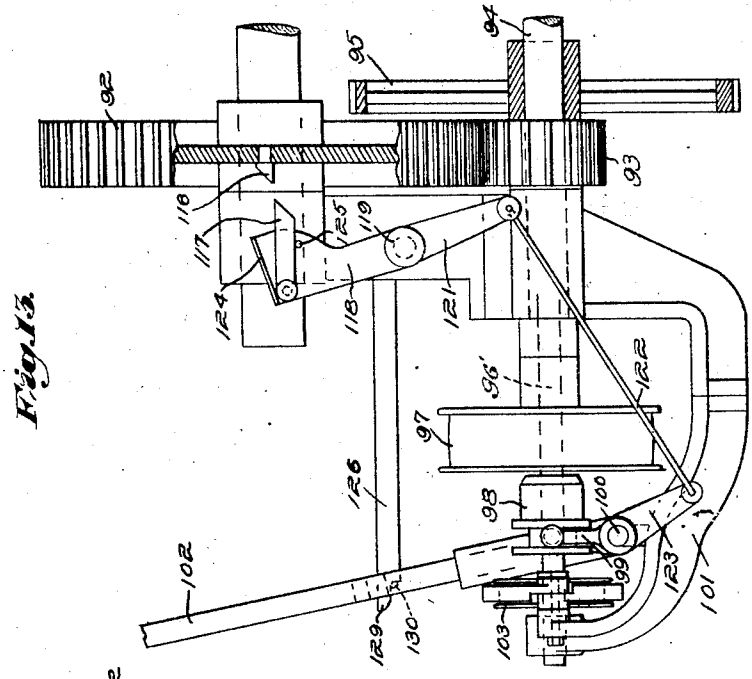
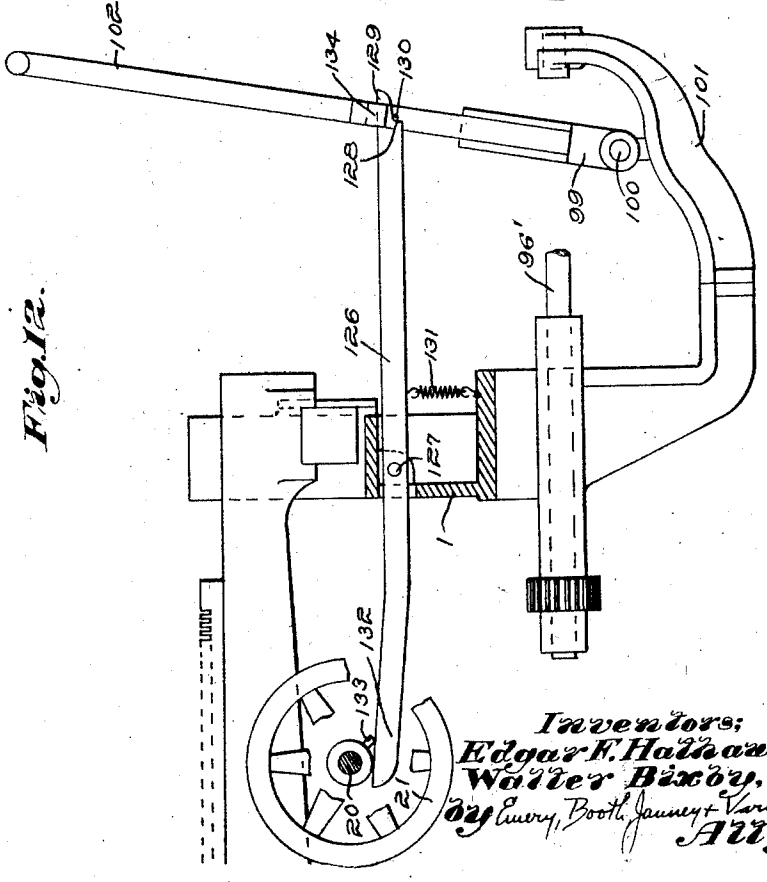


Fig. 12.



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Patented Oct. 19, 1926. 1,604,045

UNITED STATES PATENT OFFICE.

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MECHANISM FOR AND METHOD OF STRAIGHTENING TUBE FRAMES FOR AXMINSTER LOOMS.

Application filed July 16, 1925. Serial No. 44,130.

Our invention relates to straightening, reshaping, or otherwise rectifying and restoring to original shape and condition damaged yarn carriers or tube frames and the like, particularly for use with Axminster looms, and aims to provide more efficient and otherwise improved mechanism and methods for the purpose mentioned. In many respects, which will be apparent from the following specification and claims, our invention constitutes an improvement upon the manual tool or device of the United States patent to Walsh, original No. 1,006,811, dated October 26, 1911 and reissued December 5, 1911 as Reissue No. 13,335.

In the drawings illustrating, by way of example, mechanism embodying one form of our invention and constituting one means for practicing the method thereof:

Fig. 1 is an end elevation of the machine as a whole;

Fig. 2 is a view partly in plan and partly in horizontal section through the machine of Fig. 1, and upon a larger scale;

Fig. 3 is a view partly in front elevation and partly in vertical section of the upper portion of the machine of Fig. 1, upon a scale similar to that of Fig. 2;

Fig. 4 is an end view of the mandrel carriage and operating mechanism, certain parts being omitted for the sake of clearness;

Fig. 4[a] is a detail view in vertical section and upon a large scale, showing a modified form of mandrel mounting;

Fig. 4[b] is a plan view of the butt of a mandrel for use in connection with the mounting shown in Fig. 4[a];

Fig. 5 is a vertical section taken substantially centrally through the machine from front to rear;

Fig. 6 is a view corresponding to a portion of Fig. 5, illustrating a different position of the parts;

Fig. 7 is a detail view in vertical section and upon a still larger scale, showing the tube frame support, mandrel guides, and associated parts;

Fig. 7[a] is a plan view of the entering end or nose of a mandrel;

Figs. 8 and 9 are detail views in front elevation and upon a large scale, showing two positions of the tube-engaging dies;

Fig. 10 is a detail view in horizontal section of one end of the upper die and its guide;

Fig. 11 is a plan view of one end portion of the machine including the driving mechanism;

Figs. 12 and 13 are respectively front and rear elevations showing the driving and control mechanism and associated devices, parts being omitted in Fig. 12.

Referring now to the drawings and particularly Figs. 1 to 5, the machine is provided with suitable framing including the end frames 1, 1 mounted upon a base or support 2. Extending lengthwise between said end frames is the main cross member or casting 3. Upon said framing is the tube frame support, herein including the transverse bar or tube platform 4 upon which the tubes 5 of a tube frame are adapted to rest, with the carrier or back 6 of the frame abutted against its front face. Said platform may be variously formed to accommodate different types of tube frames, the construction desirably being such that the upper surfaces of the tubes, which latter normally taper toward their outer or free ends, will lie in substantially a horizontal plane; see particularly Figs. 5 and 7.

The top surface of said platform 4 is slotted from front to rear of the machine, the slots 7 being spaced to lie intermediate the tubes. Desirably said platform is readily removable so that a like member may be substituted having slots spaced to cooperate with a tube frame of different tube pitch. Suitable tube frame positioning means such as the lug 8, Fig. 2, is provided at one end of the tube platform. When inserting a tube frame to be acted upon, its end is brought up against said lug, thereby assuring proper positioning of the frame transversely of the machine.

The tube frame is held or locked in position upon its support. For this purpose we provide a locking bar 9, best seen in section in Fig. 7, having recesses in its under face

for receiving pins 10 on slides 11 by means of which the locking bar may be backed up against or removed out of contact with the back 6 of a tube frame. Said bar is preferably readily removable, being herein set upon said pins, so that bars of different lengths may be employed corresponding to the length of the particular frame to be straightened. To the top of said locking bar is secured a plate 12 having an overhanging portion or lip 13 of a length just sufficient to abut the adjacent or rear ends of the tubes when said bar is in frame locking position. Said plate backs up the tubes and receives the direct thrust thereof when the devices which act upon the interior of the tubes are being withdrawn, and thus prevents the tubes from being loosened or torn off from the frame back or carrier 6.

As best seen in Figs. 2 and 3 said slides 11 are movable in suitable guides in the cross member 3. Any suitable number of slides may be provided, two being shown in said figures. Said slides extend rearwardly beyond the cross member 3 where they are provided with cam rolls 14 received in cam paths formed in a transversely shiftable cam bar 15. Said cam paths include the inclined portions 16 and the straight or locking portion 17. As viewed in Fig. 2, the slides and locking bar 9 are in tube frame locking position, the cam rolls being in the straight portions 17 of the cam paths, thus retaining the bar in said locking position. If now the cam bar 15 be shifted toward the right in said figure, the cam rolls will enter the inclined portions of the paths and be caused to move toward the front of the machine, shifting the frame locking bar forwardly and releasing the tube frame.

For shifting said cam bar we have provided a rack 18 upon its bottom face, with which meshes a pinion 19, best seen in Fig. 5, and also in dotted lines in Figs. 2 and 3. Said pinion is fast upon the inner end of a shaft 20 journalled in the cross member 3 and in other suitable bearings upon the machine frame, said shaft being of suitable length to extend to the front of the machine where it is provided with an operating member or hand wheel 21 at a point convenient to the operator. By turning said wheel the rack and cam bar are caused to move to the right or left, Figs. 2 and 3, respectively to release or lock a tube frame. Preferably the forward ends of the teeth 7' between the slots in the tube platform or stationary die unit 4 are beveled off or pointed, particularly at their upper corners, so as to bite into any solder or other obstruction on the tube frame adjacent the juncture of the tubes and their carrier, thus assuring a true seating of the frame in its support.

Cooperating with said tube supporting bar or platform 4 in the manner of a forming die we provide mechanism for aligning or initially forming and clamping the individual tubes of a frame. Said bar 4 constitutes the stationary and herein the lower unit of the die, the movable or upper unit of which is indicated as a whole at 23, Figs. 3, 5, 7, 8, 9 and 10. Said movable die unit comprises a cross bar 24 vertically movable in guides formed in brackets 25, 26 at opposite sides of the machine and projecting forwardly from the uprights or top-pieces 27, 28 upon the side frames 1, 1.

Said cross bar 24 acts as a carrier for a plurality of relatively short die sections 29 of I-shape in cross-section, as best seen in Figs. 5 to 10. Referring particularly to Figs. 7 and 8 the neck portions 30 of said sections are each somewhat longer than the height of the bar, permitting them to move relatively to the latter, herein vertically, and independently of each other whereby pressure may be applied locally along a tube frame to form or reshape its tubes. The heads of said sections seat upon the upper edge of said bar and upon a strip 32 let into the front face of said bar and secured to it as by bolts 33; see particularly Fig. 10. Between the end die sections of the series and the adjacent end portions of the cross bar, which ride in the guides in the brackets 25, 26 are spacing blocks 34, 35 of a proper dimension correctly to position the several die sections 29 in a direction transversely of the machine. Desirably also the entire movable die unit may be accurately adjusted lengthwise, as by the adjusting screw 36 tapped into one of the brackets or guides 25 or 26 and engageable with the adjacent end of the cross-bar 24.

The feet 37 of the die sections 29 have formed on their lower surfaces the aligning and forming devices or teeth 38, clearly seen in Figs. 8 and 9, and also in Fig. 7. The forward ends of said teeth are preferably somewhat longer than their rear ends, (see Fig. 7) so that as the die unit is moved down said teeth engage between the individual tubes first at their forward or secured ends and progressively toward their rear or free ends with a comb-like action upon the tubes to straighten and true up the same.

Said teeth 38 are so shaped that the interdental spaces or grooves 39 correspond accurately in cross-sectional shape to the desired shape of a perfect tube. When the movable die unit is depressed said teeth enter into the slots 7 in the bar or stationary die unit 4, so that each tube is completely surrounded and engaged on all sides by the mating die units, which together form a true die for forming the tubes exteriorly. Resting upon the heads of the several die sections 29 is a relatively thin metal strip 40 secured at its ends to the bar 24, as by the nuts 41 upon the bolts 42 (Figs. 3 and 8) tapped into said

bar. Said strip is sufficiently flexible so that when pressure is applied to it above any given die section that section may be moved relatively to the others if necessary to form the particular tubes which that section engages.

In other words, the entire movable die 23 initially may be depressed as a unit until the various die sections engage the tubes, with some pressure. Some tubes will probably be more damaged than others, and the die section or sections engaging those tubes will not seat so deeply as others but will lift slightly above them, such action being permitted by the extra length of the section necks 30 in excess of the height of the bar 24 and by the flexibility of the strip 40. When subsequently pressure is applied locally as required along said strip all of the die sections will be forced down to a proper seat upon the tubes, aligning them in both the horizontal and vertical planes and reshaping them exteriorly.

For raising and lowering the die unit 23 in the guide brackets 25, 26 we provide the links 43, 44 one at each end of the die, said links having vertically elongated bearings or slots near their lower ends, as at 45, (see Figs. 3 and 8) to receive the pins 46 secured to the heads of the adjacent bolts 42 on the bar 24. Since said pins extend through slots in said links rather than close-fitting bearings, said pins may move up slightly with respect to the links when the die engages the tubes, thus preventing said links from receiving directly any pressure subsequently applied to the die in forming the tubes.

Said links are provided at their upper ends with collars 47, 48 respectively, Fig. 3, loosely surrounding eccentrics 49, 50 fast upon a cross shaft 51 journalled in suitable bearings in the uprights 27, 28. By rocking said shaft, as by the hand rod 52 secured thereto by arms 53, 54 the links are raised or lowered thereby to bring the movable unit into or out of engagement with the tubes of a frame. Said rod preferably extends substantially the entire length of the machine so that the die or forming clamp 23 may readily be operated from any point along the machine.

After a tube frame has been acted upon by the die, by the interior formers and by pressure applying devices, the latter not yet described, the movable die unit frequently is so tightly fitted to the tube frame that it may tend to lift the latter as said die is being withdrawn. To effect prompt and complete disengagement of the tube frame we preferably employ a stripper, herein the bar or strip 55, Figs. 3, 5, 7 and 8, fastened at its ends to the guide brackets 25, 26 and projecting downwardly toward the tube frame being acted upon so as to engage the latter and strip it from the movable die should it stick in the same as it is withdrawn. Prior to withdrawal of said movable die the frame locking bar 9 is backed away from the frame, permitting the same to lift from its seat with said die so that there is no possibility of tearing the tubes from the frame back or carrier 6.

When a tube frame has been positioned upon its support and the movable die brought into engagement with it, the tubes are properly aligned and securely held in position where they may be acted upon by means engageable with their interior surfaces to remove or press out any dents, burrs, or other irregularities.

Said means, engageable interiorly with the tubes, comprises a series of shapers or formers, herein termed mandrels, indicated at 60, Figs. 2, 5, 6 and 7, one for each tube of the frame, or of a section thereof to be acted upon simultaneously. The butts of said mandrels are supported upon a mandrel carriage or cross-head 61 which is reciprocable toward and away from the tube frame, the upper face of said cross head being formed with a series of parallel kerfs or slots 62 (see Fig. 2) in which the mandrel butts are positioned. It also is provided with a longitudinal slot or keyway while the mandrels are correspondingly slotted on their lower edges, whereby a key 63 may be inserted through the said aligned slots to hold the mandrels against displacement in the direction of their lengths. The entire series of mandrels are held against vertical displacement by the plate or series of plates 64 having slots 65 through which extend the securing bolts 66. Said slots permit any one or all the plates 64 to slide forwardly when the bolts 66 are loosened, making it unnecessary entirely to remove the plates in removing or replacing any of the mandrels. Also by constructing said plate in sections as illustrated one mandrel or a section of mandrels may be removed without disturbing the others.

In Fig. 4[a] we have shown a modified form of mounting for the mandrels. As there shown the cross-head 61 has a flat upper face provided with a longitudinal rib 67. A removable mandrel bar 68 is set upon the cross-head and secured to it by bolts 69, said bar having a channel in its lower face to receive said rib. Said bar is chamfered along one upper edge to a depth equal to the height of the mandrels, the rear ends of which abut the vertical wall of said chamfered portion. A key 70 is set in a keyway 71 in the bottom of said chamfered portion, said key having its upper edge notched at proper intervals to receive the butts of the mandrels. Said notches in the key are slightly narrower than the thickness of the mandrel butts which latter are vertically notched upon one side, as indi-

cated at 72 in plan in Fig. 4[b], to receive the lugs or teeth 73 intermediate said notches of the key. The mandrels are held against vertical displacement by a sectional cap or plate 64 as in the form previously described.

The mandrel mounting illustrated in Figs. 4[a] and 4[b], facilitates changing of the mandrels to conform to the spacing or pitch of a particular tube frame, and more readily accommodates the machine to act upon tube frames of different pitch. It is necessary merely to remove the mandrel bar 68 which carries with it the entire mandrel assembly undisturbed. An alternate plate with an additional set of mandrels spaced to conform to the spacing or pitch of a particular tube frame may then be substituted. In such alternate plate the key 70 is notched at the required intervals to give the desired spacing of the mandrels.

Also in said form, as shown in Figs. 4[a] and 4[b], the entire set of mandrels may be adjusted lengthwise the cross head to align them accurately with the die units or tubes held therein merely by shifting the key 70 lengthwise. Also the expense of construction is less since only the relatively thin key requires to be notched or slotted instead of the entire upper face of the cross-head as shown for example in Fig. 2. It will be understood that in changing the mandrels for a tube frame of different pitch the grooved portions of the stationary and movable die units will also be changed, as well as the guide for the forward ends of the mandrels, not yet described. Each of said parts is preferably constructed and arranged to facilitate such substitution.

Referring again to the main figures, the cross-head 61 is carried by a pair of slide bars 75, 76 mounted for reciprocating movement in suitable bearings 78, 79 upon the adjacent end frames 1, 1. In the present instance said cross-head is formed as a hollow bar through which extends a shaft 80 journalled in bosses 81, 82 formed at the opposite ends of the cross-head, said shaft projecting outwardly beyond the latter. Pivoted upon hubs 83, 84 at the opposite ends of said shaft is a pair of pitman-like arms or operating links 85, 86. Said links are pivoted at their opposite or rear ends to crank pins 87, 88 respectively upon a pair of crank disks 89, 90 fast upon a crank shaft 91 journalled in the machine side frames. As herein illustrated said links 85, 86 are somewhat curved or bowed (see particularly Figs. 1 and 4), so that their upper surface is at all times below the plane of the tube frame. By reason of this formation of the arms we are able to obtain a powerful straight line driving action for the mandrels while at the same time the machine is organized for use with tube frames of any desired length, even such as to project beyond the sides of the machine, as in the case of extra length frames employed in so called "wide work."

Rotation of the crank shaft 91 and disks 89, 90 will crank the inner ends of the links 85, 86 about the axis of said shaft. As they approach the back center position they come into substantially the same horizontal plane with the cross-head. Said links and disks thus act in the manner of a toggle, applying maximum power to move the cross-head and mandrels forwardly, that is, toward the right, Figs. 1 and 4. We have herein illustrated means whereby the extent of travel imparted to the cross-head and mandrels may be accurately adjusted. For this purpose said hubs 83, 84 of shaft 80 upon which the forward ends of the links 85, 86 are pivoted are positioned eccentrically to the axis of said shaft. By turning the latter in its bearings 81, 82 the cross-head will be shifted toward or away from the axis of the crank disks, the links 84, 85 adjusting themselves to the new spacing. Said shaft may be so turned as by a hand wheel 80[a], see Figs. 4 and 5, upon a short shaft journalled in the cross-head and carrying a worm 80[b] meshing with a gear segment 80[c] formed on or secured to said shaft. By said adjusting means the mandrels may be set as desired, to control the distance they are forced into or through the tuft tubes.

The crank shaft 91 may be driven through any suitable mechanism and herein for the purpose we provide a relatively large gear 92 keyed to said shaft and meshing with a pinion 93, Figs. 1, 4 and 13, fast upon a counter shaft 94. Said counter shaft carries a large gear 95 meshing with a pinion 96, see Fig. 11, fast upon the drive shaft 96'. Thus a considerable speed reduction is afforded between the drive shaft and crank shaft and ensuring a powerful drive for the latter.

Power may be applied to said drive shaft in any suitable manner, as by the pulley 97, suitable clutch mechanism being provided intermediate the latter and the drive shaft.

As herein indicated, said pulley 97 is loose upon the drive shaft and is adapted to be clutched to or unclutched from it by clutch mechanism of the expansion type, such, for example, as shown and fully described in the patent to Hathaway and Lea 1,153,865, dated September 14, 1915. Interiorly of the pulley is a split internal ring (not shown) fast upon the shaft and expansible into clutching engagement with the pulley. Said engagement may be effected by the tapered expanding member 98, best seen in Figs. 11 and 13, slidable upon the drive shaft, by a yoke 99 having opposed pins engaging a circumferential groove in said expanding member. Said yoke is secured to a control shaft 100 extending from

front to rear of the machine and mounted for rocking movement in a suitable bearing carried by the bracket 101, which latter also provides a bearing for the outer end of the drive shaft; see particularly Figs. 12 and 13. At its forward end said control shaft is provided with a starting member or control lever 102 positioned conveniently to the hand of the operator.

Desirably, we also provide brake mechanism to prevent overrunning of the machine due to the momentum of its parts. Said mechanism may be of any suitable type and, as herein shown, is generally similar to that fully disclosed in our copending application, Serial No. 751,269, filed November 21, 1924. A drum 103 upon the drive shaft is surrounded by a pair of semicircular brake shoes 104, 105 pivoted upon a stud carried by said bracket 101. Said shoes are normally held in engagement with the brake drum by means of the expansion spring 106 (see Figs. 1 and 4) bearing between collars upon a bolt 107 extending loosely through ears 108 upon the respective brake shoes.

To release the brake there is provided a brake cam 109, see Fig. 11, projecting inwardly between said ears and carried by a pin 110 mounted for rocking movement in an adjacent portion of said bracket 101. Secured to said pin is a finger 111 having a cam roll 112 at its outer end in position to be actuated by a face cam 113 upon an arm 114 projecting from the control shaft 100. When the latter is rocked to clutch the pulley to the shaft, said cam arm 114 is swung up into engagement with said cam roll 112, thus moving the outer end of the finger 111 toward the rear of the machine as viewed in Fig. 4 and turning the brake cam 109 sufficiently to spread the brake shoes and release the brake. In stopping the machine a reverse operation occurs, the tapered expanding member 98 being moved back, when started sufficiently to be disengaged, by a compression spring (not shown) and the brake being simultaneously applied by the spring 106.

Preferably means is employed automatically to stop the machine at certain times, desirably after the mandrels have been inserted into the tubes and again after the machine has subsequently been started and the mandrels withdrawn. For this purpose there is provided upon a side face of one of the gears, herein the large gear 92, a pair of stops or cams 115, 116, properly positioned upon the gear to institute stopping of the machine at the desired times. As best seen in Figs. 4, 11 and 13 said stops cooperate with suitable mechanism whereby the clutch is thrown out and the brake applied.

Said mechanism herein includes a dog 117, Figs. 11 and 13, pivoted near one end of an arm 118 upon a sleeve 119 journalled upon a stud 120 projecting rearwardly from the machine framing. Said sleeve carries a second arm 121 connected by a pivoted link 122 to a finger 123 secured upon the rear end of the control shaft 100. Said dog 117 is limited to a movement between a flange 124 on the arm 118 above the dog and a pin 125 beneath it.

In Figs. 11 and 13 the machine is assumed to be stationary, the pulley being disengaged and the brake applied. Upon starting of the machine by movement of the control lever 102 to rock the control shaft 100, the arm 118 and dog 117 thereon are moved toward the right, Fig. 13, by means of the connections above described, so as to bring said dog into the path of the next approaching cam 115 or 116. The gear carrying said cams is assumed to be rotated in a counterclockwise direction, as viewed from the left in Fig. 13, or in Fig. 11 as viewed along the countershaft 94 from the outer end, near the bottom of said figure. When one or the other of said cams comes around into engagement with the dog the latter is first lifted until brought up against the flange 124, whereupon the arm 118 is cammed forwardly, into the position shown in Figs. 11 and 13, thereby rocking the control shaft 100 through the intermediate connections 121, 122, 123 to release the clutch and apply the brake. The dog 117 when freed from the cam 115 or 116 falls down upon the pin 125, thus passing to the opposite side of the cam by which it was operated, and into position again to be moved into the path of the cams without interference therewith when the machine is subsequently started.

Suitable interlocking or other safety means is desirably employed to prevent starting of the machine unless and until the tube frame is locked in proper position to be acted upon by the mandrels. As clearly illustrated in Figs. 11, 12 and 13, such means herein includes an interlocking lever 126 extending through and pivotally supported, as at 127, upon and extending through the right hand side frame 1. At its outer or right hand end, Figs. 12 and 13, said lever is formed with a shoulder 128 and finger 129 cooperating with a pin 130 on the control lever 102. The outer end of said interlocking member is normally held down as by a spring 131 so that said shoulder lies in the path of the pin 130 when the clutch is released, preventing movement of the control lever to the left, Fig. 12, to start the machine until the desired conditions exist.

The inner end 132 of said interlocking lever extends to a position adjacent, and herein below, the shaft 20 carrying the hand wheel 21 by which the frame locking and positioning mechanism is operated. Projecting from said shaft is a release pin 133 which, when the shaft has been sufficiently

turned to completely lock the frame, comes into engagement with the inner end of the interlocking lever and depresses the same sufficiently to raise the shoulder 128 at its opposite end out of the path of the pin 130 on the control lever. The latter may then be moved to start the machine, the tube frame having been completely locked in position to be acted upon. Said interlocking lever is retained in proper relation to the control lever as by a guide 134 on the latter.

When the tube frame has been properly positioned and locked upon its support and the upper die or aligning assembly 23 has been moved down into engagement therewith by the operator, the machine may be started to cause the mandrels to enter and press out or remove any indentations or bent-in portions from the interior of the tubes or at either of their end edges. The mandrels are so formed and held in the cross-head, as by the key and slot arrangement previously described, that they are permitted to float slightly to allow for uneven spacing of the tubes. Because of this construction, and to afford extreme accuracy in the movements of the relatively long, narrow mandrels means is provided to guide them at or near the point where they enter the tubes, thereby insuring that they register properly with the open ends of the latter. Such guiding means should be so arranged as to leave the mandrels entirely free to enter the tubes and pass sufficiently beyond them to allow the noses 60^a of the mandrels to remove any indentations or burrs at the small or free ends of the tubes. The mandrels preferably have forming shoulders 60^b, see Fig. 7 and 7^a, to engage and press out any irregularities at the large or secured ends of the tubes. Any guiding means should therefore be such as not to interfere with the engagement of said mandrel shoulders with the ends of the tubes.

As herein illustrated we provide a guide member or bar 135, seen in section in Figs. 5, 6 and 7 and in plan in Fig. 2. Said bar normally rests upon the mandrels, having slots 136 on its under face in the manner of a comb, said slots being shaped to receive the forward or entering portions of the mandrels snugly and being spaced properly to direct the same into the mouths of the tubes. Said guide 135 thus assures proper positioning of the mandrels in the horizontal plane, that is, longitudinally of the tube frame, effecting proper registering of mandrels and tubes in the plane mentioned.

Said guide 135 is fastened at its ends to a pair of curved arms 137, 138 pivoted at 139, 140 respectively upon the adjacent slide bar 75 or 76 and normally urged toward the rear of the machine so as to hold the guide down in engagement with the mandrels, by springs 141, 142 intermediate said arms and the cross-head 61. As the cross-head and mandrels approach the tubes said guide remains in engagement with the mandrels near their entering ends or noses 60^a until the latter are about to enter or have just entered the tubes, ensuring correct registering. At or about that time the free ends of the guide-carrying arms 137, 138 come into contact with a stationary part of the machine, herein the forward faces of the guide brackets 25, 26 respectively.

Continued rearward movement of the slide bars 75, 76 then causes said arms to be swung upwardly or away from the mandrels, lifting the guide 135 out of engagement therewith and out of the path of the shoulders 60^b of the mandrels, thus permitting the latter to act upon the open or secured ends of the tubes to form them. Said raised position of the guide is illustrated in Fig. 6. The arms 137, 138 desirably carry rollers 143, 144 respectively which contact and roll upon said brackets 25, 26, facilitating the action above described. Just prior to or at the time of complete withdrawal of the mandrels during their return movement the guide 135 again moves into engagement with the ends thereof, by gravity and under the influence of the springs 141, 142. Thus the mandrels are guided longitudinally of the tube frame and near their entering ends at all times when the latter are clear of the tubes, both during approach to and withdrawal from the same.

Means may also be provided to guide and retain the mandrels in the plane at right angles to that above considered, that is, herein, vertically or transversely of the tube frame. As best seen in Figs. 1, 2, 5, 6 and 7, we provide for said purpose the guides 145, 146 extending across the series of mandrels upon opposite sides thereof and in contact with them.

Said guides are mounted for movement with the mandrels during portions of their travel but are yieldable, so as to permit movement of the mandrels with respect to them at other times. Herein said guides are secured at their ends to slide rods 147, 148 movable in guideways 149, 150 upon the mandrel carriage or cross-head 61 and in bearings 151, 152 supported from the machine end frames 1, 1.

During movement of the mandrels toward the tube frame said guides 145, 146 at first move with the mandrels, due to frictional engagement with them, keeping them aligned vertically. At approximately the time the mandrels enter the tubes the stops or collars 153, 154 upon the respective slide rods 147, 148 bring up against the outer face of said bearings 151, 152; see Fig. 6. Thereupon said guides remain stationary and the mandrels advance relatively to them, into the tubes. On retraction of the mandrels a re-

verse action occurs, the guides and mandrels at first moving back together until a second pair of stops or collars 155, 156 engage the inner face of said bearings 151, 152. Further retracting movement of the guides is thereby halted, while the mandrels retract still further and relatively to said guides into their former position, as shown in Figs. 1, 2, 5 and 7. Said stops or collars 153, 154, 155, 156 may be adjustable upon their slide rods to limit the movement of the guides as desired. Said guides 145, 146, in cooperation with the guide 135, ensure proper spacing and alignment of the mandrels in all directions and at all times during travel of the latter when disengaged from the tubes.

From the foregoing it will be understood that a tube frame to be straightened and restored to the desired original form is inserted in the machine, locked up by the locking bar 9 by turning the wheel 21, and the tubes initially combed out, formed and aligned by the clamp or movable die unit 23, operated by the hand rod 52. The frame is then ready to be acted upon by the interiorly effective expansion formers or mandrels 60. Turning of the wheel 21 sufficiently to lock up the frame properly has released the interlocking safety means 126, etc. so that the starting or control lever 102 may be thrown to apply the power whereby the mandrels are advanced and forced into or through the tubes. At their innermost position the power driving means is thrown out, the control lever being automatically knocked off by the stop mechanism already described.

When the mandrels are in the tubes, as illustrated in Fig. 6, they are completely enclosed, their entire surfaces, both inside and out, being engaged by forming mechanism, including the movable and stationary die units and the mandrels themselves. Pressure exteriorly of the tubes to correct outwardly projecting irregularities or to smooth out indentations and the like may accordingly be applied as desired, being received through the tubes onto the mandrels and the stationary die unit. With the parts so positioned the movable die may be manually hammered, rolled or otherwise brought to a set upon the tubes, but preferably we effect this automatically. As stated, said pressure may be applied in any suitable manner such as rolling, pressing or hammering, and where the latter is employed it may be effected electrically, pneumatically, or mechanically, or by a combination of such methods.

In the present instance we have illustrated as exemplary of means for applying pressure an electric hammer 160 which is mounted for reciprocation along the supported tube frame in position to cooperate with the movable die 23. As best seen in Figs. 3 and 5, and also in Figs. 1, 6 and 7, said hammer is secured to a slide 161 whereby it is supported for movement along a track 162, a hand grip 163 being provided for effecting said movement, or the same may be done automatically. Said track is mounted on the die-operating links 43, 44, so that the hammer is depressed or lifted with them.

The spring-operated control switch 164 for the hammer is arranged to operate reversely from the usual action, being moved by its spring to "on" position when the switch is free or released. When out of action the hammer is moved to one end or the other of its track at which points the switch is engaged by a switch-lifter 165 or 166 (Fig. 3) which raises the same and shuts off the current. In said figure the hammer is shown, for the sake of clearness, at an intermediate point along its slide, although the movable die is not shown in position for the setting or hammering operation as it actually would be with the hammer positioned as shown.

At the proper time the operator has merely to grasp the grip 163 and move the hammer across the machine one or more times, the current being automatically applied by the release of the switch from the lifter 165 or 166 and the hammer brought into and continued in action so long as it is out of engagement with said lifters. Due to the sectional construction of the movable or upper die and the arrangement whereby the die sections 29 are independently movable, as previously described, pressure may be applied locally along the frame as desired, special or additional attention being given to any tubes or group of tubes which may have been more damaged than others. The hammer nose 167 acts directly upon the metal strip 40, the flexibility of which permits said local action, allowing the several die sections to be brought to a seat successively and in any desired order. Said nose piece 167 may be of any suitable material but preferably is brass, which we have found to be peculiarly suited for the purpose.

To prevent operation of the hammer until the movable die is closed upon the tube frame suitable interlocking safety means is desirably provided. As best seen in Fig. 3, the stationary cross support or bar 168 near the upper ends of the frame uprights or top-pieces 27, 28 carries the depending stop fingers 169, 170 which project into the path of the hammer when the die and hammer are raised, as in said figure. The hammer at such times is in its inactive position (not so shown in Fig. 3) at one end or the other of its track, its switch being held open by the adjacent lifter 165 or 166. Said fingers thus prevent the hammer being moved off

said lifters and started, until the links 43, 44, which carry both the movable die and the hammer, are depressed to close the die on the tube frame. At such time the hammer drops below the end of the stop fingers 169, 170 and it may then be moved freely along its track.

Upon completion of the straightening and forming operations the control lever 102 may again be shifted to start the machine, causing the power-operated means to withdraw the mandrels. When the latter have been completely withdrawn their movement is again automatically stopped. The tube frame lock 9 is then backed off, the movable die raised, releasing the completely reformed frame, the stripping means 55 assisting in disengaging the frame if the latter adheres in and is lifted with the die as it opens.

From the foregoing it will be understood that the method of our invention includes all or certain of the steps, among others, of supporting a tube frame in position to be acted upon, initially aligning and clamping or forming the individual tubes exteriorly as in a die, forming the tubes interiorly by relative movement of the tubes and of forming devices shaped to conform to the interior shape desired for the tubes, applying pressure to the tube frame where required completely to reform the tubes, as by hammering, rolling or otherwise, preventing the tubes from being stripped from their carrier during withdrawal of the internal formers, and in releasing and when necessary stripping the tube frame from engaging portions of the mechanism.

Our invention is not limited to the particular embodiment herein shown and described and constituting one example of means for practicing the method thereof, its scope being set forth in the following claims.

1. In a machine for straightening and reforming loom tube frames the combination with a tube frame support of a reciprocable carriage, a series of mandrels mounted thereon for insertion into and withdrawal from the tubes to reform them, guiding means for holding said mandrels in the desired plane during their travel, and other guiding means to insure proper spacing of the mandrels in said plane.

2. In a machine for acting upon loom tube frames to straighten and reform the same, a tube frame support, a movable mandrel carriage, and a series of mandrels thereon for entering and reforming the tubes, the butts of said mandrels being yieldably supported by said carriage in a manner permitting the mandrels to float sufficiently to adjust themselves to uneven spacing of the tubes, and guiding means to insure registration of the mandrels with said tubes.

3. In a machine for straightening and reshaping loom tube frames, the combination of a tube frame support, a series of mandrels adapted to be inserted into and withdrawn from the tubes to reform the same, and means to guide the mandrels adjacent their entering ends to insure registration thereof with the respective tubes, said guiding means traveling with the mandrels up to approximately their instant of entry into the tubes and being thereafter withdrawn from the path of the mandrels to permit the latter to pass the desired distance into or through the tubes.

4. In a machine for straightening and reshaping loom tube frames, the combination of a tube frame support, a series of mandrels adapted to be inserted into and withdrawn from the tubes to reform the same, and means moving with the mandrels to guide the same adjacent their entering ends during their approach to the tubes.

5. In a machine for straightening and reshaping loom tube frames, the combination of a tube frame support, a series of mandrels adapted to be inserted into and withdrawn from the tubes to reform the same, and guiding means adjacent the entering ends of the mandrels to insure registration thereof with the respective tubes.

6. In a machine for straightening and reshaping loom tube frames, the combination of a tube frame support, a series of mandrels adapted to be inserted into and withdrawn from the tubes to reform the same, and guiding means traveling with the mandrels up to approximately their instant of entry into the tubes and being thereafter withdrawn from the path of the mandrels to permit the latter to pass the desired distance into or through the tubes and subsequently replaced in operative guiding position at about the time of full withdrawal of the mandrels.

7. In a machine for straightening and reshaping loom tube frames, the combination of a tube frame support, a series of mandrels adapted to be inserted into and withdrawn from the tubes to reform the same, and means supported for movement with the mandrels continuously to guide them up to the time of their entry into the tubes.

8. In a machine for straightening and reforming loom tube frames the combination with a tube frame support of a reciprocable carriage, a series of mandrels mounted thereon for insertion into and withdrawal from the tubes to reform them, a guide mounted for movement with said carriage for properly spacing the mandrels near their entering ends, and means for removing said guide from engagement with the mandrels when their registration with the tubes has been insured.

9. In a machine for straightening and reforming loom tube frames the combination with a tube frame support of a reciprocable

carriage, a series of mandrels mounted thereon for insertion into and withdrawal from the tubes to reform them, a guide mounted for movement with said carriage for properly spacing the mandrels near their entering ends, and means for removing said guide from engagement with the mandrels when their registration with the tubes has been insured and for returning said guide to operative engagement with the mandrels during withdrawal of the latter.

10. In a machine for acting upon loom tube frames to straighten and reform the same, a tube frame support, a movable mandrel carriage, and a series of mandrels thereon for entering and reforming the tubes, the butts of said mandrels being yieldably supported by said carriage in a manner permitting the mandrels to float sufficiently to adjust themselves to uneven spacing of the tubes.

11. In a machine for straightening and reforming loom tube frames the combination with a tube frame support of a reciprocable carriage, a series of mandrels carried thereby for insertion into and withdrawal from the tubes to reform them, a guide engaging opposite sides of the mandrels to confine them to substantially the same plane during their travel, said guide moving with the mandrels during portions of their travel but adapted to permit movement of the mandrels relative thereto at other times, and a second guide for spacing the entering ends of the mandrels, said guides together effecting the desired positioning of the mandrels at all times when the latter are disengaged from the tubes.

12. In a machine for straightening and reforming loom tube frames the combination with a tube frame support of a reciprocable carriage, a series of mandrels mounted thereon for insertion into and withdrawal from the tubes to reform them, a guide mounted for movement with said carriage for spacing the mandrels near their entering ends, and additional guiding means for confining the mandrels to substantially the same plane.

13. In a machine for straightening and reforming loom tube frames the combination with a tube frame support of a reciprocable carriage, a series of mandrels mounted thereon for insertion into and withdrawal from the tubes to reform them, and a guide engaging opposite sides of the mandrels to confine them to substantially the same plane during their travel, said guide moving with the mandrels during portions of their travel but adapted to permit movement of the mandrels relative thereto at other times.

14. In a machine for straightening and reshaping loom tube frames, the combination with tube frame supporting means and a series of power-operable reciprocable mandrels, of means to guide the mandrels during their approach to and recession from the tubes to insure their proper registering with the latter.

15. In a machine for acting upon loom tube frames to straighten and reform the same, a tube frame support, a movable mandrel carriage, a series of mandrels for entering and reforming the tubes, and a removable support on said carriage for said series of mandrels whereby the latter may be removed as a unit for substitution of a like series of differently spaced mandrels, said mandrels being individually removably mounted on said mandrel support.

16. In a machine for acting upon loom tube frames to straighten and reform the same, a tube frame support, a movable mandrel carriage, and a series of mandrels thereon for entering and reforming the tubes, said mandrels being readily shiftable as a unit lengthwise the tube frame to align them with the tubes.

17. In a machine for acting upon loom tube frames to straighten and reform the same, a tube frame support, a movable mandrel carriage, and a series of mandrels thereon for entering and reforming the tubes, said mandrels being readily removable from their carriage individually.

18. Mechanism for straightening and reshaping the tubes of loom tube frames, comprising a support for a tube frame, a series of mandrels and a carriage therefor movable to insert them into and withdraw them from the tubes, a crank device, means for operating the same, and connections between said crank and carriage effective in the manner of a toggle to force the mandrels into the tubes and to withdraw them.

19. Mechanism for straightening and reshaping the tubes of loom tube frames, comprising a support for a tube frame, a series of mandrels and a carriage therefor movable to insert them into and withdraw them from the tubes, a crank having an axis in substantially the plane of the tubes, and one or more pivoted links intermediate said crank and carriage.

20. Mechanism for straightening and reshaping the tubes of loom tube frames, comprising a support for a tube frame, a series of mandrels and a carriage therefor movable to insert them into and withdraw them from the tubes, a crank having an axis in substantially the plane of the tubes, and one or more pivoted links intermediate said crank and carriage, said link or links being constructed and arranged to exert a maximum driving action substantially in the plane of the tubes.

21. In a machine for straightening and reshaping loom tube frames, a tube frame support, a series of reciprocable mandrels for acting upon the tubes, and power operated

means to reciprocate said mandrels, said support, mandrels, and reciprocating means being organized to permit proper positioning of and successive action upon different portions of a tube-frame which is longer than said mandrel series while avoiding interfering engagement with any portion of said frame projecting laterally to either side of the mandrel series, said reciprocating means including a rotatable power-receiving element and crank and pitman-like connections between said element and the series of mandrels.

22. Mechanism for straightening and reshaping the tubes of loom tube frames, comprising a support for a tube frame, a series of mandrels adapted to enter and reform simultaneously a corresponding number of tubes, and power operated means for actuating said mandrels, said support being formed to receive and position tube frames including those having tubes in excess of the number of mandrels, and said mandrels and their actuating means being constructed and arranged to exert a thrust of maximum efficiency substantially in the plane of the tubes but to avoid interference with any portion of the frame extending laterally beyond the mandrel series, whereby frames of any length may be acted upon.

23. Mechanism for straightening and reshaping the tubes of loom tube frames, comprising a support for a tube frame, a series of mandrels and a carriage therefor movable to insert them into and withdraw them from the tubes, a crank having an axis in substantially the plane of the tubes, and one or more pivoted links intermediate said crank and carriage, said link or links being constructed and arranged to exert a maximum driving action substantially in the plane of the tubes and being bowed to avoid interference with a supported tube frame which is longer than the width of the machine, thus adapting the latter to handle frames of any length.

24. In a machine for straightening loom tube frames, a tube frame support, a series of mandrels adapted to be inserted into and withdrawn from the respective tubes to reform them, and means relatively to adjust said support and mandrels to control the extent of their entrance into or through the tubes.

25. In a machine for straightening loom tube frames, a tube frame support, a series of mandrels adapted to be inserted into and withdrawn from the respective tubes to reform them, and means variably to control the extent of travel of said mandrels.

26. In a machine for straightening loom tube frames, a tube frame support, a series of mandrels adapted to be inserted into and withdrawn from the respective tubes to reform them, a carriage supporting a series of mandrels and reciprocable to insert the latter into and withdraw them from the tubes, and carriage operating means including crank mechanism and one or more pivoted links connecting the latter to said carriage, said link or links being adjustable relatively to the carriage to control the extent of insertion of the mandrels.

27. In a machine for straightening loom tube frames, a tube frame support, a series of mandrels adapted to be inserted into and withdrawn from the respective tubes to reform them, a carriage supporting a series of mandrels and reciprocable to insert the latter into and withdraw them from the tubes, carriage operating means including crank mechanism and one or more pivoted links connecting the latter to said carriage, said link or links being adjustable relatively to the carriage to control the extent of insertion of the mandrels, and means to effect said adjustment.

28. In a machine for straightening and reshaping loom tube frames, the combination of a tube frame support, means to engage the individual tubes exteriorly, reciprocable means to enter and reform the respective tubes interiorly, a rotatable power-receiving element, and operating connections between said element and said reciprocable means, including a crank and a pitman-like link.

29. In a machine for straightening and reshaping loom tube frames, the combination of a tube frame support, means to engage the individual tubes exteriorly, power-operable means to enter and reform the respective tubes interiorly, and automatic mechanism to stop said interiorly effective means upon full movement into or through the tubes.

30. Mechanism for restoring to original shape and position the tubes of a damaged tube frame, comprising in combination, a tube frame support, frame locking means, a forming die for surrounding the tubes, mandrels, means for inserting and withdrawing the latter, a rotatable power-receiving element, and gearing connections between said element and said means for inserting and withdrawing the mandrels.

31. Mechanism for restoring to original shape and position the tubes of a damaged tube frame, comprising in combination, a tube frame support, frame locking means, a reforming die for surrounding the tubes, mandrels, power-operable means for inserting and withdrawing the latter, and means automatically to stop the machine upon full insertion of the mandrels and again upon complete withdrawal of the same after subsequent starting of the mechanism.

32. In a machine for straightening and reshaping loom tube frames, the combination of a tube frame support, means to engage and hold the individual tubes exteriorly, power-operable means to enter and re-

form the respective tubes interiorly, and automatic mechanism to stop said interiorly effective means upon full movement into or through the tubes and again upon withdrawal of the same.

33. In a loom tube frame straightening mechanism, a tube frame support, manual means for initially aligning and reforming the tubes exteriorly, mandrels for reshaping the tubes interiorly, a rotatable power-receiving element, and operating connections between said element and said mandrels, including a crank and a pitman-like link.

34. In a loom tube frame straightening mechanism, a tube frame support, manual means for initially aligning and reforming the tubes exteriorly, mandrels for reshaping the tubes interiorly, power means for operating the latter, and automatic devices to stop said operating means upon full insertion of the mandrels and again when the latter have been withdrawn.

35. In mechanism of the class described, a tube frame support including a platform for the tubes and an abutment for the tube frame, a tube frame locking bar extending lengthwise along and engageable with said frame, and means for moving the same toward or away from a supported frame to lock the same in position.

36. In mechanism of the class described, a tube frame support including a platform for the tubes and an abutment for the tube carrier, a tube frame locking bar, and means for moving the same toward or away from a supported frame to lock the same in position, said bar having a portion engageable directly with the adjacent ends of the tubes to resist any force tending to displace the same with respect to their frame in the direction of their lengths.

37. In mechanism of the class described, a tube frame support including a platform for the tubes and an abutment for the tube frame, a tube frame locking bar, means for moving the same toward or away from a supported frame to lock the same in position, and a movable series of mandrels insertable into the tubes, said locking bar having a portion engaging the ends of the tubes to back up the same during withdrawal of said mandrels.

38. In mechanism of the class described, a tube frame support including a platform for the tubes and an abutment for the tube frame, a tube frame locking bar, means for moving the same toward or away from a supported frame to lock the same in position, a movable series of mandrels insertable into the tubes, operating mechanism therefor, and an interlocking device intermediate said means for moving the locking bar and said operating mechanism to prevent starting of the latter except when said bar is in frame locking position.

39. In mechanism of the class described, a tube frame support including a platform for the tubes and an abutment for the tube frame, a tube frame locking bar, and means for moving the same toward or away from a supported frame to lock the same in position, said locking bar being readily removable to permit substitution of a like member of a length corresponding to that of the particular tube frame to be acted upon.

40. In a machine for straightening and reshaping loom tube frames, a tube frame support, means to lock a frame in position thereon, a series of mandrels and operating mechanism therefor, and means to prevent starting of the mandrel operating mechanism unless the tube frame is properly positioned and locked on its support.

41. In a machine for straightening and reshaping loom tube frames, a tube frame support, means for locking the frame in position thereon, a movable element cooperating with said support completely to enclose the individual tubes in the manner of a die, mandrels adapted to be inserted into and withdrawn from the individual tubes, and means to guide said mandrels to insure proper registering of the same with the respective tubes.

42. That method of straightening and reshaping loom tube frames which includes the steps of enclosing the individual tubes in a die-like device but in such manner as to permit locally effective application of pressure upon the tubes, supporting the tubes internally, and thereafter applying pressure in a locally effective manner along the enclosing die-like device, as required to bring all portions thereof into reforming engagement with the adjacent tubes.

43. In a machine for realigning and shaping the tubes of loom tube frames, a support for a tube frame constituting a stationary die unit and a movable die unit cooperating therewith and having portions accurately to fit the outer walls of the respective tubes and together with said stationary die unit completely to surround the same and in uninterrupted circumferential contact therewith whereby the tubes may be accurately reformed at all portions circumferentially thereof, one of said die units comprising a longitudinal series of independently movable sections.

44. In a machine for straightening loom tube frames, a tube frame support, an aligning and clamping element movable into and out of position to close upon a tube frame upon said support and having portions to enclose the individual tubes, guides wherein said element is movable, and means associated with said guides, permitting adjustment of said element lengthwise the tube frame correctly to position it with respect to the tubes.

45. In a machine for straightening loom tube frames, a tube frame support, an aligning and clamping element movable into and out of position to close upon a tube frame upon said support and having portions to enclose the individual tubes, said element being adjustable lengthwise the tube frame correctly to position it with respect to the tubes, and means to effect such adjustment.

46. In a machine for straightening loom tube frames, a tube frame support, including a bar having a face to receive the tubes and a wall at approximately right angles to said face to act as an abutment for the tube carrier, the edge of said bar between said face and wall having a formation enabling it to bite into any obstruction such as solder lumps or the like at the juncture of the tubes and their carrier, whereby the tube frame may seat flush upon said support.

47. In a machine for straightening loom tube frames, a tube frame support, including a bar having a face to receive the tubes and a wall at approximately right angles to said face to act as an abutment for the tube frame, a toothed clamp or die element cooperable with said bar, said tube-receiving face of said bar being slotted, as at 7, to receive the teeth of said element upon insertion of the latter between the tubes of a frame positioned on said support, the free corners or edges of the tooth-like portions of said bar intermediate its slots being formed, as at 7′, to bite into obstructions such as solder lumps or the like at the juncture line of the tubes and their frame permitting the tube frame to seat flush upon its support.

48. In a machine for straightening loom tubes frames, a tube frame supporting element, and means including a plurality of links pivotally connected to said element for moving the same, said connection being such as to permit relative movement between the links and said element after initial closing of the latter, to relieve said links of any pressure subsequently applied to said element to bring it to a forming set on the tubes.

49. In a machine for realigning and shaping the tubes of loom tube frames, a support for a tube frame constituting a stationary die unit, and a movable die unit cooperating therewith and having portions to fit the outer walls of the respective tubes and together with said stationary die completely to surround the same, the tube engaging portions of one of said dies being formed of independently movable sections lengthwise the tube frame to facilitate local action on the tubes when subjected to pressure.

50. In a machine for realigning and shaping the tubes of loom tube frames, a support for a tube frame constituting a stationary die unit, a cooperating movable die unit comprising a plurality of relatively short sections, a movable holder in which said sections are independently movable toward or away from the tubes, and means for moving said holder initially to close said die sections upon the tubes.

51. In a machine for straightening and reshaping loom tube frames, a tube frame support, means for locking the frame in position thereon, a movable element cooperating with said support completely to enclose the individual tubes in the manner of a die, a series of formers or mandrels adapted to be inserted into the tubes, and means for applying pressure upon the closed die to bring it to a set upon said tubes to reform them.

52. In a loom tube frame straightening mechanism, a tube frame support, stationary and movable die units initially to align and form the tubes exteriorly, and automatic means for applying pressure to said die when closed to bring it to a true set completely to contact with and form the tubes.

53. In a loom tube frame straightening mechanism, a tube frame support, stationary and movable die units initially to align and form the tubes exteriorly, and automatic means for applying pressure to said die when closed to bring it to a tube set completely to contact with and form the tubes, the die unit to which said pressure is applied being formed of a plurality of relatively short, independently movable sections to enable said pressure to be effective locally along the tube frame as desired.

54. In a machine for realigning and shaping the tubes of loom tube frames, a support for a tube frame constituting a stationary die unit, a cooperating movable die unit comprising a plurality of relatively short sections, a movable holder in which said sections are independently movable toward or away from the tubes, means for moving said holder initially to close said die sections upon the tubes, and mechanism for applying pressure locally along the closed die to effect a true setting of each die section.

55. In a loom tube frame straightening mechanism, a tube frame support, stationary and movable die units initially to align and form the tubes exteriorly, and an automatic hammer traversable lengthwise the closed die and operable to force the same to a perfect set upon the tubes.

56. In a machine for realigning and shaping the tubes of loom tube frames, a support for a tube frame constituting a stationary die unit, a cooperating movable die unit comprising a plurality of relatively short sections, a movable holder in which said sections are independently movable toward or away from the tubes, means for moving said holder initially to close said die sections upon the tubes, and an automatic hammer supported for traversing movement in cooperative relation to the closed die to

force the respective portions thereof to a proper set upon the tubes.

57. In a machine for straightening and reshaping loom tube frames, a tube frame support, means for locking the frame in position thereon, a movable element cooperating with said support completely to enclose the individual tubes in the manner of a die, a series of formers or mandrels adapted to be inserted into the tubes, means for applying pressure upon the closed die to bring it to a set upon said tubes to reform them, and means to prevent operation of the pressure-applying mechanism except when the movable die is closed upon the tube frame.

58. In a loom tube frame straightening mechanism, a tube frame support, stationary and movable die units initially to align and reform the tubes exteriorly, an automatic hammer traversable lengthwise the closed die in cooperative relation thereto to force the same to a perfect set upon the tubes, and means to prevent actuation of the hammer unless the die is closed.

59. In a machine for realigning and shaping the tubes of loom tube frames, a support for a tube frame constituting a stationary die unit, a cooperating movable die unit comprising a plurality of relatively short sections, a movable holder in which said sections are independently movable toward or away from the tubes, means for moving said holder initially to close said die sections upon the tubes, and an automatic hammer supported for traversing movement in cooperative relation to the closed die to force the respective portions thereof to a proper set upon the tubes, said hammer being automatically set in action when traversed.

60. In a machine for realigning and shaping the tubes of loom tube frames, a support for a tube frame constituting a stationary die unit, a cooperating movable die unit comprising a plurality of relatively short sections, a movable holder in which said sections are independently movable toward or away from the tubes, means for moving said holder initially to close said die sections upon the tubes, an automatic hammer supported for traversing movement in cooperative relation to the closed die to force the respective portions thereof to a proper set upon the tubes, said hammer being automatically set in action when traversed, and means to prevent operation of the hammer unless the die is closed upon the tubes.

61. In a machine for straightening loom tube frames, a tube frame support, a movable die-like aligning and clamping element cooperable with said support to enclose the individual tubes, and means to strip a tube frame from said element upon opening thereof in case the frame or portions of it tend to adhere therein.

62. In a machine for straightening loom tube frames, a tube frame support, a die-like aligning and clamping element adapted to be depressed into engagement with the individual tubes of a frame on said support or to be raised out of engagement therewith, and a stripper for releasing from said element a frame which has lifted with it.

63. That method of straightening and reshaping loom tube frames which consists in supporting a frame in position to be acted upon, initially aligning and clamping the individual tubes exteriorly, forcing reforming devices into or through the respective tubes, applying exterior pressure along and upon the tube frame completely to conform the tubes to the clamping and reforming devices, withdrawing said inserted reforming devices, and finally in releasing the tube frame.

64. That method of straightening and reshaping loom tube frames which consists in supporting a frame in position to be acted upon, initially aligning and clamping the individual tubes exteriorly, forcing reforming devices into or through the respective tubes, applying exterior pressure along and upon the tube frame completely to conform the tubes to the clamping and reforming devices, withdrawing said inserted reforming devices, and finally in releasing the tube frame and automatically stripping the same from the clamping means in case it adheres therein.

65. That method of straightening and reshaping loom tube frames which includes the steps of enclosing the individual tubes in a die-like device simultaneously but by groups, while permitting the respective portions of at least one element of said device which engage the several groups to move independently of each other, inserting reformers into the tubes, and applying pressure in a locally effective manner along the closed die as required to bring all portions thereof to a proper set upon the adjacent tubes to reform them.

In testimony whereof, we have signed our names to this specification.

EDGAR F. HATHAWAY.
WALTER BIXBY.