

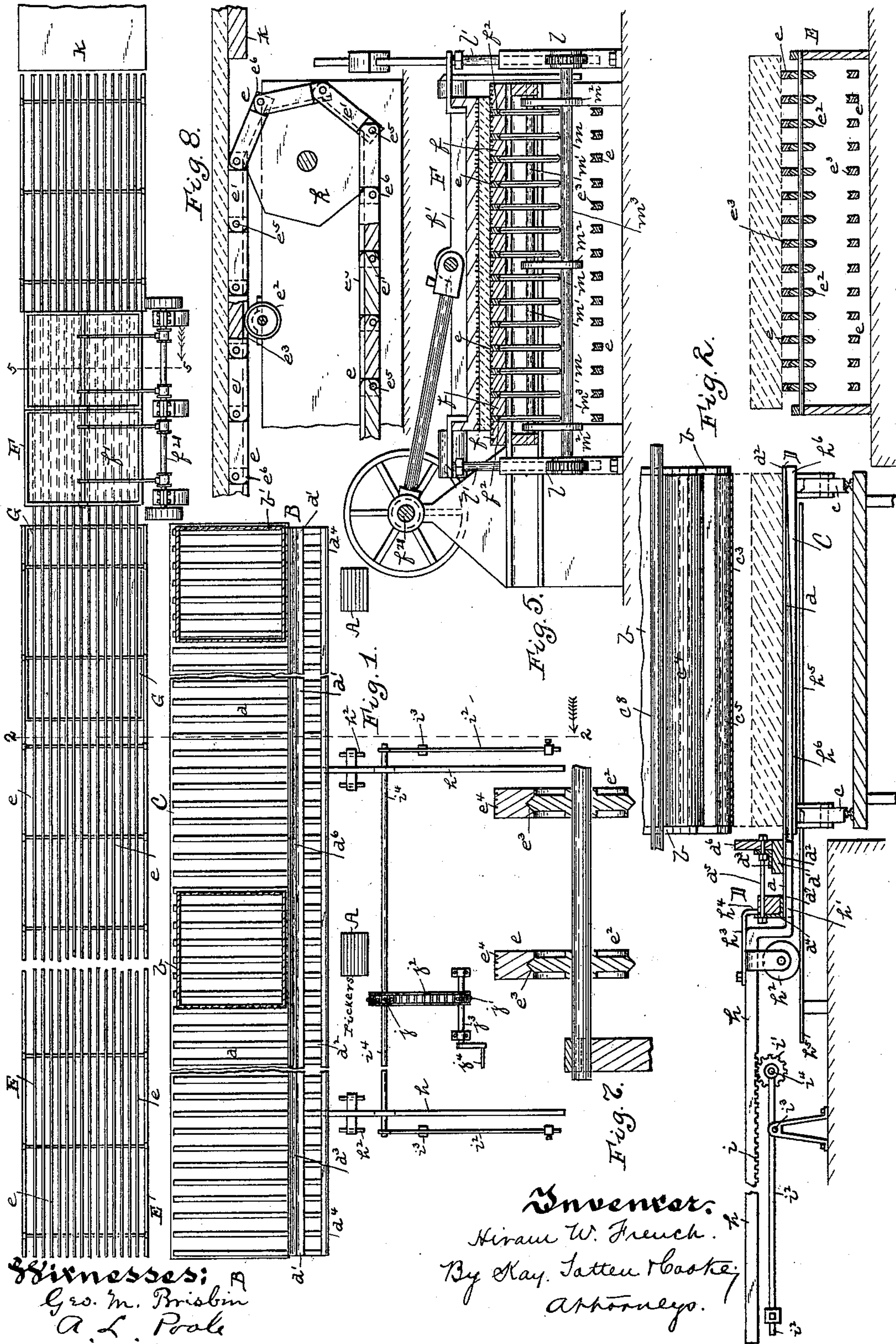
(No Model.)

4 Sheets—Sheet 1.

H. W. FRENCH.
APPARATUS FOR FORMING HAIR FELT.

No. 606,163.

Patented June 21, 1898.



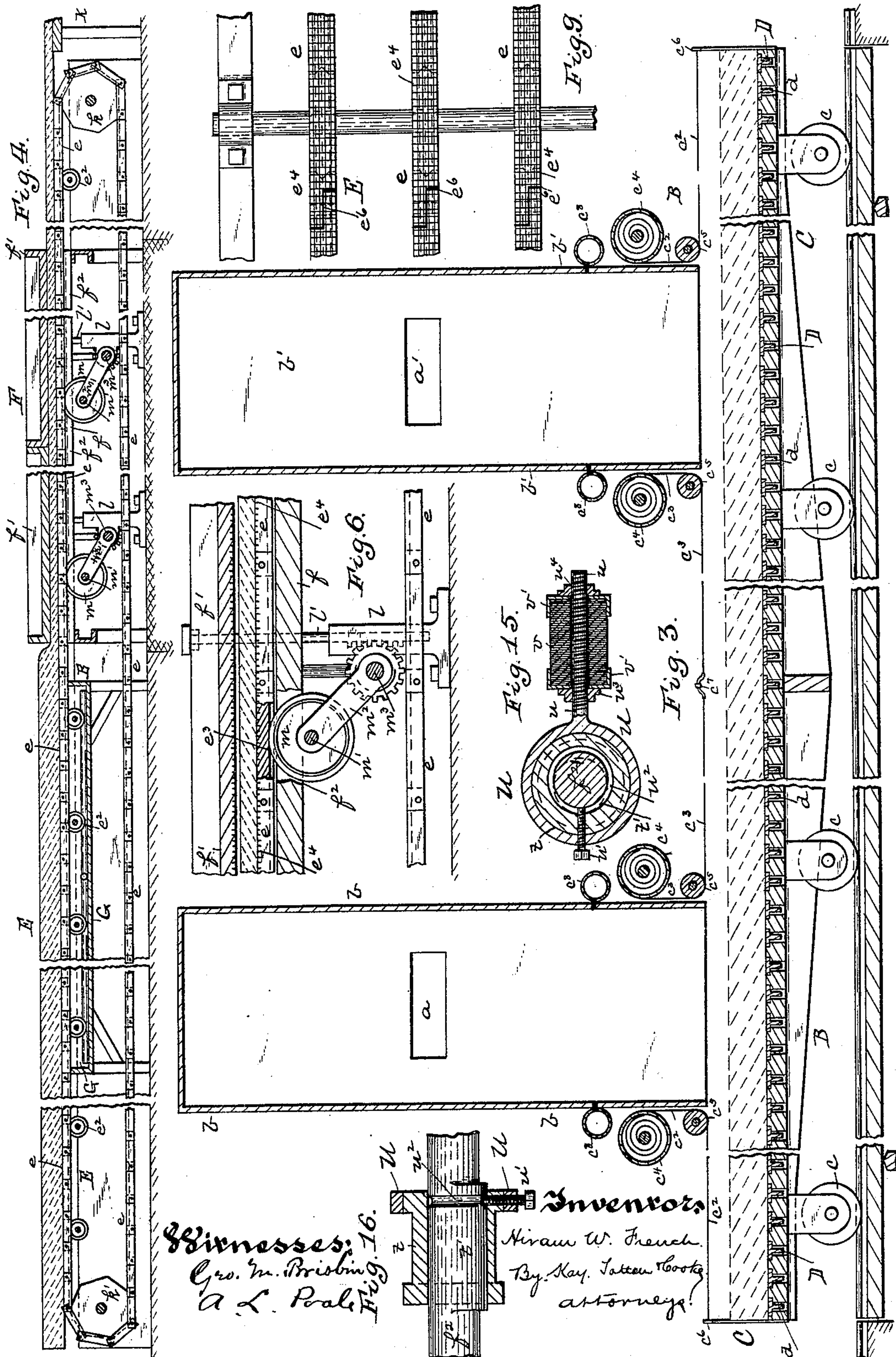
Witnesses:
Geo. M. Brislin
A. L. Poole

Inventor:
Hiram W. French.
By Kay, Tatten & Cooley
Attorneys.

4 Sheets—Sheet 2.

No. 606,163.

Patented June 21, 1898.



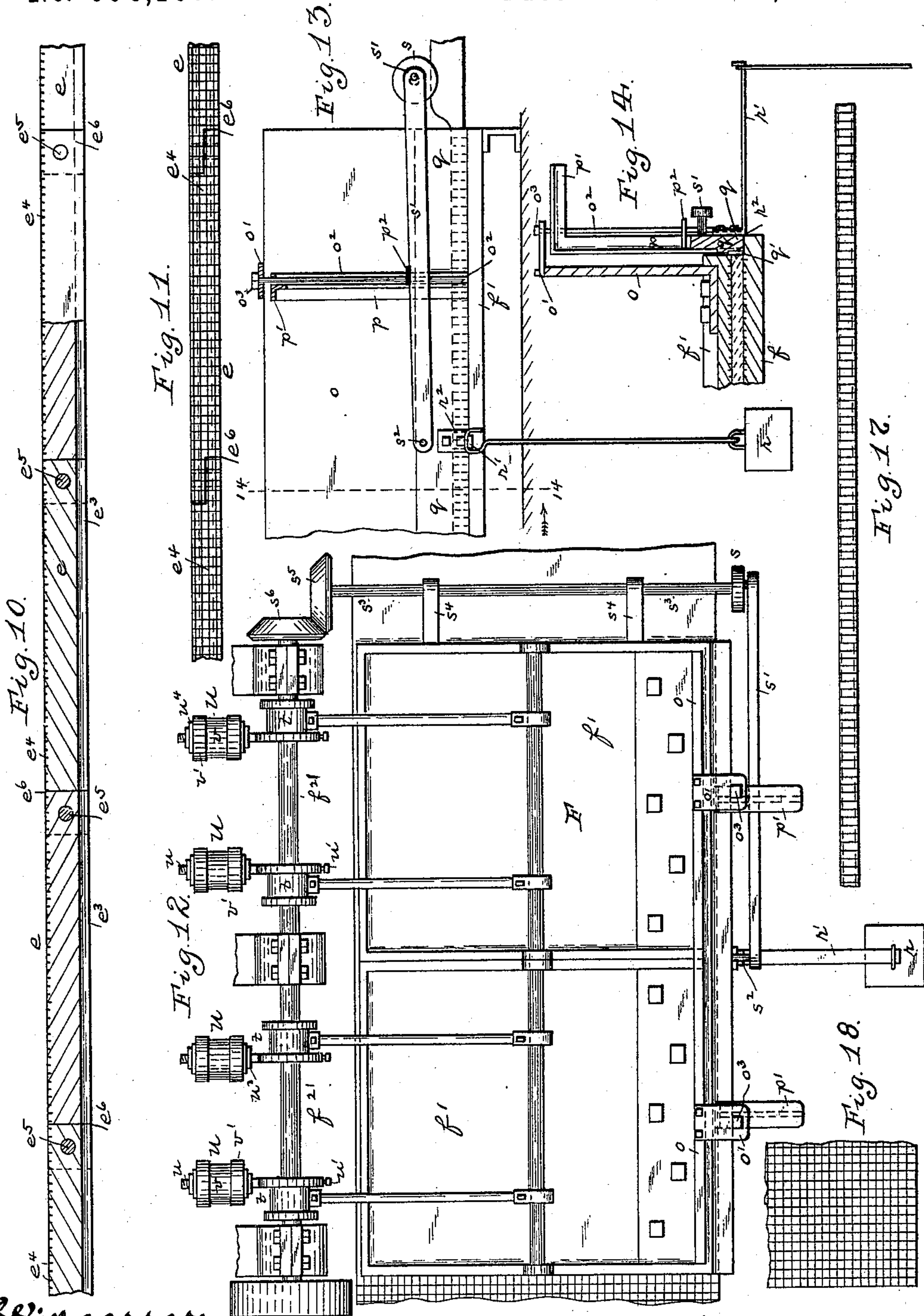
(No Model.)

4 Sheets—Sheet 3.

H. W. FRENCH.
APPARATUS FOR FORMING HAIR FELT.

No. 606,163.

Patented June 21, 1898.



Witnesses:

Geo. M. Brislin
A. L. Poole

Inventor
Hiram W. French.
By Kay, Latten & Co.
Attorneys.

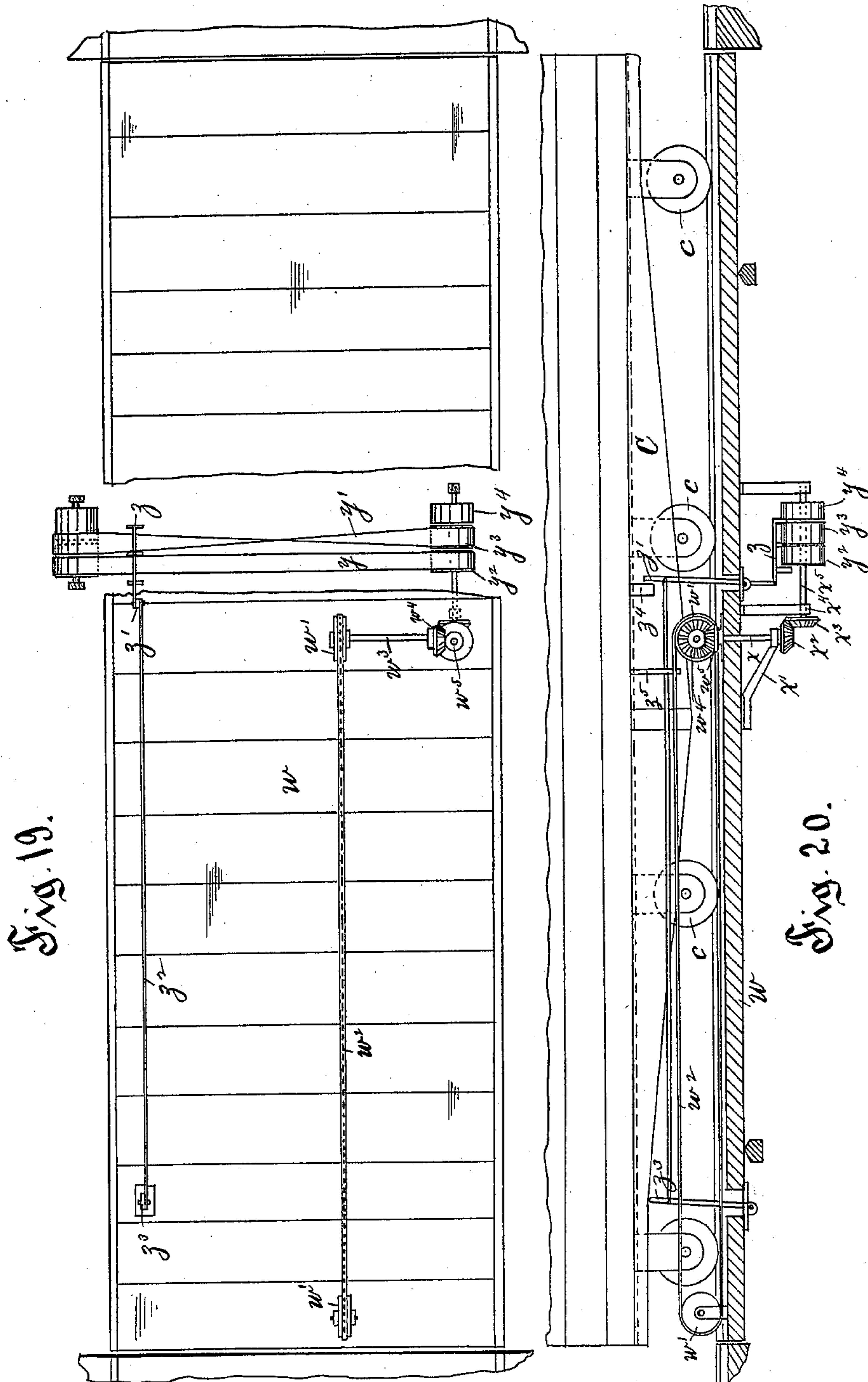
(No Model.)

4 Sheets—Sheet 4.

H. W. FRENCH.
APPARATUS FOR FORMING HAIR FELT.

No. 606,163.

Patented June 21, 1898.



Witnesses
Chas. J. Farrar.
Robert C. Totten

Inventor
Hiram W. French
By Ray Gotter
Attorneys.

UNITED STATES PATENT OFFICE.

HIRAM W. FRENCH, OF BELLEVUE, PENNSYLVANIA.

APPARATUS FOR FORMING HAIR FELT.

SPECIFICATION forming part of Letters Patent No. 606,163, dated June 21, 1898.

Application filed August 6, 1892. Serial No. 442,365. (No model.)

To all whom it may concern:

Be it known that I, HIRAM W. FRENCH, a resident of Bellevue, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Apparatus for Forming Hair Felt; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to improvements in apparatus for forming hair felt.

The ordinary operation of forming hair felt has consisted in first picking the hair, then carding the same and rolling it into bats, which bats are then built up on the table of the felting-machine, there being a sufficient number of layers to produce the felt of the required thickness and several such layers being necessary in order to obtain a thickness suitable for hair-felting. These bats are spread over an apron, by which they are carried first over the steaming-box and then between the felting-plates, where they are subjected to the felting operation by the rapid reciprocation of the top plate or platen, after which the felt is moved a suitable distance, according to the length of the platen, the felt being thus made in short lengths while conveyed by the apron. Difficulty has been found in the manufacture of hair felt in this way, first, because of the numerous shifts or movements to complete the ordinary length of hair felt, the felt being generally made in lengths of fifty feet, and as three feet is the usual length to be felted at a single time, and at the point where the lengths of shifts stop there is liability of weakening the felt, the hair felt has necessarily numerous weak points throughout its length. Another difficulty is in obtaining an even distribution of hair, so as to form the bats into a body of hair of even or regular thickness throughout, this requiring the work of skilled workmen and adding to the cost of the felting operation. In the ordinary felting operation it is also necessary to felt a greater width than required for the finished felt and to trim off several inches on each edge, in order to obtain the necessary thickness and the stability at the edge of the finished product, as the rapid reciprocation of the platen has a tendency to thin the felt at the edge. The object of the present invention is generally to overcome

these difficulties and to reduce the cost of forming the felt and to improve the quality of the article produced by forming a felt having a less number of impressions made by the shifts or movements under the platen, and a felt which is of more even and regular thickness and which has an even-felted edge and ends, as well as to improve the apparatus necessary for carrying out the same.

My invention consists, in a general way, of the following mechanism, namely: a supporting or skeleton table having a series of supporting-chains or carriers traveling longitudinally of the same, which chains or carriers travel over and are adapted to fit into the bottom plate of the felting apparatus, so that during the felting operation the chains or carriers, with the body of the bottom plate, form a bottom surface on which the hair is felted.

It also consists in a distributing mechanism having a reciprocating table or platform, towers under which such table or platform is caused to reciprocate, and mechanism for feeding the hair to such towers, from which it falls so as to be spread upon the platform and form the layer of hair ready for the felting operation.

It also consists in forming a table or platform to receive the hair from such hair-distributing apparatus, as a scale to weigh the hair, so that the exact amount of hair necessary for the purpose of forming the length of hair felt may be obtained.

It also consists in a withdrawing mechanism for withdrawing the fork after the bat has been deposited on the supporting or skeleton table.

It also consists in mechanism for conveying the layer or mass of hair from such table or platform to the skeleton table or support, from which it is conveyed to the felting mechanism.

It also consists in a counterbalance for the felting-machine.

It also consists in a chain for carrying the bat to the felting-machine.

The particular improvements desired to be covered will be hereinafter more particularly described, and set forth in the claims.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a plan view of the apparatus and plant suitable for practicing the invention. Fig. 2 is a cross-section on the line 2 2, Fig. 1. Fig. 3 is a longitudinal section through the hair-distributing apparatus above referred to. Fig. 4 is a longitudinal section of the felter and mechanism for conveying the hair to the felter. Fig. 5 is a sectional view of the felter, looking in the direction of the arrow on the line 5 5, Fig. 1. Fig. 6 is an enlarged detail section of the two platens, showing the hair felt raised from the lower platen. Fig. 7 is an enlarged detail longitudinal section of a portion of the skeleton table, showing the sprocket-wheel and other parts. Fig. 8 is an enlarged detail section showing the end of the skeleton table. Fig. 9 is an enlarged detail plan view of the skeleton table. Figs. 10 and 11 are views of the chain. Fig. 12 is a plan view of the edge felter. Fig. 13 is a side view of the edge felter; and Fig. 14 is a cross-section on the line 14 14, Fig. 13, in the direction of the arrow. Figs. 15 and 16 are views of the counterbalance. Figs. 17 and 18 are views of the finished hair felt. Figs. 19 and 20 are plan and side views, respectively, of the reciprocating table and mechanism for operating same.

The apparatus which I prefer to employ in practicing my invention has the following main features: The pickers A, the hair-distributing mechanism B, having the towers b b' , to which the picked hair is fed through the openings a a' , such towers being simply vertical chambers which are closed at the top and open below, and into which the light picked hair is discharged from the pickers by air-blast or other suitable means and in which it gradually falls, so as to be distributed over the surface of the table or platform C, that table or platform in its most approved form being a scale or being supported on a suitable scale. This platform or scale C supports a suitable fork or carrier D, which is employed for carrying the body of loose hair onto the skeleton table or support E, from which it is conveyed to the felter F, a steaming-box G being generally placed in the course of movement of the body of hair. In order to carry or convey the body or bat of hair from the support E to the felter F, I employ a series of endless chains or conveyers, as shown at e , which are arranged to pass along the bottom plate f of the felter, fitting within seats provided for them therein and by which the bat is carried over the bottom plate of the felter and lifted and carried therefrom after the felting operation.

The mechanism for distributing the hair is practically as follows, being more particularly shown in Fig. 3: The hair felt, as above stated, is generally made in lengths of fifty feet, and the platform or scale C corresponds in length and width to the bat to be formed and is suitably supported and braced, being carried upon a track by wheels c , and suitable weighing mechanism being embodied in

the car thus formed, or the car or platform traveling upon a suitable scale, as may be desired. The platform C reciprocates on suitable mechanism under the towers b b' , and it is arranged to bring one-half of the surface of the platform under each tower, so as to deposit upon the same in an even body the hair which is introduced into the tower. In order to confine the hair so deposited upon the scale or platform, I employ aprons c^2 c^3 , connected to each tower and extending from a spring or like operated drum c^4 around a pulley c^5 near the base of the tower and then over to a suitable point on the platform a sufficient height above the same to receive the hair—such, for example, as the end of the platform, as at c^6 , or the center of the platform, as at c^7 . By such device and the employment of the spring or like operated drum as the hair is deposited upon the platform the disturbance of the hair by air-drafts or other causes will be prevented by the covering-aprons, which covering-aprons will be taken up by the spring-drums as the platform is reciprocated under the tower, while the opposite aprons are let out so as to cover the hair.

I have illustrated the invention where the reciprocating scale or platform is moved in the direction of its length; but it is evident that the same means of distributing or depositing the loose hair may be employed where the tower is the full length of the bat to be formed and the platform moves in the direction of its width. In order to regulate the depositing of the loose hair upon the platform, I may employ at any suitable point an air-blast c^8 , which consists of a pipe or air-holder through which the air may be discharged through the perforations in such way as to affect the forming of the hair through the tower and cause the even depositing thereof over the platform.

In order to provide for a reciprocation of the table C, I employ the following form of mechanism: Mounted on the platform w are the wheels w' , said wheels being connected by the endless sprocket-chain w^2 . Depending from the table C is the arm z^5 , which engages with the sprocket-chain w^2 . The lug z^4 also projects downwardly from the table C. In line with the lug z^4 are the levers z' z^3 , said levers being connected by the rod z^2 . The lever z' has secured to the lower end thereof the belt-shifter z . This belt-shifter z works the belts y y' , which are mounted on the rigid and loose pulleys y^2 y^3 y^4 . The belt y' is crossed. The shaft x^5 is journaled in a suitable hanger x^4 , said shaft having the beveled pinion x^3 , engaging with the beveled pinion x^2 on the vertical shaft x , journaled in the bracket x' . The upper end of the shaft x has the beveled pinion w^5 , which engages with the beveled pinion w^4 on the shaft w^3 . It is apparent that when the belt y is on the tight pulleys y^2 the table C will be advanced until the lug z^4 strikes the lever z^3 , whereupon the belt-shifter will throw the cross-belt y' onto

the pulleys y^4 and the belt y on the loose pulleys y^3 , whereupon the table will be reversed.

The platform C is placed parallel with the support or skeleton table E, and means must of course be provided for transferring the bat formed in the manner above described to the skeleton platform. For this purpose I employ what I term the "fork" D, which fork is formed of a series of tines d , preferably formed of T-iron, which tines are connected together along the one end thereof, as at d' , the several tines resting in seats d^2 and extending transversely across the platform C, so as to provide the platform with a practically smooth surface. The operation of the fork is to raise the bat from the platform C and carry it over to the table E, and any suitable mechanism for accomplishing this end may be employed, that shown in the drawings being large levers h , which extend out at the side of the platform C and are in position to engage with the fork D when it is desired to lift the bat from the platform, but which permit the reciprocation of the fork upon the platform during the depositing of the hair upon the same. The mechanism described consists of the tines d , which have the extensions d^7 beyond the longitudinal bar d' , in which the tines fit, said tines being also secured to the angle-iron d^3 above the bar d' , and to the angle-iron d^4 at the ends of the extensions d^7 of the tines, the fork being suitably braced in this way. To further brace the fork, I connect the angle-bars d^3 d^4 at intervals by the bolts d^5 , which give a trussing or bracing to the same. In order to confine the material upon the platform, I also employ the vertical side plate d^6 , which is supported upon the fork. The levers h have extensions thereof, as at h' , which extend under the bars d' , and back of the same they carry the rollers h^2 , which act as movable fulcrums for the levers in the shift of the fork. The levers have also the lips h^3 , which extend over the angle-bar d^4 , and have the downwardly-extending lugs h^4 , which engage with the said angle-bars, so as to hold down the outer end of the fork. The wheel h^2 travels on a track h^5 , leading up to the platform C and the extension h' of the lever, and the wheel h^2 enters within a transverse groove in the platform, so that in the transferring of the bat by the fork the wheel will travel on the track h^5 and then enter the groove h^6 in the platform, so as to transfer the bat from the platform to the skeleton platform E. The groove or recess h^6 may be closed by one of the tines d of the fork. In the operation of transferring the bat it will be noticed that by pressing upon the lever h the extension h' extends under the bar d' and raises the same, while the lug h^4 on the arm h^3 holds down the outer end, so raising the fork from the platform, and by pressing forward upon the levers the fork can in this way be transferred above and deposit the bat upon the support or skeleton platform E. After the bat has been deposited on the sup-

porting-frame or support E the fork D is withdrawn to place by means of the apparatus shown in Figs. 1 and 2, which consists in a gear-rack i under the levers h , into which mesh pinions i' , said pinions i' being hung or supported on weighted levers i^2 , pivoted at i^3 , so that by raising the levers they can be thrown out of engagement when the fork D is being pushed forward to deposit the hair on the skeleton frame E. A shaft i^4 connects the pinions i' and a sprocket-wheel j is on said shaft i^4 , connecting by a chain j^2 to the sprocket-wheel j' on the shaft j^3 . Power is applied to the shaft j^3 to withdraw the fork D through this mechanism by means of the crank-handle j^4 .

The skeleton frame or support E is formed of suitable metal suitably braced and has at intervals therein the V-shaped antifriction pulleys or sheaves, which at suitable distances apart support the sprocket-chains or carriers e . I find that these sprocket-chains or carriers can generally be placed at the distance of about six inches, and, as will be seen from Fig. 4, they extend from the rear end of the skeleton frame E to the discharge-platform K at the opposite end of the felt, passing around the driving-sprocket k and being supported at the opposite end upon the sprocket k' . It will be noticed that these chains are of peculiar construction, as is shown more particularly in Figs. 8, 10, and 11, being formed of long bars e' , having V-shaped grooves e^3 in their under surfaces, in which the sheaves e^2 fit, and having their upper surfaces provided with indentures e^4 , preferably extending in both directions across the same, corresponding to the indentures on the bottom plate of the felt. The chain is pivoted or connected at intervals, as at e^5 , by means of the tongue-and-groove joint e^6 , being made in lengths corresponding to the sprocket-wheel, and forms a flat, corrugated, or indented surface, which when it extends over the bottom plate f of the felt forms therewith a continuously-indented felting-surface upon which the hair may be felted, the particular advantage of the construction being that as these chains or carriers convey the hair under the felt no apron or like device to support the hair is required, and as a result in the single felting apparatus both sides of the body of hair may be imprinted, at the same time a much stronger piece of felt being produced in this way because of the hold that the bottom plate has upon the hair while the top plate or platen f' is reciprocated over the same, this having been practically proven. The chain e is supported upon the sheaves e^2 , as above stated, and, being placed at small distances apart, forms a proper support or carrier for the hair bat, not only over the skeleton frame E, but over the steaming-box G, and in this way the usual apron, which has always heretofore been employed and which has given much trouble in the ordinary work of hair-felting, is done away with.

The general construction of the felter differs but little from that described in Letters Patent No. 425,604, granted to me April 15, 1890, it being understood, of course, that any suitable means of supporting the base-plate f and supporting and operating the platen f' may be employed. The base-plate f is formed stationary between the carriers e , said carriers fitting into recesses f^2 in the base-plate, and its surface is indented longitudinally and transversely, corresponding to the indenture of the chain, while the surface of the top plate or platen f' is indented in like manner. I do not limit myself, however, to this particular form of carrier or the particular arrangement described, as this may be varied without departing from the spirit of my invention. The top plate or platen is operated by the driving-shaft f^{21} and is raised by suitable jacking devices, that shown in the drawings being the jacks l on each side of the plate, the vertically-moving bars l' of which engage with the platen to lift the same and provide room for the movement of the bat or the felt formed. In order to lift the felt out of the indented bottom plate, I provide for the raising of the chain carriers in their course over the bottom plate, so as to lift the portion felted out of the indentures of the bottom plate and bring a new portion of the bat over the same and lower it onto the bottom plate. For this purpose the sheaves m , under the bottom plate and at each end thereof, are supported on the shafts m' , which are in turn carried on crank-arms m^2 , said crank-arms being connected to the shafts m^3 , operating the jacks l thereof in such way that when the jacks are employed to raise the platen the crank-arms will be turned so as to raise those portions of the chain carriers above the base-plate by forcing the sheaves m upwardly through seats in the base-plate. The body of hair which has been felted is thus raised from the base-plate, and as the carriers are moved therefrom such portion of the felt is carried over onto the receiving-table k , while a new portion of the bat is carried under the platen, and as the platen is lowered the chain also is lowered and forms part of the base-plate f , so that the felting operation may be continued on the portion of the bat which has thus been carried under the platen. I do not wish to limit myself to this particular manner of raising and lowering the carrier.

The apparatus for edge-felting the bat is shown more particularly in Figs. 12, 13, and 14, it being shown only on one side of the felting-machine F , there being two used, one on each side, so that both edges are felted at one time, and, if desired, practically the same apparatus can be used at each end of the felting-machine, so that both ends of the bat can be felted. Bolted to the platen f' is the L-shaped plate o , which extends up from the platen f' and has bolted at the top thereof the outwardly-extending plate o' , which carries the rod o^2 , having the head o^3 , resting on said

plate o' . This rod passes through the projection p' on the bar p and also through the link p^2 on the bar p , while said bar p carries the edge-felter q , having on its face the serrations or corrugations q' . In order to hold the edge-felter q against the bat, weights r are hung from the bar r' , which is attached to the edge-felter q at r^2 . As the platen f is vibrated back and forward the edge-felter is moved horizontally by means of the eccentric s , carrying the eccentric-rod s' , attached to the plate f at s^2 . Said eccentric s is mounted on the shaft s^3 , which is hung in bearings s^4 on the platen f and is operated from bevel-pinion s^5 on the shaft s^3 , meshing with the bevel-pinion s^6 on the driving-shaft f^{21} of the felting-machine. When a portion of the bat has been felted and it is desired to free the edge-felter, it may be raised by lifting the weights r or by a system of levers connected from the jacks l to the edge-felter, so that when the plate f' is raised by the jacks l the edge-felter can be lifted from contact and the bat moved forward, when the parts can be returned to place for another operation.

As great strength is required to move or vibrate the platen f' , which is very heavy and is to operate very rapidly, it causes the ground to shake and jar the buildings. To overcome this difficulty, I have provided the counterbalances U , which fit around the outside eccentrics t on the shaft f^{21} of the felter F . The shaft f^{21} has the inside eccentrics t' thereon to assist in (as is fully shown in said Letters Patent No. 425,604) operating the felter. In the construction of the counterbalance U it has the threaded end u and is held around the eccentric t by means of the set-screw u' , fitting into a recess u^2 in the eccentric t' , while fitting around the threaded end u are the nuts $u^3 u^4$, having interposed between them the weight v , composed of lead or other heavy material, this weight v being in the form of washers, so that they can be removed with ease from the threaded end u , and are held in place by the caps v' between the nuts $u^3 u^4$, the action of the counterbalance U being to move in the opposite direction from the felter F , and the weight being adjustable by means of the nuts $u^3 u^4$, the stroke of the counterbalance U can be regulated according to the stroke of the felter.

In practicing the invention the hair is fed to the pickers A , which separate from it the dust, dirt, &c., and open it out, and either by air-blast or by mechanical means the hair is carried up into the towers $b b'$, where, under the influence of the air-blast properly directed it falls in an even current, so that as the table or scale is reciprocated under it the hair is evenly distributed over the same and the bat is gradually formed upon the table, this being continued until the bat is made of sufficient thickness to form the layer of hair felt desired, the bat of course being much thicker than the hair felt to be produced and being in a single mass, and as the hair is thus

caused to fall gradually upon the platform it is found that an evenly-distributed body is obtained, so that in the subsequent felting operation a very even thickness and equal condensation are also obtained. As soon as a bat of sufficient thickness is obtained the operator raises the same from the table by means of the fork or tine carrier and carries it over upon the chain carrier or skeleton table E, and the tine carrier is then removed, leaving the bat upon the chain carrier. It is permitted to rest in this position until the forward end thereof is sufficiently steamed, when, by the movement of the chain while the upper platen is rising, the forward end of the bat is carried on the chain between the two platens and held above the lower platen by means of the chain carrier, and as the top platen is lowered through the jack mechanism above described the chain above the lower platen is also lowered and fits within the same, so as to form with it a practically solid corrugated level lower face to the platen having the print-marks thereon which are to be imparted to the layer of felt formed. In this operation any suitable length of platen may of course be employed, which as the mass or bat of hair is carried automatically it is best to employ a very much longer platen and one which will carry a much larger surface. The upper platen is thus caused to reciprocate rapidly, as in the ordinary method of felting, and the hair is felted between the corrugated surfaces of the upper platen and the corrugated surfaces of the lower platen, which obtains a much stronger hold upon the body of hair than if an apron or other device for carrying the hair were interposed between them, the result being that the hair is forced into the corrugations of the lower platen and by the felting operation is caused to be twisted or worked together therein in such a way as to practically form strong cords or binding means extending in both directions across the lower surface of the platen, and while thus, as it might be termed, "imprinting" the lower surface of the felt imparting great strength to the same and forming that part of the felt as strong as the upper part thereof, in which practically the same action is taking place in the corrugated surfaces of the upper platen, and during the operation of felting both sides of the bat by the upper and lower platens the edges of the bat are being felted by the edge-felters. As a result of these steps of the method a peculiar action takes place, which may be described as follows: By the steaming of the hair prior to the felting of the same the glutinous substance at the base or stub of each particle or spear of hair is so heated as to become soft and sticky and ready to adhere to or affiliate with the other hair in the mass, while at the same time the body of each hair, which is of a shelly substance, by the steaming action softens and curls, so that when subjected to the felting action it is ready to become intermingled with and hold to the other hair of

the mass of felt. This peculiar effect of the steaming cannot be obtained when steaming through burlaps and a muslin or linen cloth conveyer, according to the old process, because the muslin or linen must be of such fine texture as to prevent the adherence of the hair to it or its passage through and the adherence of the hair to the burlaps, and they retard the action of the steam and cause condensation of the same, preventing the mass of felt from receiving the necessary amount of heat to cause the action above described. When, however, the mass is subjected directly to the passage of the steam through the same, it is moistened thereby by the moisture of the steam and is raised to a sufficient heat to cause the moistening of the stub ends of the hair and the softening of the hairs themselves, as above described, and when this mass is carried between the felting plates or platens and is subjected directly to their action, while there is no fear of the adherence of the hair or the glutinous portions of the hair to the plates directly while being felted, the hair is by the vibratory action and weight upon it felted, so as to cause the affiliation of one hair-spear with another and the interlocking of the hair-spears together and, further, the gluing or glutinizing of the base of one hair to the bodies of other hairs, so as to form a much stronger and more tenacious hair felt than produced according to the old process. As the steam is applied directly to the mass, it can penetrate the mass of hair before it is felted and brings the entire mass to proper heat and condition of moisture for felting, so that the felting operations can all be performed at one time, instead of requiring the double felting operation of the prior art, and both faces of the body of felt can be finished and corrugated at one time. As a result, as has been practically proven, a very much stronger body of felt is obtained and one which is more even in texture and firmer for handling and transporting, while at the same time the printing on both surfaces and edges is obtained at one operation. As soon as the body between the platens is felted the upper platen is raised, the edge-felters are removed, and at the same time the body felted is raised above the lower platen by the means above described, after which by starting the machinery for operating the chain carrier that felted portion may be carried from and another portion to be felted carried between the platens, the operation being continued until the whole body is properly felted, and the frequent jars and the shaking of ground and building by the vibration of the felter are overcome by the counterbalance, thus rendering the machine noiseless and steady in its operation. During this operation in the manner above described a new mass or bat of hair may be formed upon the platform or scale, which will accurately weigh the same when the proper amount of hair has been obtained, and the mass or bat so obtained can

then be carried over by means of the tine carrier onto the chain carrier and the operation repeated.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In apparatus for forming hair felt, the combination of a lower felting-platen and an upper platen, a traveling-chain carrier adapted to carry the material to be felted between said platens, means for moving the same, and mechanism for raising and lowering said traveling-chain carrier, substantially as set forth.

2. In apparatus for forming hair felt, the combination of a lower felting-platen and an upper platen, a carrier normally in operative position with said lower platen, means for moving the same, and mechanism for raising and lowering said carrier, substantially as set forth.

3. In apparatus for forming hair felt, the combination of a lower felting-platen and an upper platen, a carrier normally flush with said lower platen and mechanism for raising and lowering said carrier and means for moving same, substantially as set forth.

4. In apparatus for forming hair felt, the combination of towers through which the hair is caused to fall, a reciprocating table or platform below the same whereby a mass or bat of hair is distributed over the platform, substantially as and for the purposes set forth.

5. In apparatus for forming hair felt, the combination of one or more towers through which the hair is caused to fall, a reciprocating table or platform below the same, and aprons extending from the ends and center of the platform to the towers so as to protect the hair distributed upon the table, substantially as and for the purposes set forth.

6. In apparatus for forming hair felt, the combination of one or more towers through which the hair is caused to fall, a reciprocating table or platform below the same, aprons extending from the ends of the platform to the towers so as to protect the hair distributed upon the table, and means for taking up the aprons as the table reciprocates, substantially as and for the purposes set forth.

7. In apparatus for forming hair felt, the combination of one or more towers through which the hair is caused to fall, a reciprocating table or platform below the same, aprons extending from the ends and center of the platform to the towers so as to protect the hair distributed upon the table, and spring-rollers for taking up the aprons as the table reciprocates, substantially as and for the purposes set forth.

8. In apparatus for forming hair felt, the combination of a reciprocating table, one or more towers through which the hair is caused to drop, and air-blast pipes in said towers for controlling the dropping of the hair, substantially as and for the purposes set forth.

9. In apparatus for forming hair felt, the combination of a reciprocating table having

a tine carrier supported thereon, one or more towers above the same through which the hair is caused to drop, and mechanism for engaging said tine carrier to lift the bat from the platform, substantially as and for the purposes set forth.

10. In apparatus for forming hair felt, the combination of a reciprocating table having a tine carrier supported thereon, one or more towers above the same through which the hair is caused to drop, mechanism for engaging said tine carrier to lift the bat from the platform, and mechanism for withdrawing said tine carrier from the traveling carrier after depositing the bat, substantially as and for the purposes set forth.

11. In apparatus for forming hair felt, the combination of a reciprocating table, a tine carrier on the same, a traveling carrier to which the bat is transferred by the tine carrier and felting-platens to which the bat is carried by the traveling carrier, substantially as and for the purposes set forth.

12. In apparatus for forming hair felt, the combination of a lower and upper platen, and edge-felters at the sides thereof, substantially as and for the purposes set forth.

13. In apparatus for forming hair felt, the combination of a lower felting-platen having grooves therein and traveling-chain carriers fitting in said grooves, an upper platen above the same, and edge-felters at the sides of the upper and lower platens, substantially as and for the purposes set forth.

14. In apparatus for forming hair felt, the combination of a lower felting-platen having grooves therein and traveling-chain carriers fitting into said grooves, and an upper platen above the same, substantially as and for the purposes set forth.

15. In apparatus for forming hair felt, the combination of a lower platen having grooves therein and traveling-chain carriers fitting in said grooves and forming therewith the lower platen of the felting mechanism, substantially as and for the purposes set forth.

16. In apparatus for forming hair felt, the combination of a lower platen having grooves therein and traveling-chain carriers fitting in said grooves and forming therewith the lower platen of the felting mechanism, said traveling-chain carriers being vertically movable, substantially as and for the purposes set forth.

17. In apparatus for forming hair felt, the combination of a lower felting-platen having grooves therein and traveling chains fitting in said grooves, said chains having corrugations or indentures on their upper faces, substantially as and for the purposes set forth.

18. In apparatus for forming hair felt, the combination of a lower felting-platen having grooves therein and traveling chains fitting in said grooves, said chains having grooves on their lower faces, substantially as and for the purposes set forth.

19. In apparatus for forming hair felt, the combination of a lower felting-platen having

grooves therein and traveling chains fitting in said grooves, said chains being connected by a tongue-and-groove joint having a pivot therein, substantially as and for the purposes set forth.

20. In a felting-machine, a driving-shaft having eccentrics provided with eccentric-collars in combination with counterbalances fitting around said eccentric-collars and reciprocated by said eccentrics, substantially as and for the purposes set forth.

21. In a felting-machine, a driving-shaft having eccentrics provided with eccentric-collars in combination with counterbalances fitting around said eccentric-collars, and having weights thereon, substantially as and for the purposes set forth.

22. In a felting-machine, a driving-shaft having eccentrics provided with eccentric-

collars in combination with counterbalances fitting around said eccentric-collars and having weights thereon, said weights being adjustable, substantially as and for the purposes set forth.

23. In a felting-machine, a driving-shaft having eccentrics provided with eccentric-collars and annular grooves in combination with counterbalances fitting around said eccentric-collars and attached by set-screws entering said grooves, substantially as and for the purposes set forth.

In testimony whereof I, the said HIRAM W. FRENCH, have hereunto set my hand.

HIRAM W. FRENCH.

Witnesses:

J. N. COOKE,
F. G. HAY.