(No Model.) 10 Sheets—Sheet 1.

G. MEYER.

CARDING MACHINE.

No. 473,585. Patented Apr. 26, 1892.

Fig. 1.

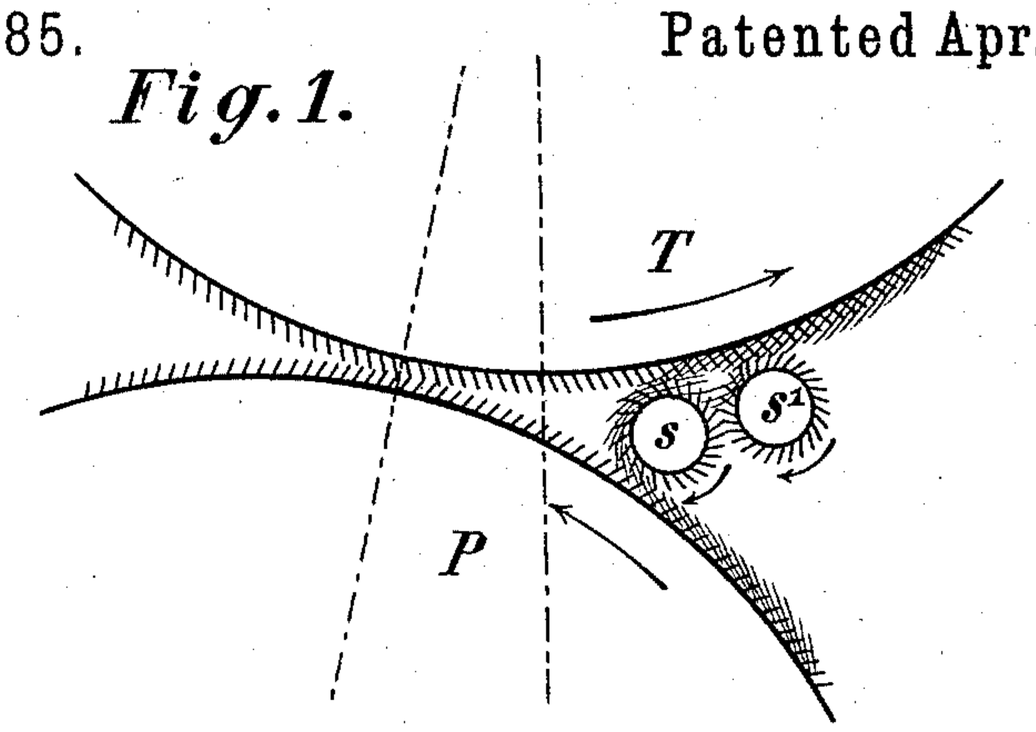


Fig. 2.

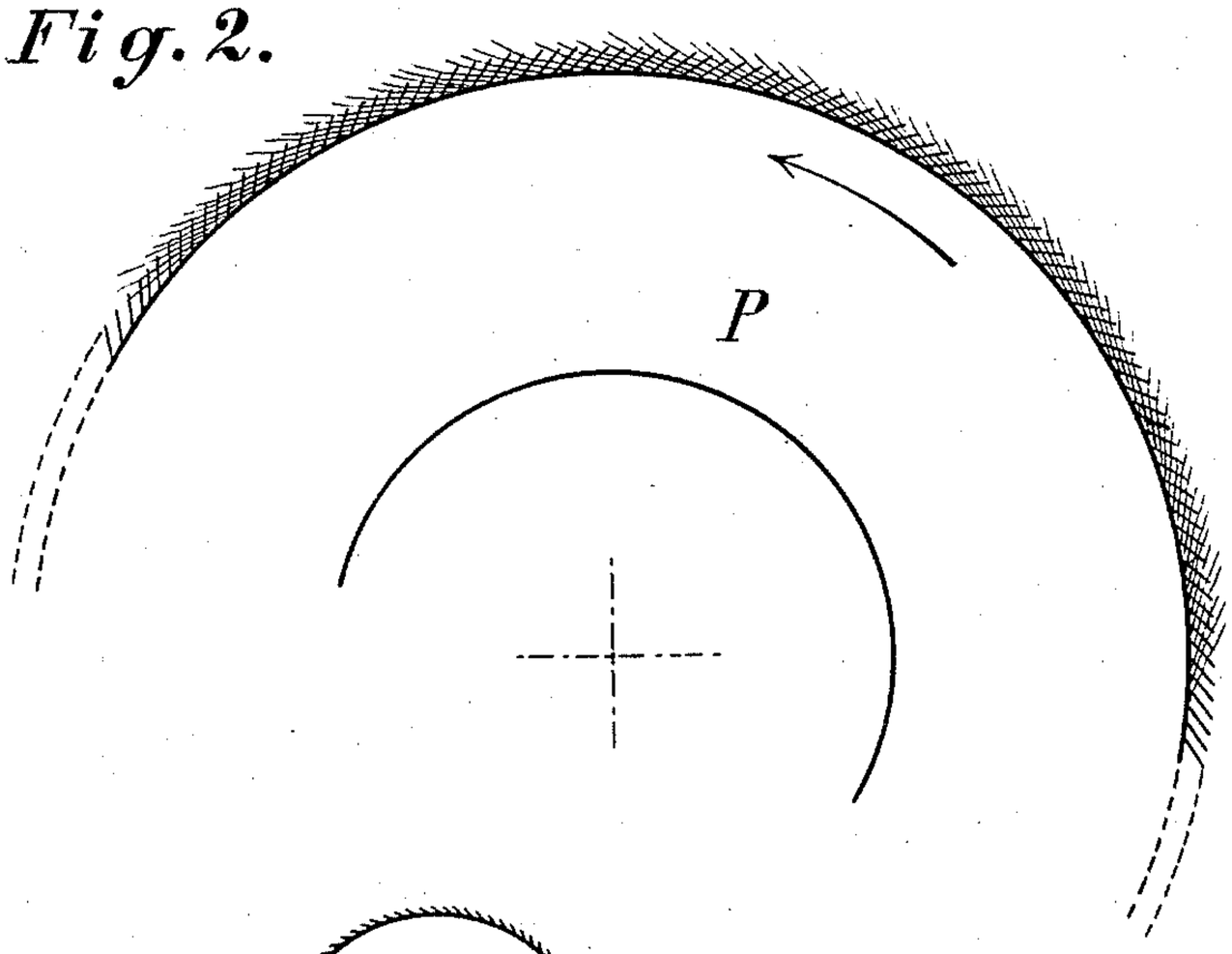
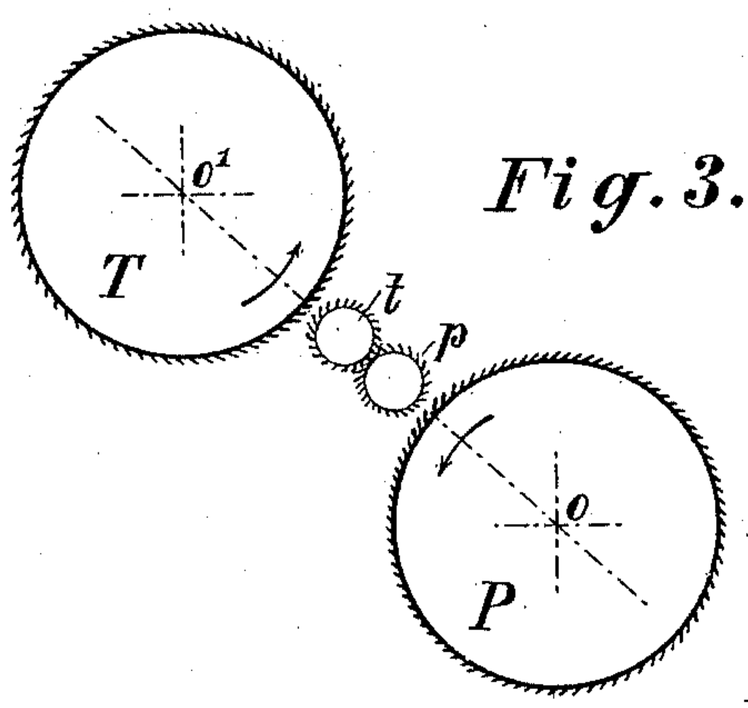


Fig. 3.



Witnesses:
Marion Hall
Charles Schroeder

Inventor:
G. Meyer
by Goepel & Raegener
Attorneys.

(No Model.) 10 Sheets—Sheet 2.

G. MEYER.

CARDING MACHINE.

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Fig. 4.

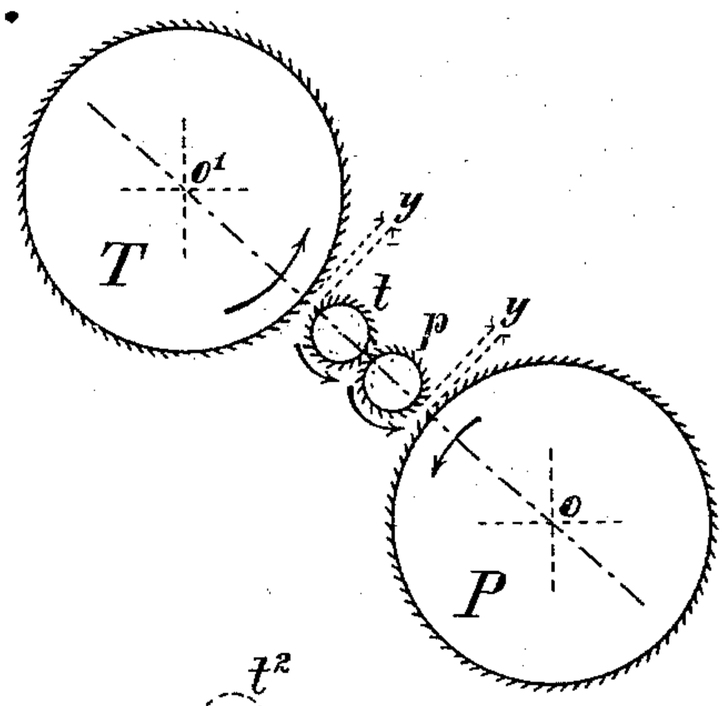


Fig. 5.

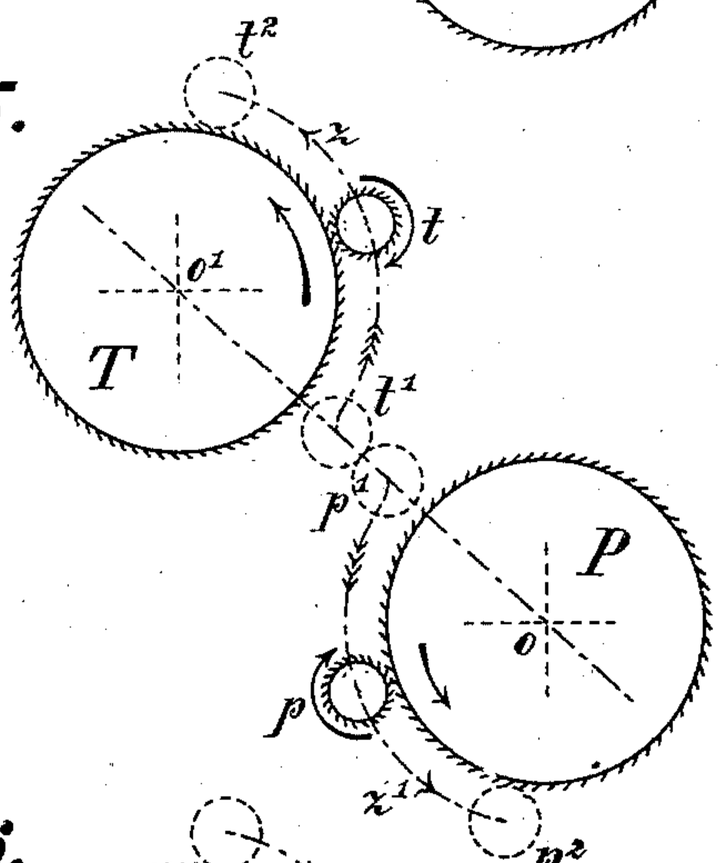
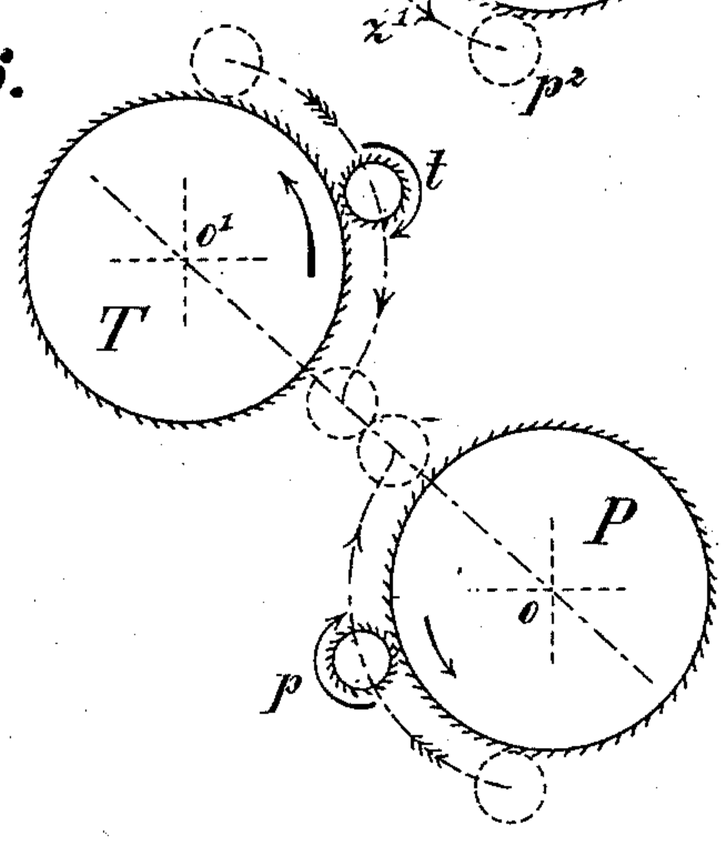


Fig. 6.



Witnesses:

Marion Hall

Charles Schraeder.

Inventor:

G. Meyer

by Foster & Freeman

Attorneys.

(No Model.) 10 Sheets—Sheet 3.

G. MEYER.

CARDING MACHINE.

No. 473,585. Patented Apr. 26, 1892.

Fig. 7.

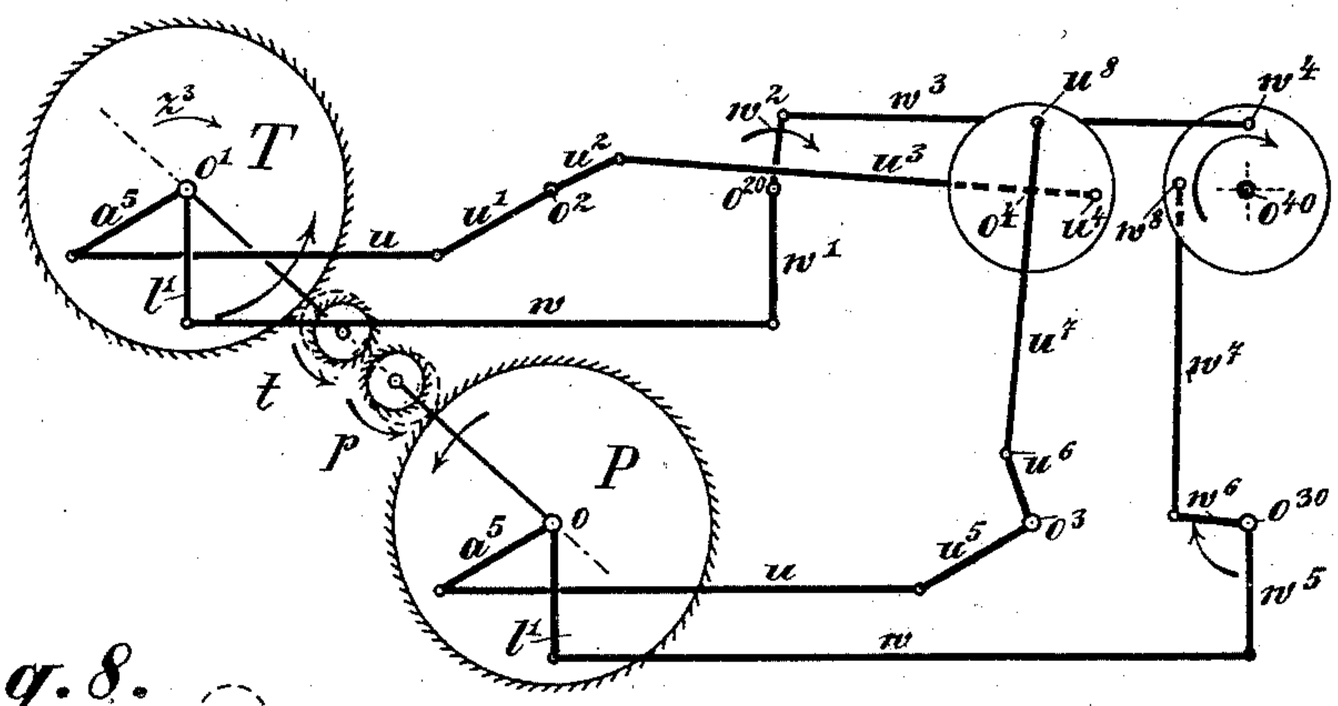


Fig. 8.

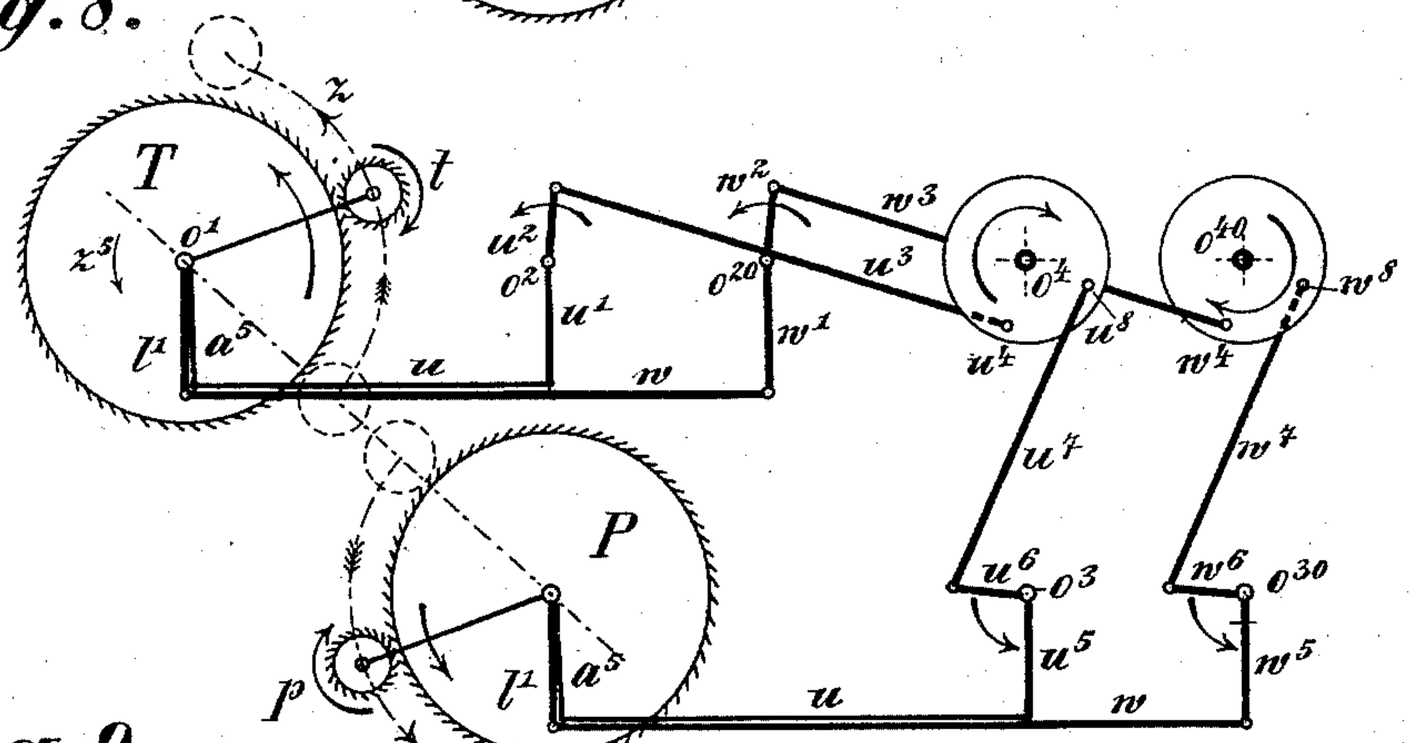
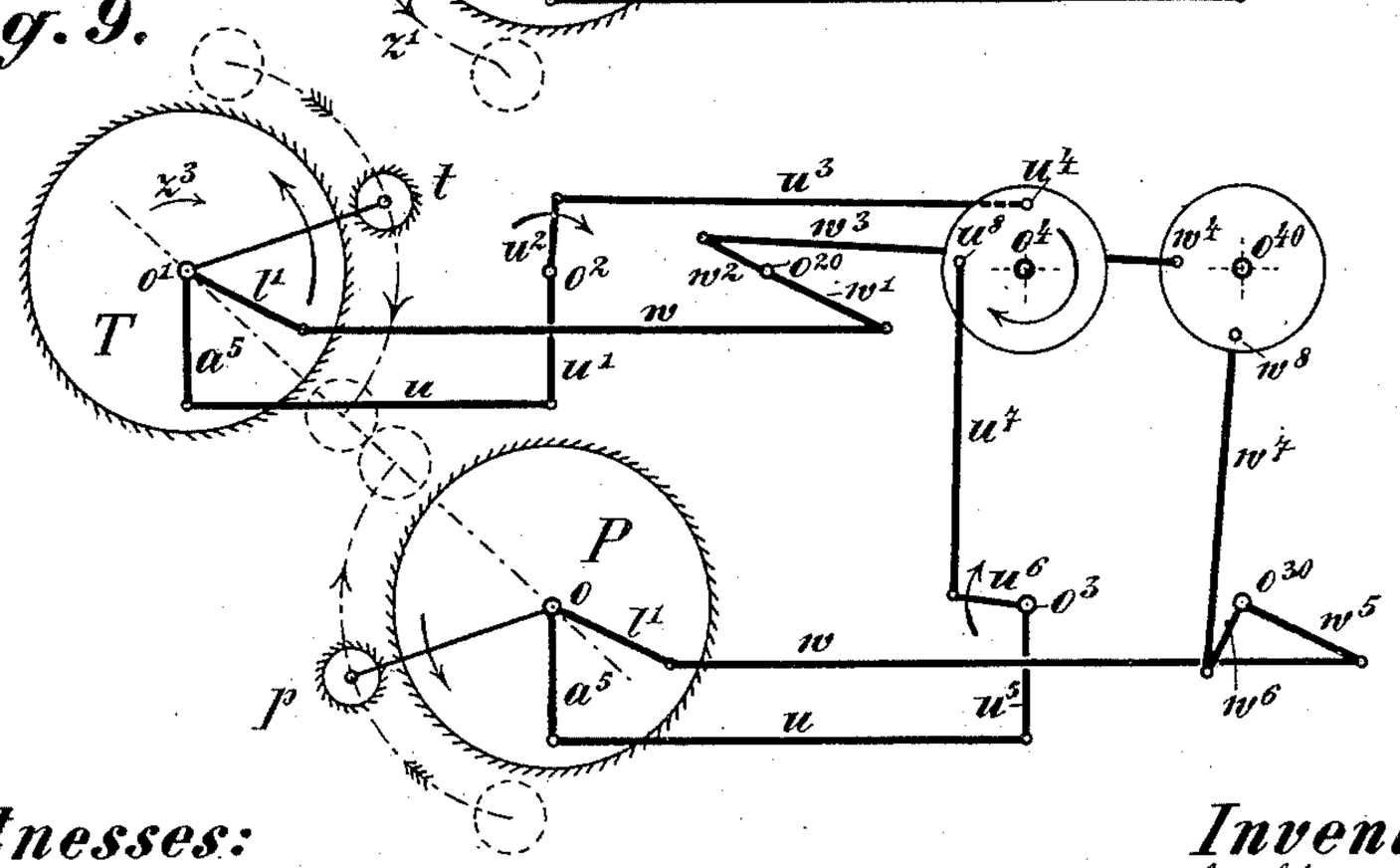


Fig. 9.



Witnesses:

Marion Hall

Charles Schroeder.

Inventor:

G. Meyer

by Goepel & Wagener

Attorneys.

(No Model.) 10 Sheets—Sheet 4.

G. MEYER.

CARDING MACHINE.

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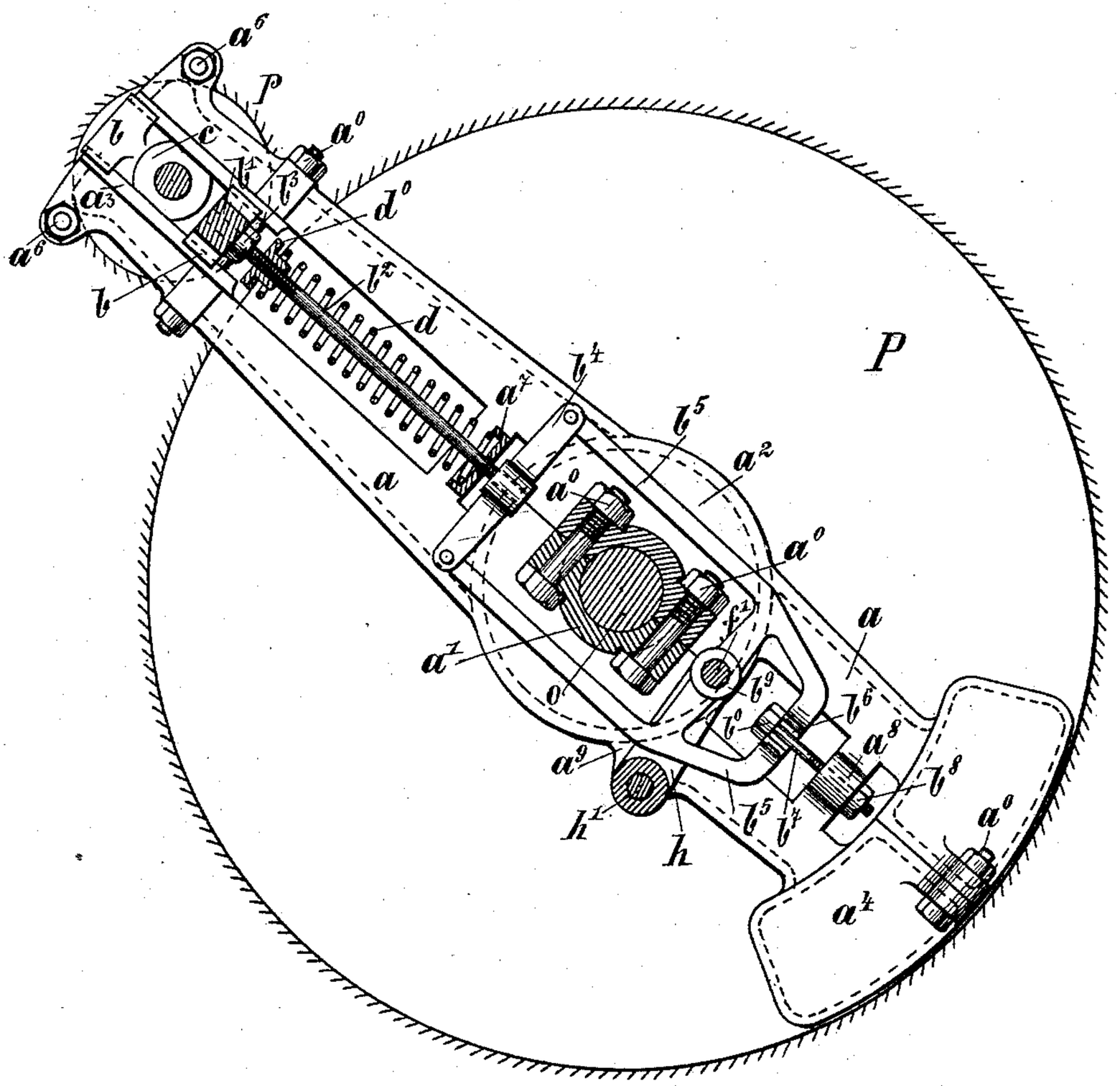
Fig. 10.



Witnesses:
Marion Hall
Charles Schraeder.

Inventor:
G. Meyer
by Goepel & Raegener
Attorneys.

(No Model.) 10 Sheets—Sheet 5.

G. MEYER.

CARDING MACHINE.

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Fig. 11.

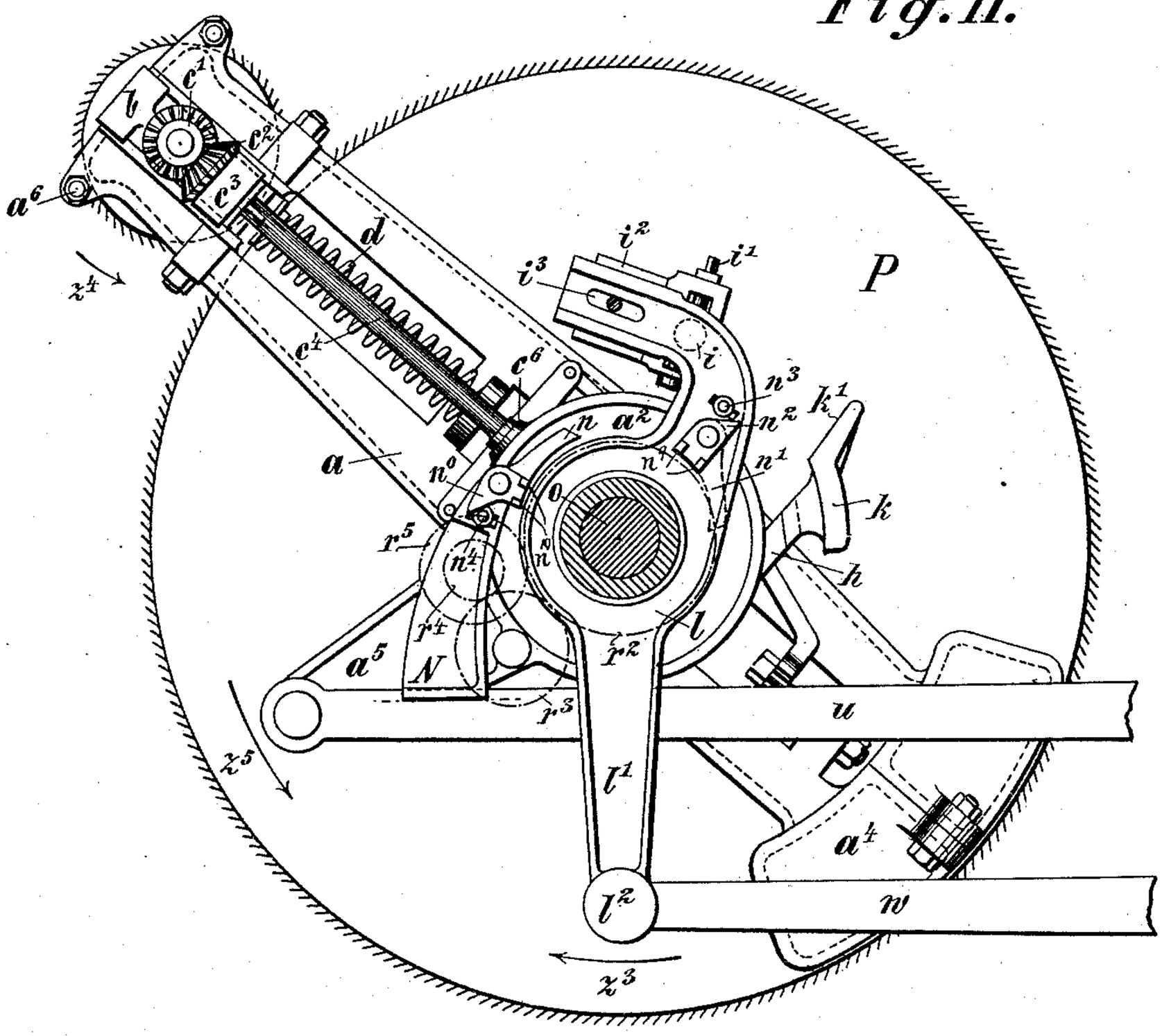


Fig. 12.

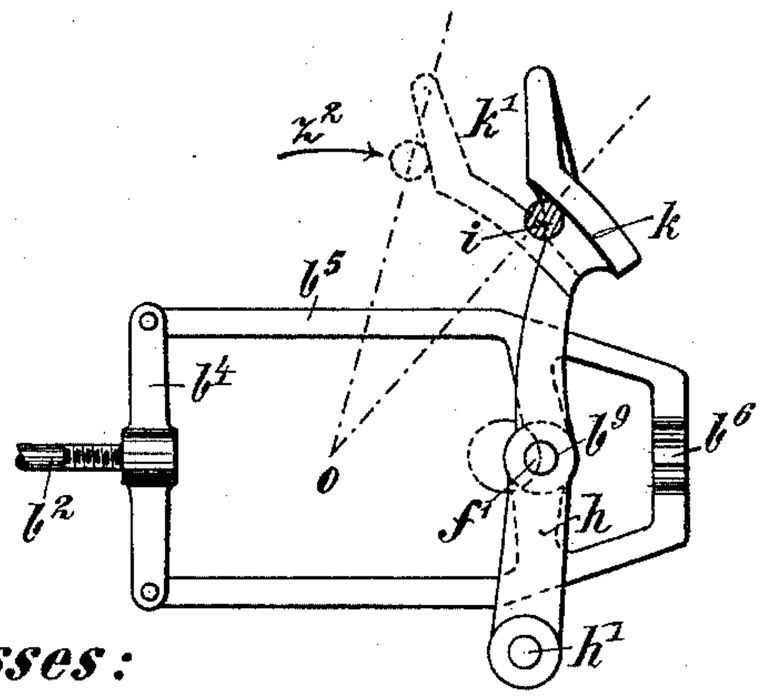
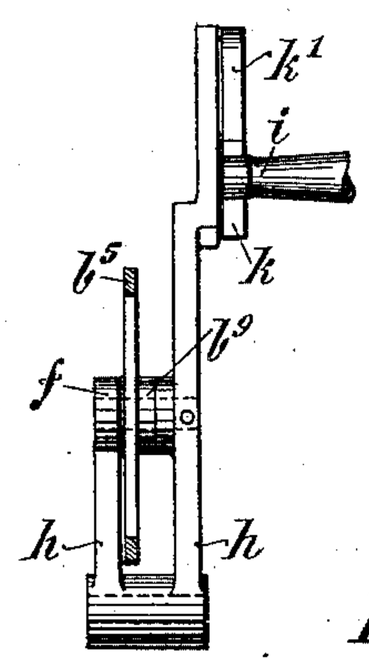


Fig. 13.



Witnesses:

Marion Hall

Charles Schroeder.

Inventor:

G. Meyer

by Goepel & Laegener.

Attorneys.

(No Model.) 10 Sheets—Sheet 6.

G. MEYER.

CARDING MACHINE.

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Fig. 14a.

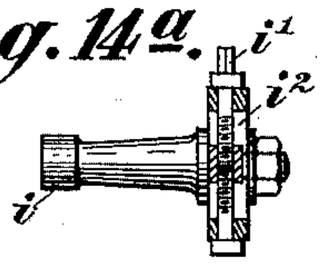
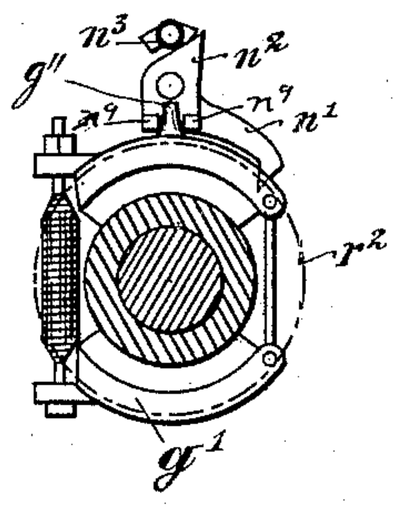


Fig. 14.

Fig. 15.



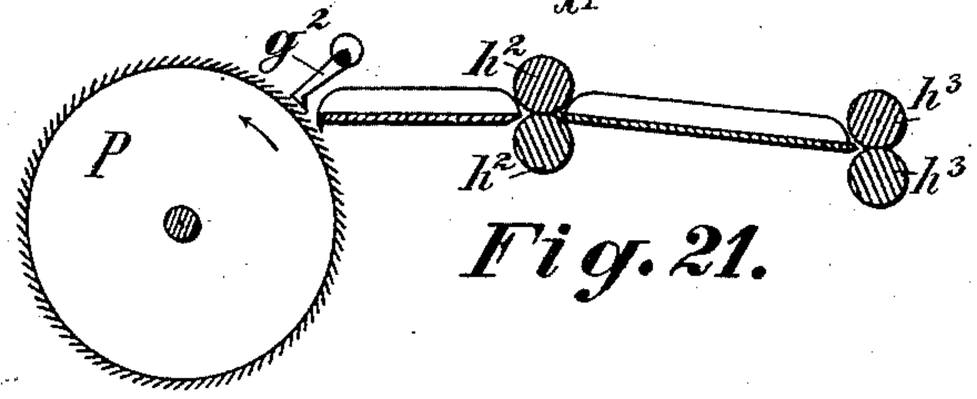
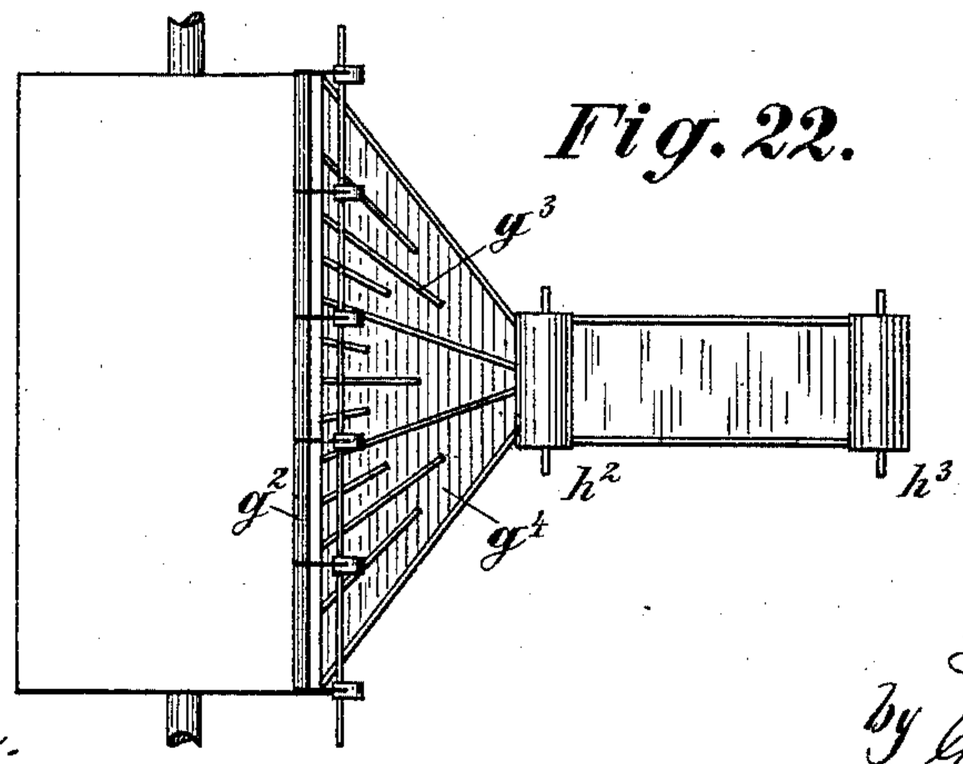


Fig. 21.

Fig. 22.



Witnesses:
Marion Hall
Charles Schroeder.

Inventor:
G. Meyer
by Goepel & Raegener
Attorneys.

(No Model.) 10 Sheets—Sheet 7.

G. MEYER.

CARDING MACHINE.

No. 473,585. Patented Apr. 26, 1892.

Fig. 17.

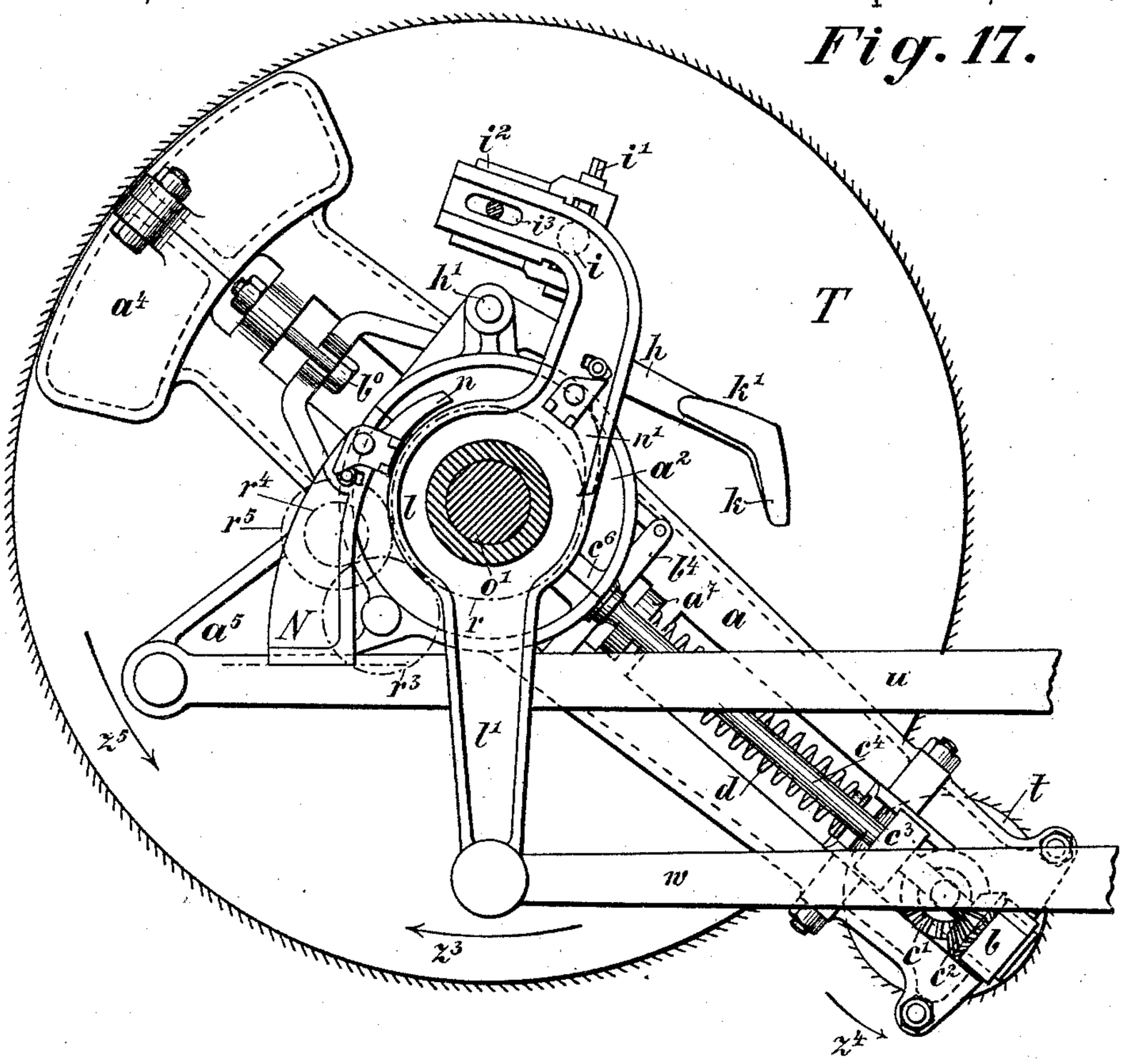
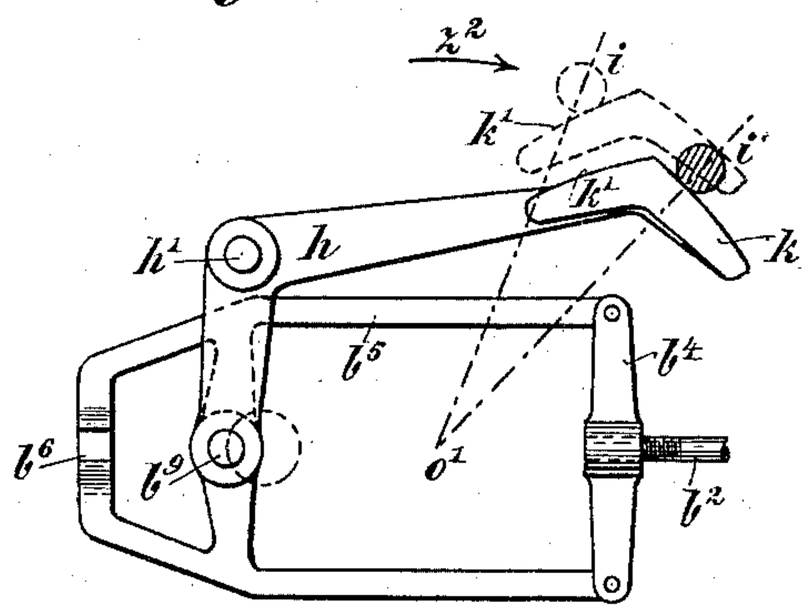


Fig. 16.



Witnesses:

Marion Hall

Charles Schroeder.

Inventor:

G. Meyer

by Goepel & Raegener

Attorneys.

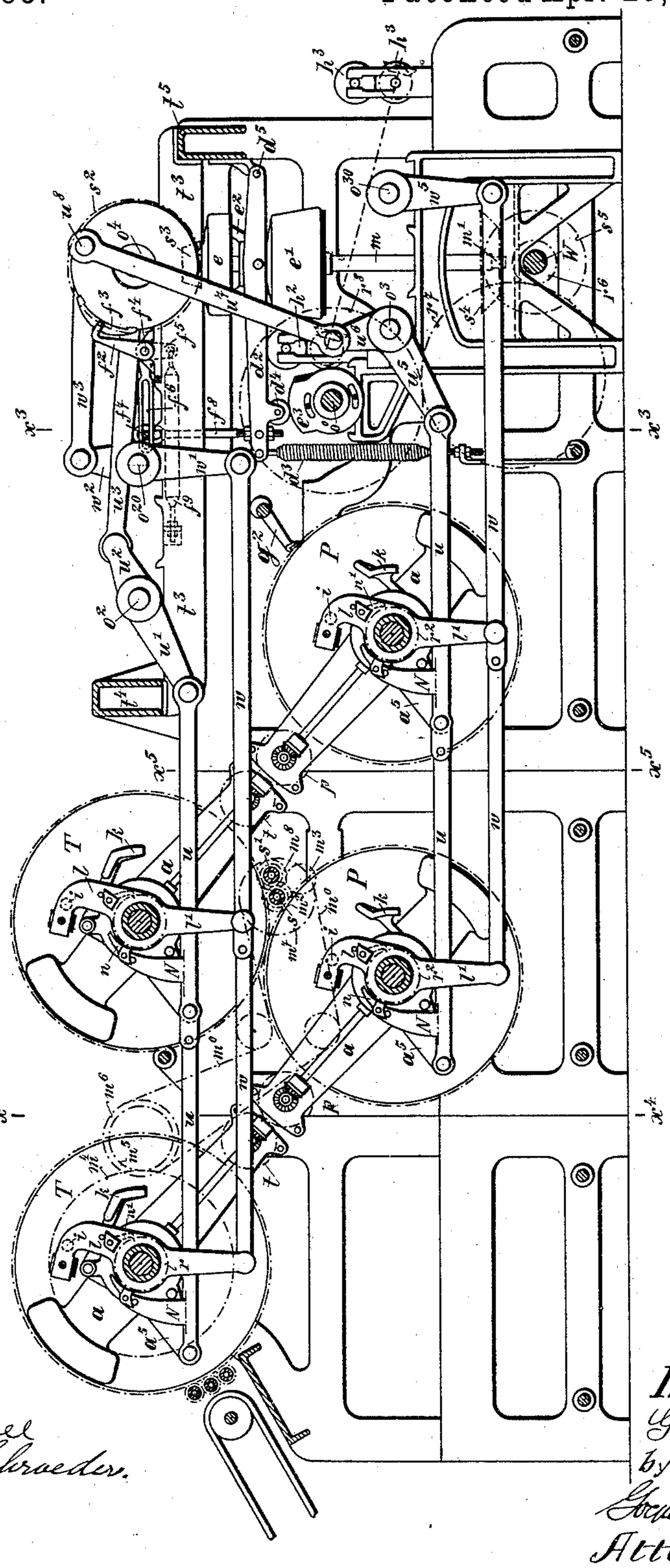
(No Model.) 10 Sheets—Sheet 8.

G. MEYER.

CARDING MACHINE.

No. 473,585. Patented Apr. 26, 1892.

Fig. 18.



Witnesses:
Marion Hall
Charles Schraeder.

Inventor:
G. Meyer
by
Goepel & Raegener
Attorneys.

(No Model.) 10 Sheets—Sheet 9.

G. MEYER.

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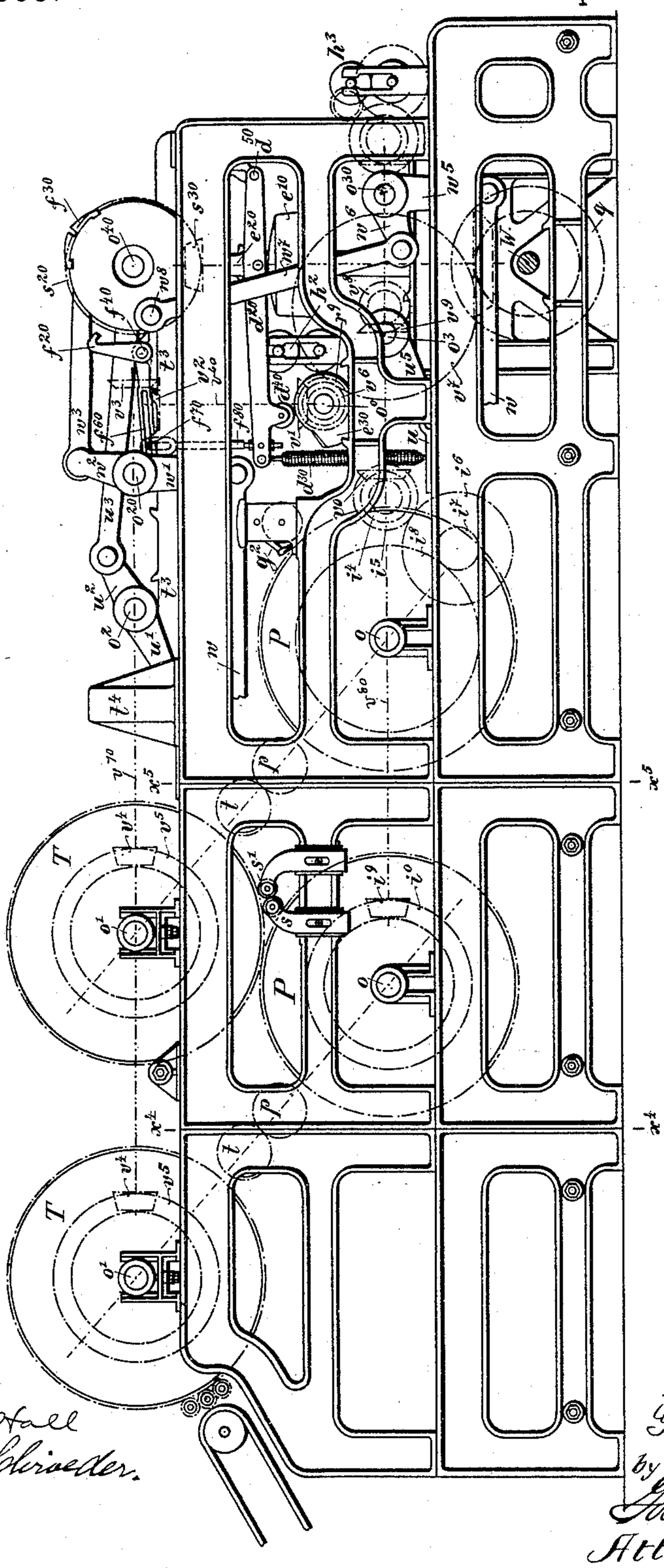
No. 473,585. Patented Apr. 26, 1892.

Fig. 19.



Witnesses:
Marion Hall
Charles Schroeder.

Inventor.
G. Meyer
by Goepel & Weisenberger
Attorneys.

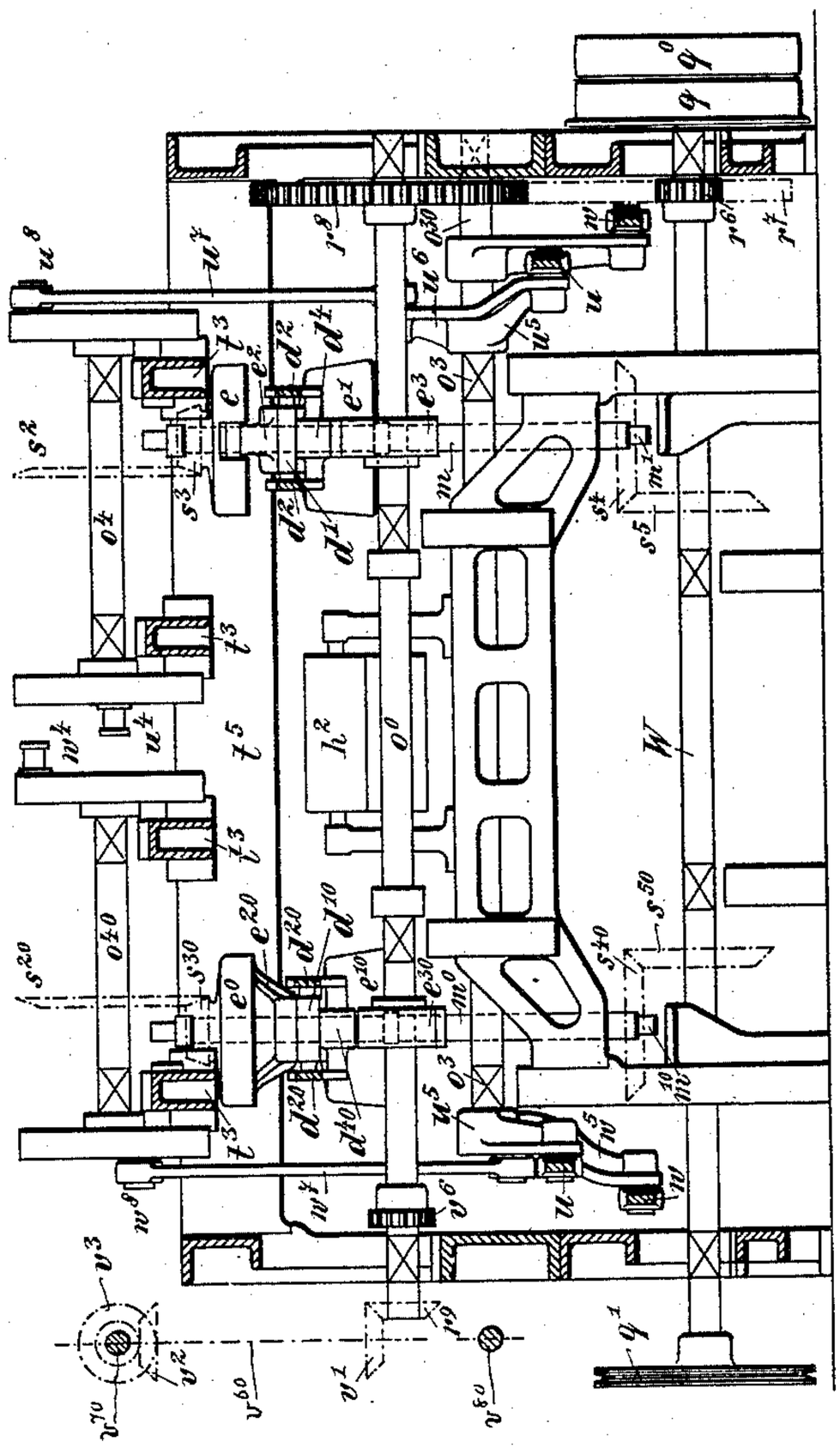
(No Model.) 10 Sheets—Sheet 10.

G. MEYER.

CARDING MACHINE.

No. 473,585. Patented Apr. 26, 1892.

Fig. 20.



Witnesses:
Marion Hall
Charles Schroeder.

Inventor:
G. Meyer
by Goepel & Raegener
Attorneys.

UNITED STATES PATENT OFFICE.

GOTTFRIED MEYER, OF SCHAFFHAUSEN, SWITZERLAND.

CARDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 473,585, dated April 26, 1892.

Application filed September 28, 1891. Serial No. 407,074. (No model.)

To all whom it may concern:

Be it known that I, GOTTFRIED MEYER, a citizen of the Republic of Switzerland, residing at Schaffhausen, in Switzerland, have invented certain new and useful Improvements in Carding-Machines, of which the following is a specification.

This invention relates to a machine for bringing washed wool or other fibrous material in such condition as to adapt it to be acted upon in a combing-machine or other machine, to the actions of which said fibers are subjected preparatory to being spun or woven. The function of this machine is to transform fibrous material from a crude and entangled state into a band, fleece, or sliver, the fibers of which are all parallel. This machine is to produce this transformation entirely by means of a series of stretching and transmitting or transporting processes in which the fiber is at all times held stretched.

In the accompanying drawings, Figs. 1, 2, and 3 are diagrammatic views for the purpose of illustrating the manner in which the machine acts on the fibers. Figs. 4, 5, and 6 are diagrammatic views for showing the movements of the transmitting or transporting devices. Figs. 7, 8, and 9 are diagrammatic views of the movements of the transporting devices and the mechanism for operating the same. Fig. 10 is an enlarged detail end view of one of the cylinders, the swinging lever at the end of the same being shown in central longitudinal section. Fig. 11 is a similar view in which an outside view of the lever is shown. Fig. 12 is a detail view of the frame at the end of the rod for moving the smaller roller toward or from the cylinder. Fig. 13 is an edge view of the parts shown in Fig. 12, parts being in section. Fig. 14 is an enlarged detail longitudinal sectional view of the sleeve at one end of the shaft of the cylinder. Fig. 14ª is a detail vertical sectional view of the mechanism for adjusting the pin *i*. Fig. 15 is a cross-sectional view of said shaft, showing the brake. Fig. 16 is a detail view of the modified construction of the frame that is connected with the rod for moving the other roller toward or from its cylinder. Fig. 17 is an end view of the other cylinder, showing a slightly-modified construction of the parts, combined with the swinging lever at the end of the same. Fig. 18 is a vertical longitudinal sectional view of the entire machine, said sectional view being taken adjacent to the ends of the cylinders. Fig. 19 is a side elevation of the entire machine, parts being omitted and others shown in dotted lines; and Fig 20 is a rear end view of the machine, parts being in section, others shown in dotted lines, and others omitted. Fig. 21 is a longitudinal sectional view of the end roller receiving platform or guide and rollers. Fig. 22 is a plan view of the same.

Similar letters of reference indicate corresponding parts.

In case fibrous material is submitted to the action of rollers provided on the periphery with projections, such as inclined teeth or points, saw-teeth, card-cloth, and the like, the fibrous material can only be drawn or stretched in such cases where the member that takes or receives the fibrous material has a greater peripheral speed than the member that brings or conveys the fibrous material. In all cases where the fibrous material is conveyed with greater rapidity than it is removed the same must necessarily spread and crowd itself. It is immaterial whether the conveying member has its teeth inclined in the direction of the rotation or in the reverse of the direction of the rotation.

In Fig. 1 a drawing or stretching device is shown in diagram which can be used for the purpose of drawing the fibrous material. The cylinder P, which conveys or delivers the material to be stretched, has its teeth inclined in the reverse of the direction of rotation of the cylinder, and this construction is preferred as the material can more readily be removed from a cylinder having its teeth inclined in the reverse of the direction of rotation than it can from a cylinder having its teeth inclined in the direction of rotation. The roller *s* rotates about with the same peripheral speed as the doffer P, whereas the peripheral speed of the receiving-cylinder T is a multiple of the speed of the doffer P. At the point of contact of the roller *s* and the receiving-cylinder T the fibrous material is taken up by the teeth or projections of the receiving-cylinder T, whereas the projections on the roller *s*, having less speed, have a tendency to hold back the material, thereby caus-

ing the continuous and gradual transporting of the material to the receiving-cylinder T, and whereby such material is subdivided, laid parallel, and straightened. The roller *s'* only serves for taking the fibers that remain on the roller *s* from the same and to deliver them to the cylinder T, to which the fibrous material is conveyed by the roller *s*. Besides the stretching device shown in Fig. 1 any other number of combinations of such stretching devices or drawing devices are conceivable that shall not be discussed here.

As stated above, the object of this invention is to provide a machine in which a series of successive stretching or drawing operations take place by means of suitable stretching and drawing devices and suitable conveying devices, which conveying devices do not upset or crowd the fibers, but at all times hold them in stretched condition. The several stretching or drawing devices, each for itself, stretch or draw the fibrous material passing from a delivery-cylinder to a receiving-cylinder in a certain proportion—for example, as one is to five—and the function of said transporting or conveying device is to take the fibers thus stretched from a receiving-cylinder and to place them in several successive layers, Fig. 2, upon a new delivery-cylinder P, which also travels with the speed I, and from which it is taken by means of suitable transporting or conveying devices to a new receiving-cylinder traveling at the speed of 5, whereby the fibers are again drawn and stretched. In this manner the drawing or stretching and transporting operations can take place alternately until the fibers have been sufficiently stretched and lay parallel. From the last receiving-cylinder the fleece is taken in the same manner as from the previous ones and placed in a number of superimposed layers upon a final delivery-cylinder, from which it is taken by means of a comb or a pair of rollers, and is then passed in form of a band or sliver into a can or receptacle or wound up as a bobbin to be subjected to the actions of other machinery.

The essential features of this invention, therefore, are the transporting or conveying devices, which convey the fibrous material from a receiving-cylinder upon a delivery-cylinder and at the same time keep it in stretched or drawn condition.

Figs. 4, 5, and 6 represent, diagrammatically, the different positions of one of the above-mentioned transporting or conveying devices. T represents a main cylinder, P a doffer, and *t* and *p* two transporting or conveying rollers, which, like the doffer and main cylinder, have their surfaces covered with thickly-grouped inclined teeth or inclined points. The main cylinder T and doffer P have greater diameter than the rollers *t* and *p*, and the distance from the center *o'* of the main cylinder T to the center *o* of the doffer P is such that when the rollers *t* and *p* are on the line connecting the centers *o o'* and said rollers *t* and *p* are in contact, as shown in Fig. 4, the distance between the main cylinder T and the roller *t* and between the doffer P and the roller *p* is sufficient to prevent during the rotation of the rollers the transmitting of any fibrous material between the main cylinder T and the roller *t* and between the doffer P and the roller *p*.

Fig. 3 further shows that when the rollers *t* and *p* are on the line connecting the centers *o* and *o'* the teeth or pins of the main cylinder T and the roller *t*, as likewise the teeth of the doffer P and the roller *p*, all project toward the same side of the line connecting the centers *o o'*. The main cylinder T and the doffer P rotate with a constant medium speed, both in the same direction—that is to say, the main cylinder in the direction in which its teeth or pins point and the doffer in the reverse direction to that in which its teeth point—and the relationship between the peripheral speed of the main cylinder T and the doffer P is equal to *u*. The transporting or conveying rollers *t* and *p* have combination movements. They oscillate around the centers of the main cylinder and doffer, respectively, and when they arrive at the line connecting the centers *o o'* their oscillatory movements are interrupted for a time, and while executing their oscillating movements they rotate upon their own axes in a direction the reverse of that of the main cylinder and doffer, and when the two rollers *t p* are on the line connecting the centers *o o'* and their oscillatory movement has been interrupted they rotate in the same direction as the main cylinder and doffer. Finally, they perform a third movement—namely, a short time before they arrive at the line connecting the centers *o o'* the roller *t* moves from the main cylinder T and the roller *p* from the doffer P a distance sufficient to prevent the transmitting of fibrous material between the main cylinder T and the roller *t*, as also between the doffer P and the roller *p*. Thereby the rollers *t* and *p* approach so close to each other that the fibrous material can pass from the roller *t* upon the roller *p*.

The following three movements are thus distinguishable:

First period, Fig. 4: The rollers *t* and *p* are on the line connecting the centers *o o'* and have approached each other and rotate in the same direction as the main cylinder T and the doffer P, and the roller *p* rotates with the same or greater peripheral speed than the roller *t*.

Second period, Fig. 5: The roller *t* has approached the main cylinder T to such an extent that the fibrous material can be delivered from the main cylinder T upon the roller *t*, which roller swings around the center *o'* of the main cylinder in the direction of *z*, and the speed of this swinging movement, measured on the circumference of the main cylinder T, is during the second period or during the greater part of the same greater than

the peripheral speed of said main cylinder. At the same time the roller t rotates in the reverse direction of the main cylinder T with a peripheral speed that is equal to or greater than its speed of oscillation along the circumference of the main cylinder minus the peripheral speed of said main cylinder. Likewise the roller p has approoched the doffer P to such an extent that the fibrous material can be delivered from the roller p to the doffer P, and performs an oscillatory movement in the direction of the arrow z', the speed of which, measured on the circumference of the doffer P during the second period or during the greater part of the same is greater than the peripheral speed of said doffer P. At the same time the roller p rotates in the reverse direction of the rotation of the doffer P with a speed that is equal to or less than its oscillatory speed, measured on the circumference of the doffer P, minus the peripheral speed of said cylinder P. The dotted circles p' and t' and p^2 and t^2, respectively, indicate the starting and ending positions of the oscillatory movements of the rollers p and t.

Third period, Fig. 6: The rollers p and t return to their original position and perform the second half of their oscillatory movement, the speed of which is such that the two rollers arrive at their starting-points at the same time. During this period the roller t rotates in the reverse of the direction of rotation of the main cylinder T with a speed that is equal to or greater than the oscillatory speed of the roller t, measured on the circumference of the main cylinder T, plus the peripheral speed of the cylinder T, and the roller p, which also rotates in the reverse of the direction of rotation of the doffer P, oscillates with a speed that is equal to or greater than the oscillatory speed of the roller p plus the peripheral speed of the doffer P.

Toward the end of the third period the rollers p and t approach each other, so that at the end of period three, respectively at the beginning of a new period one, fibrous material can be transmitted from the roller t upon the roller p and a transmitting of fibrous material between the main cylinder T and roller t and the roller p and doffer P is not possible. Now the movements take place again in the periods one, two, three, and so on.

Assuming that by a previous operation fibrous material has been placed into the teeth of the main cylinder T, the fibrous material will be taken from the main cylinder T and will be placed in drawn or stretched condition upon the periphery of the roller t during the second period as long as the speed of rotation of the roller t is greater than its oscillatory speed, measured on the circumference of the main cylinder T, minus the circumferential speed of the main cylinder T, and also during the third period, as long as the speed of rotation of the roller t is greater than its oscillatory speed, measured on the circumference of the main cylinder T, plus the peripheral speed of the main cylinder T. Afterward during the first period the roller t will transmit the material thus received upon the roller p, which retains the same on its pins in a stretched condition. In the following second period, during the time that the roller t receives fresh material from the main cylinder T, the roller p delivers its material to the doffer P, and this transmitting or conveying of material in stretched condition lasts as long as the speed of rotation of the roller p is less than the oscillatory speed of said roller p, measured on the circumference of the doffer P, minus the peripheral speed of the doffer P. During the third period the roller p is prevented from taking material from the doffer P as long as the speed of rotation of the roller p is greater than its speed of oscillation, measured on the circumference of the doffer P, plus the peripheral speed of said doffer P. During the execution of a series of movements—first, second, and third—layers of fibrous material continually pass from the main cylinder T by means of the rollers t and p upon the doffer P, and this fibrous material at all times remains stretched. As the proportion of the peripheral speed of the main cylinder T and doffer P′ is equal to u, the thickness of the several layers of fibrous material on the doffer P will be equal to u when the thickness of the layer on the main cylinder T is equal to I.

In place of the above-described combinations of movable rollers and cylinders another combination can be made, in which the movements also take place in three periods, which are slightly different from those of the above combinations. In the said second combination the movements differ during the first period from the movements of the first combination in that the approaching of the roller t and main cylinder T and roller p and doffer P takes place at the end of the first period, instead of at the beginning of the second period, Fig. 7.

The movements during the second and third periods of the second combination are distinguished from the movements during the second and third periods of the first combination in that the rollers t and p move from the main cylinder T and doffer P, respectively, toward the end of the second period and remain away from them during the third period and are only rotated during the second period. They arrive at the starting-point at the beginning of the first period, Fig. 9.

In the second combination the transmitting of the fibrous material takes place only during the first and second periods, and does not take place during the third period, but begins again with the first. If the direction of rotation of the main cylinder T or the doffer P, or both, is reversed, then the movements of the transmitting-rollers t and p must be changed accordingly, and in this manner a number of other combinations can be made;

but the four-roller system, which is the fundamental principle of this invention, seems to be fully explained by the first and second combinations herein described.

The machine for carrying out the above operations, as set forth in the second combination, will now be described in detail.

P, Figs. 10 and 18, is a doffer-cylinder, on the shaft *o* of which a double-armed lever *a* is mounted loosely at each end thereof. Said double-armed lever includes two disks a^2, Fig. 14, connected by a sleeve a', of which the inner disk—that is, the one nearest the end of the cylinder—is provided with extensions at opposite sides on its circumference. One of them terminates in a guide a^3 and the other in a segment-shaped receptacle or body a^4, that serves for receiving a counter-weight. The outer one of the two disks a^2 of the lever *a* is provided toward one side with an extension a^5, Fig. 11, in the shape of a crank, which is provided on its end with a pivot. The two halves of the lever *a* are connected by the four screws a^0, Fig. 10, whereas the two levers *a* at the ends of the doffer P are connected by the transverse bars a^6, Fig. 10, that extend over the doffer P and serve to stiffen said levers *a*. In the slide a^3 the slide-piece *b* is mounted movably, and in said slide-piece the roller *p* is mounted to rotate. The slide *b* is provided with a block b', into which the rod b^2 is screwed and held by the locking-nut b^3. The rod b^2 passes through an opening of the socket a^7, beyond which socket it is screwed into the cross-piece b^4, connected at its ends with the forked piece b^5, and thus a firm connection between the slide *b* is formed around the hub a' of the lever *a* with that part of the lever *a* beyond said hub. The forked piece b^5 is provided at its closed end with a slot b^6, and at that slot the closed end strikes against the head b^0 of the set-screw b^7. Said set-screw is secured at a^8 into a threaded aperture formed in the lever *a*, and is locked and held in place by the locking-nut b^8. On the other side of the hub a' the above-mentioned socket a^7 is firmly connected with the lever *a*. Said socket a^7 serves as a support for the helical presser-spring *d*, which can be adjusted as much as is necessary by means of the screw d^0, mounted on the rod b^2. The pressure exerted by the spring *d* against the nut d^0 keeps the slide *b* and also the roller *p* so far from the periphery of the doffer P that the forked piece b^5 rests at b^6 against the head b^0 of the adjusting-screw b^7. At a^9 eyes are cast on the two disks a^2 of the lever *a*, and in the same the pin h' is fastened. Between the two disks a^2 the forked lever *h*, Figs. 10, 12, and 13, is mounted loosely on the pin h', and is provided with a pin f', that can pass into a notch b^9, formed on a cross-piece of the forked piece b^5. On the end of the lever *h* a concave segmental cam-piece *k* of hardened metal is fastened and is provided with an eccentric-extension k'. The center of the cam-segment *k* is at *o*, and the pivot *i*, having a hardened head, swings in certain periods around the center *o* in the direction of the arrow z^2, Fig. 12. When the pivot *i* strikes the eccentric part k' of the cam piece *k*, it presses the lever *h* back until the pivot *i* passes under the segmental cam part *k*, below which it can continue its swinging movement for a short distance without producing any further action of the lever *h*. The effect that the swinging pivot *i* has on the lever *h* will increase as the distance from the pivot *i* to the center *o* increases. Said pivot *i* is adjustable radially by means of the set screw i', Figs. 11 and 14^a, and as it is fixed on the slide-piece i^2, guided in the slot i^3, it can also be adjusted tangentially as much as may be necessary. Said slide-piece i^2 is screwed upon the lever *l*, which is mounted loosely on the axis *o* of the doffer P, adjacent to the fixed bearing *v* of said cylinder, and said lever *l* has a crank-extension l', provided with a crank-pin l^2. The lever *l* performs in certain periods reciprocating oscillating movements in which the pin *i*, mounted on said lever *l* and adjustable on the same, participates. During the time in which the periodically-swinging lever *l* causes the pivot *i* to strike against the extension k' and to pass under the cam-edge *k* the lever *h* is pushed back and brought into an end position, which is governed by the radial adjustment of the pivot *i*. This end position corresponds to the necessary movement of the roller *p* toward the doffer P, in order to permit transmitting fibrous material from the roller *p* to the doffer P. (See Fig. 8.) During the time that the periodically-swinging lever *l* keeps the pivot *i* clear of the parts *k k'* the lever *h* is pressed in the opposite direction by the spring *d* and the intermediate members, consisting of the rod b^2, cross-piece b^4, and the forked piece b^5, and is thus brought in the opposite end position, which is governed by the adjustment of the adjusting-screw b^7. This second end position corresponds to the movement of the roller *p* toward the roller *t*, Fig. 7, so as to permit transmitting fibrous material from the roller *t* upon the roller *p*, and during this time the roller *p* is such a distance from the doffer P that the transmitting of fibrous material between the roller *p* and the doffer P cannot take place.

On the outer end of the pivot of the roller *p*, that is mounted in the hub *c* of the slide *b*, the bevel cog-wheel c', Fig. 11, is fixed, and the same is engaged by the bevel cog-wheel c^2, that is cast integral with a sleeve mounted to turn in the bearing c^3, made integral with the block b' of the slide *b*, said sleeve being connected by a feather with the shaft c^4 in such a manner that said sleeve and beveled pinion can rotate with the same, but can at the same time be moved lengthwise on said shaft c^4 a greater or less distance. The shaft c^4 is journaled at c^6 in one disk a^2 and carries at said journal a bevel cog-wheel c^7, (shown in dotted lines in Fig. 14,) which engages the bevel cog-wheel r', that is cast inte-

gral with a sleeve and a cog-wheel r, said sleeve being mounted loosely on the shaft o of the cylinder P. Adjacent to the cog-wheel r' the cog-wheel r^2 is mounted loosely on the shaft o, said cog-wheel r^2 having the same number of teeth as the cog-wheel r, and all of said wheels are arranged between the lever a and the lever l, mounted loosely on the shaft o. Said wheels r and r^2 are connected by a train of cog-wheels r^3, r^4, and r^5, of which the cog-wheels r^4 and r^5 are mounted on a pivot projecting from the crank-arm a^5 of the lever a, and the cog-wheel r^3 is mounted on a separate pivot of said crank-arm a^5. The cog-wheels r^3 and r^5 have the same number of teeth, and the cog-wheel r^4, that engages the cog-wheel r^3, has a less number of teeth, so that when the wheel r^2 makes one revolution the cog-wheel r is rotated in the reverse direction of the cog-wheel r^2 and with greater speed, according to the relation and the number of teeth between the wheels r^3 and r^4.

The wheel r^2 is engaged periodically by the pawl n', Figs. 11, 14, and 15, which is mounted in a hub cast on the lever l, which pawl is provided at its pivoted end with a lug n^2, having an inclined surface that can strike against a stop n^3, which is mounted adjustably in a slot of the lever l, said lug on the pawl being also provided with the two lateral projections n^9, between which a pin g^{11} of a brake-shoe g' projects. The brake g' consists of two jaws connected at one side by a jointed rod and at the opposite side by a helical spring, and said brake is mounted on a brake-disk cast integral with the bearing v. The pawl n, Figs. 11 and 14, is mounted loosely on the support N, bolted on the frame of the machine and periodically engages the teeth of the cog-wheel r, and it is provided at its pivoted end with a lug n^0, having a surface striking against the stop n^4, which is adjustable in the support N. Said lug n^0 also has two lateral projections n^{10}, between which a pin of the brake g projects. The brake g, corresponding to the pawl n, is constructed in the same manner as the brake g', and is mounted on a brake-disk cast integral with the lever l. By this combination of pawls and brakes the following results are obtained: When the lever l is moved in the direction of the arrow Z^3, Fig. 11, the brake g' causes the pawl n' to engage the wheel r^2, and the brake g causes the pawl n to move from the cog-wheel r a distance which can be regulated by the position of the adjustable stop n^4, Figs. 11, 14, and 15; but when the lever l is moved in the inverse direction of the arrow Z^3 the brake g causes the pawl n to engage the wheel r and the brake g' causes the pawl n' to move from the rim of the cog-wheel r^2 a distance regulated by the position of the adjustable stop n^3. On the other side of the machine the doffer P is mounted in a similar manner in the frame, and likewise carries on its axis a lever provided with a slide. In this lever the roller p, as previously described, is mounted to turn and to slide radially, and all the mechanism for the radial reciprocating movement of the roller p is provided, as previously described; but the mechanism for rotating the roller p—that is, the bevel cog-wheels c' and c^2, the bearing c^3, the shaft c^4, the bevel cog-wheels c^7 and r', and the cog-wheels r, r^2, r^3, r^4, and r^5—as also the pawls and brakes are omitted.

The elements of machinery described above are arranged in the same manner for the main cylinder T, Fig 17, however, with the following slight changes; the lever h in Fig. 16 is constructed as an angle-lever, the eccentric surface of the part k' points toward the turning-point of the lever h and the segmental cam-surface k is convex in place of being concave, as previously described. The action of the pivot i on the edges of the parts $k\,k'$, however, is the same as for the doffer P, inasmuch as thereby the roller t is also moved toward the main cylinder T. Furthermore, the beveled pinion c^3 is arranged in the construction shown in Fig. 11 at the inner edge of the bevel-pinion c', whereas in the construction shown in Fig. 17 it is arranged at the outer edge, and finally the pawl n, which is mounted on the fixed support N and combined with the brake g on the lever l, engages the wheel r^2, whereas the pawl n' engages the cog-wheel r, cast integral with the bevel cog-wheel r'; or, in other words, the functions of the two pawls for the main cylinder T are merely the reverse of the functions of the same pawls for the doffer P.

The cranks a^5 and l', both for the main cylinder T and doffer P, are connected at both sides of the machine with the connecting-rods u and w, which give them an oscillatory swinging motion. The movements of the functional organs of the above machine take place in conformity with the second combination, as previously mentioned, in three successive periods, as follows:

Period I.—The levers a are in a position of rest, as shown in Figs. 7, 11, and 17, so that the centers of the rollers p and t are on the line $o\,o'$, connecting the centers of the main cylinder T and doffer P. The levers l, operated by the connecting-rods w, swing in the direction of the arrow z^3. The resistance of the brake g' of the main cylinder T forces the pawl n' into engagement with the cog-wheel r, and said pawl turns it in the direction of the arrow z^3. This rotative movement is transmitted through the bevel cog-wheels r' and c^7, the shaft c^4, the bevel-pinions c^2 and c' to the roller t, which thereby is rotated in the direction of the arrow z^4, Fig. 17. Furthermore, the resistance of the brake g' on the bearing of the doffer P causes the pawl n' to engage the cog-wheel r^2, and the latter is rotated in the direction of the arrow z^3. This rotative motion is transmitted through the wheels r^3, r^4, and r^5 and is increased correspondingly to the proportion of the wheels r^3 and r^4, and is transmitted in the reverse direction of the arrow z^3 upon the wheel r and from the latter

is transmitted by means of the bevel cog-wheels r' c^7 and the shaft c^4 and the bevel-pinions c' and c^2 upon the roller p, which in consequence thereof is rotated in the direction of the arrow z^4, Fig. 11, but with greater speed than the roller t. The brakes g are then arrested by the lugs n^0, and thus cause by their resistance the disengagement of the pawls n. The pins i swing with the levers l, but are not in contact with the faces of the parts k k'. The levers h are thus free and are subjected to the actions of the springs d, which bring the rollers t and p toward each other and keep them clear of the cylinders T and P, respectively. The distance that the rollers t and p are to approach each other can easily be adjusted by the screws b^7. Toward the close of the first period the pins i strike against the faces of the parts k k' and cause a withdrawing of the rollers p and t—that is, they move them, respectively, toward the main cylinder T and doffer P, the screw i' serving to regulate the throw of said levers h.

Period II.—The levers l, operated by the connecting-rod w, perform the second part of the oscillatory movement—namely, the same distance that they have traveled in the first period they now travel in the reverse direction, as indicated by the arrow z^5 in Figs. 11 and 17. The levers a, operated by the connecting-rod u, describe the first part of their oscillatory movement in the direction of the arrows z^5. The levers a and l thus swing in the same direction at the same time. In consequence thereof the pivots i, which at the end of the first period were in contact with the faces of the parts k, remain in contact with the same and keep the roller p close to the doffer P and the roller t close to the main cylinder T. The rollers p and t of course participate in the movements of the lever a around the center o in the direction of the arrow z^5. By the change in the direction of the movement of the levers l the action of the brakes g and g' is changed, as the pawls n' are held out of gear and the pawls n are brought in gear. In the doffer P the pawl n, mounted on the fixed support N, prevents the cog-wheel r from turning, as it locks it and also locks the bevel cog-wheel r', and in consequence thereof the bevel cog-wheel c^7, which participates in the swinging movements of the lever a, must rotate on the wheel r'. It transmits its rotary movements through the shaft c^4 and the bevel cog-wheels c^2 and c' on the roller p, which is thereby rotated in a direction the reverse of that shown by the arrows z^4. As the proportion between the diameters of the doffer P and roller p is about as five is to one, and the proportion of the gearing of the wheel r to the wheel c' is about three, and the proportion of the medium oscillatory speed of the roller p, measured on the circumference of the doffer P, to the peripheral speed of the doffer P is about equal to twenty, the difference of the latter is about equal to nineteen, when the medium rotative rapidity of the roller p is about equal to twenty and three-fifths equal twelve. The latter speed is thus less than the difference in the former. At the main cylinder T the pawl n locks the cog-wheel r^2, and thereby forces the cog-wheel r^3, which participates in the swinging movement of the lever a, to rotate on the wheel r^2. The rotary movements of the wheel r^3 are transmitted by the cog-wheels r^4, r^5, r, r', and c^7, the shaft c^4, and the cog-wheels c^2 and c' upon the roller t, which is thereby rotated in the inverse direction of the arrow z^4. As the proportion of the diameter of the cylinder T to the diameter of the roller t is about as five is to one and the proportion of the wheels from r^2 to c' is about 5.4, the proportion of the medium oscillatory speed of the roller t to the circumferential speed of the cylinder T is about as twenty is to five. Therefore the difference of the latter is about equal to fifteen when the medium rotary speed of the roller t is equal to $20\frac{5.4}{5}=21.6$. The latter speed is thus greater than the difference of the former. Toward the end of the second period the pivots i slide off the faces of the parts k, as the levers l must travel a slightly-greater path than the levers a, and the result of this is that the rollers t and p begin to move from the doffer P and main cylinder T at the end of said second period.

Period III, Fig. 9.—The levers l remain at rest in the position that they had at the end of the second period. The levers a complete the second part of their oscillatory movement and travel the same path that they traveled in the second period, but in the reverse direction—that is, now in the direction of the arrow z^3—until the centers of the rollers p and t are on the line $o\,o'$, connecting the centers of the cylinder T and doffer P. The levers h participate in the swinging movements of the levers a and the faces of the parts k' at the beginning of the third period move from the now stationary pivots i, the result of which is that the rollers p and t gradually move from the doffer P and main cylinder T and approach each other on the line $o\,o'$ as far as permitted by the set-screws b^7. As the levers l are at rest the brakes g and g' remain indifferent, as do also the pawls n and n', and for that reason no rotary movement is given to the rollers t and p during the third period.

At the end of the third period the first period begins again, and the above movements take place in the three periods, as described, successively, and so on. The upper and lower connecting-rods u, which give the oscillatory movement to the levers a, themselves derive motion from the crank-shaped levers u' and u^5, which are arranged at both sides of the machine and are rigidly keyed on the ends of the upper shaft o^2 and the lower shaft o^3. About at the middle of the shaft o^2 the crank-shaped lever u^2 is arranged, and the same is connected with the connecting-rod u^3, mounted to turn on the crank-pin u^4, and the crank-lever u^6 on one end of the shaft o^3 receives

motion from the connecting-rod u^7, which is mounted on the crank-pin u^8. The two crank-pins u^4 and u^8 project from crank-disks keyed on the crank-shaft o^4, and are so arranged in relation to each other that they are both at their dead-centers at the same time. (See Fig. 7.) The crank-shaft o^4 is mounted on longitudinal supports t^3, which are suspended from a cross-piece t^4 of the frame, and their opposite ends rest on an end cross-piece t^5. The bevel cog-wheel s^2 is keyed on the crank-shaft o^4 and is engaged by the bevel cog-wheel s^3, which rotates it periodically. The wheel s^3 is connected with the clutch-socket e and the socket of the conical friction-coupling e' is connected with a clutch-bar e^2, the two arms of which engage notches of the cup e, and are adapted to move up and down in said slots as far as is necessary for engaging or disengaging the conical clutch e'. The wheel s^3, with the clutch-socket e, as also the clutch-bar e^2, with the friction-socket e', are mounted rotatively upon the vertical shaft m, the step part of which is mounted at m'. Above the step it is provided with the bevel cog-wheel s^4, that is engaged with and driven from the bevel cog-wheel s^5 on the main shaft W. The main shaft W rotates with a constant speed and transmits its motion to the crank-shaft o^4 when the friction-coupling e' is closed. On the ring d' of said coupling the lever d^2 acts, Figs. 18 and 20, which lever is pivotally mounted at d^5, and when the friction-coupling e' is closed rests upon the latter, the weight of said lever being increased by the action of the helical spring d^3, connected with the frame of the machine and with said lever d^2.

Figs. 18 and 20 represent the eccentric e^3 acting on the friction-roller d^4 of the lever d^2, whereby said lever is lifted and the friction-coupling e' opened. In this case no transmitting of power from the shaft W to the crank-shaft o^4 takes place; but the crank-shaft o^4 does not only not receive any motion in this case, but it is locked in its position of rest by the pawl f^2. The pawl f^2 is mounted pivotally at f^4 and secured on a shaft, on the other end of which the arm f^5 and the slotted arm f^6 are fastened. The helical spring f^9 (shown in dotted lines in Fig. 18) is connected with the frame of the machine and with the arm f^5, and the upper end of the rod f^8 is connected with the adjustable pivot f^7 in the slot of the arm f^6, the lower end of said rod f^8 being connected with the lever d^2. When the lever d^2 is raised—that is, when the friction-clutch is opened—the rod f^8 is raised and permits the spiral spring f^9 to draw the arm f^5 to the left, whereby the pawl f^2 is pressed against the eccentric-receiving socket f^3, which rotates with the crank-shaft o^4 even after the clutch is opened under the action of its inertia until the pawl f^2 arrives at said socket f^3 and snaps into the same. Thereby the crank-shaft is stopped in the moment when the connecting-rods w^3 and w^7 are at their dead-centers, the crank-pins w^4 and w^8 and the pawl-socket f^3 being arranged accordingly. When the eccentric e^3 leaves the roller d^4, the lever d^2 descends, and by means of the connecting-rod f^8 and arm f^6 removes the pawl from the socket f^3 a moment before the conical friction-coupling e' is closed. Thereby the crank-shaft e^4 is released and can resume its rotative motion. The eccentric e^3 consists of two eccentric-disks mounted adjacent to each other on the eccentric-shaft o^0, which disks are so adjusted with relation to each other that the time during which the friction-coupling e' remains open can be increased or decreased, as may be necessary. The eccentric-shaft o^0 receives its rotary movement from the main shaft W by means of the cog-wheel r^6, the intermediate cog-wheel r^7, and the cog-wheel r^8 on the shaft o^0, and the proper speed is given to said eccentric-shaft by proportioning the wheels, so that when the friction-clutch is closed the proportion of the length of the eccentric-shaft to that of the crank-shaft o^4 is precisely as one is to one and one-half. As that part of the eccentric e^3 that acts on the roller d^4 of the lever d^2 is equal to an arc of about one hundred and twenty degrees—that is, about one-third of the entire circumference—the time of rotation of the shaft o^0 can be divided into three parts which are about equal, the first being the time during which the eccentric keeps the lever d^2 raised and the crank-shaft o^0 held at a standstill, and the second and third the time during which the friction-coupling e' is closed, and the crank-shaft o^4 makes an entire revolution and reciprocates the connecting-rods w^3 w^7, which movement is transmitted by means of the rocking shafts o^2 o^3 and the upper and lower connecting-rods u upon the lever a as an oscillating motion.

The mechanism that is used for producing periodically oscillating movements of the lever a is analogous to the mechanism used for the periodical oscillations of the lever l. This is also illustrated in Figs. 7, 8, 9, 18, 19, and 20, only with the exception that the letter w has been replaced by the letter w, and the several parts are provided with the same reference-letters, but the coefficients are different—for example, e^0, e^{10}, e^{20}, and e^{30}, in place of e, e', e^2, and e^3. No further explanation is necessary, except that the lever l must, as described above, travel a slightly-greater distance than the lever a, which is accomplished by making the levers w^2 and w^6 slightly smaller than the levers w^2 and w^6, the dimensions of the other parts being the same. The eccentric e^{30} is also mounted on the shaft o^0 and is set at an angle of one hundred and twenty degrees to the eccentric e^3, so that the eccentric e^{30} raises the lever e^{20} one-third of a rotation of the shaft o^0 earlier than the eccentric e^3 raises the lever d^2. The functions of this driving mechanism for the swinging movements of the levers l and a can also be divided into three periods of about equal duration.

Period I, Figs. 7, 18, 19, *and* 20.—The eccentric e^3 has opened the friction-coupling e' by means of the pawl f^2. The crank-shaft o^4 and lever a have been brought into a position of rest. The eccentric e^{30} has left the roller d^{40}, permitting the lever d^{20} to descend, and the friction-coupling e^{10} is closed, and thereby the crank-shaft o^{40} is rotated, whereby a swinging movement is transmitted to the levers l in the direction of the arrow z^3, corresponding to the first period, described above.

Period II, Figs. 8, 18, 19, *and* 20.—The eccentric e^3 has left the roller d^4, the friction-coupling e' is closed, the shaft o^4 is rotated, and a swinging movement has been given to the lever a in the direction of the arrow z^5. The friction-clutch e^{10} remains closed, the shaft o^{40} continues to rotate, and permits the lever l to perform the second part of its swinging movement in the direction of the arrow z^5, corresponding to the second period, as described above.

Period III, Figs. 9, 18, 19, *and* 20.—The friction-coupling e' remains closed, the shaft o^4 continues to rotate, and the levers a perform the second part of their swinging movement in the direction of the arrow z^3. The eccentric e^{30} has opened the friction-clutch e^{10}, and by means of the pawl f^2 the shaft o^{40} and the lever l have been locked in a position of rest corresponding to the third period, as described above.

The constant rotative movements are transmitted in the following manner: q, Fig. 20, is the driving-pulley. q^0 is the loose pulley; W, the main shaft, and q' the belt-pulley for driving the doffer-comb. The power is transmitted from the main shaft through the cog-wheels r^6, r^7, and r^8 to the eccentric-shaft o^0, and from the latter, by means of the bevel cog-wheels r^9 and v', Figs. 19 and 20, to the smaller vertical shaft, the axis of which is shown in dotted lines in Fig. 20, and from the same through the bevel cog-wheels v^2 and v^3 to a horizontal longitudinal shaft, and from this, by means of the bevel cog-wheels v^4 and v^5, to the cylinder T, and also through the cog-wheels v^6 and v^7 and the bevel cog-wheels v^8 and v^9 to the lower horizontal longitudinal shaft v^{80}, and from the same, by means of the bevel cog-wheels v^0 and i^4 and the train of gearing i^5, i^6, i^7, and i^8, to the last doffer P, and by means of the bevel cog-wheels i^9 and i^0 to the other doffers P.

The construction of the members for conveying the fibrous material of course depends upon the nature of said fibrous material.

The machine described is constructed for acting on washed combing wool, and the usual feeding devices for this material have been shown on the left-hand side of Figs. 18 and 19. The part of the machine located between the dotted lines x^4 x^4 and x^5 x^5, Figs. 18 and 19, contains the mechanism for stretching and drawing the material. The small stretching-roller s receives its motion from the first cylinder T by means of the cog-wheels m^4 m^5 and the sprocket-wheels m^6 and m^7, over which the chain m^0 passes. The smaller wheels m^2, m^3, and m^8 drive the cleaning-roller s' from the roller s. In the least number of cases a single stretching process will be sufficient; but a number of them must follow, and the succeeding machinery must be provided with finely and more-closely grouped teeth. This can easily be done without making any changes in the construction of the machine, as the part between the lines x^4 x^4 and x^5 x^5 can be introduced a number of times in the frame of the machine. The fleece or sliver of wool, which is removed from the last doffer P by means of a hook-comb g or any other suitable device, is passed over a table having the vertical radial projections g^3, which govern the width of the slivers and conduct them to the rollers h^2 h^2, and from there they are passed through a suitable conductor to the rollers h^3, and then are filled into a can or wound on a bobbin, as may be desired.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a machine for treating fibrous material, the combination, with two rotating cylinders and two rollers, said rollers and cylinders being provided on their peripheries with teeth or projections, of mechanism for moving the rollers toward and from each other on a line connecting the centers of the two cylinders, and mechanism for oscillating each roller over the periphery of a cylinder, substantially as set forth.

2. In a machine for treating fibrous material, the combination, with two rotary cylinders and two rollers, said cylinders and rollers having their peripheries provided with teeth or projections, of mechanism for moving the rollers toward and from each other on a line connecting the centers of the cylinders, mechanism for oscillating each roller over one cylinder, and mechanism for rotating the rollers in the reverse of the direction of rotation of the cylinders while said rollers are performing their oscillatory movements, substantially as set forth.

3. In a machine for treating fibrous material, the combination, with two rotary cylinders and two rollers, said cylinders and rollers having their peripheries provided with teeth or projections, of mechanism for moving the rollers toward and from each other on a line connecting the centers of the cylinders, mechanism for oscillating each roller over the periphery of a cylinder, mechanism for rotating each roller in the reverse of the direction of rotation of the cylinder over which it oscillates, and mechanism for rotating the rollers in the same direction as the cylinders when said rollers are on a line connecting the centers of the cylinders, substantially as set forth.

4. In a machine for treating fibrous material, the combination, with two rotary cylinders and two rollers, said cylinders and rollers

having their peripheries provided with teeth or projections, of mechanism for oscillating each roller over the periphery of a cylinder, mechanism for rotating the rollers during the time that they oscillate, mechanism for holding the peripheries of the rollers against the peripheries of the cylinders during the time that the rollers perform said oscillatory movements, and mechanism for moving the rollers from the peripheries of the cylinders and toward each other when said rollers oscillate toward the line connecting the centers of the cylinders, and mechanism for rotating said rollers in the same direction as the cylinders when said rollers are on the line connecting the centers of the cylinders, substantially as set forth.

5. In a machine for treating fibrous material, the combination, with a cylinder, of swinging levers mounted on the shaft of the cylinder, slides on the ends of said levers, a roller mounted in said slides, springs acting on the slides, frames connected with the springs, and a lever acting on said springs to compress the springs and draw the roller toward the surface of the cylinder, substantially as set forth.

6. In a machine for treating fibrous material, the combination, with a cylinder, of swinging levers on the shaft of the same, slides in said levers, a roller parallel with the cylinder and mounted on the slides, a spring pressing the slides outward, rods connected with said slides, frames connected with the rods, pivoted levers adapted to act on said frames, and a swinging arm provided with a pin that acts on said levers, substantially as set forth.

7. In a machine for treating fibrous material, the combination, with a cylinder, of swinging levers on the shaft of the same, slides on the outer ends of said arms, a roller parallel with the cylinder and mounted in said slides, springs for pressing the slides outward, rods connected with the slides, frames connected with said rods, and levers acting on said rods and provided with cam-edges, a swinging arm mounted on the shaft of the cylinder, and an adjustable pin on said swinging arm, which adjustable pin acts on the above-mentioned cam-surfaces, substantially as set forth.

8. In a machine for treating fibrous material, the combination, with a cylinder, of swinging levers on the shaft of the same, a roller parallel with the cylinder mounted in said swinging arms, gearing for rotating said roller, a cog-wheel on the shaft of the cylinder for operating the gearing for rotating the roller, and automatically-operating pawls for locking said cog-wheel on the cylinder at intervals, substantially as set forth.

9. In a machine for treating fibrous material, the combination, with a cylinder, of swinging levers on the shaft of the same, a roller mounted on the outer ends of said levers, a cog-wheel mounted loosely on the shaft of the cylinder, gearing for rotating said roller from said cog-wheel on the shaft of the cylinder, gearing for rotating said cog-wheel in one direction on the shaft of the cylinder, gearing for rotating said cog-wheel in the reverse direction, two pawls for locking said gearings at intervals, and two brakes operating said pawls, substantially as set forth.

10. In a machine for treating fibrous material, the combination, with a cylinder, of swinging levers on the shaft of the same, a roller mounted in the outer ends of said levers, a cog-wheel mounted loosely on the shaft of the cylinder, gearing for rotating said roller from said cog-wheel on the shaft of the cylinder, gearing for rotating said cog-wheel in one direction on the shaft of the cylinder, gearing for rotating said cog-wheel on the shaft in the reverse direction and at greater speed, and two pawls for locking said gearings at intervals, substantially as set forth.

11. In a machine for treating fibrous material, the combination, with a cylinder, of swinging levers on the shaft of the same, a roller mounted in the outer ends of said levers, a cog-wheel mounted loosely on the shaft of the cylinder, gearing for rotating said roller from said cog-wheel on the shaft of the cylinder, gearing for rotating said cog-wheel in one direction on the shaft of the cylinder, gearing for rotating said cog-wheel in the reverse direction, two pawls for locking said gearings at intervals, two brakes operating said pawls, and a rocking lever mounted loosely on the shaft of the cylinder, which lever operates the brakes, substantially as set forth.

In testimony whereof I hereunto sign my name, in the presence of two subscribing witnesses, this 9th day of June, 1891.

GOTTFRIED MEYER.

Witnesses:
EMIL BLUM,
HENRY LABHART.