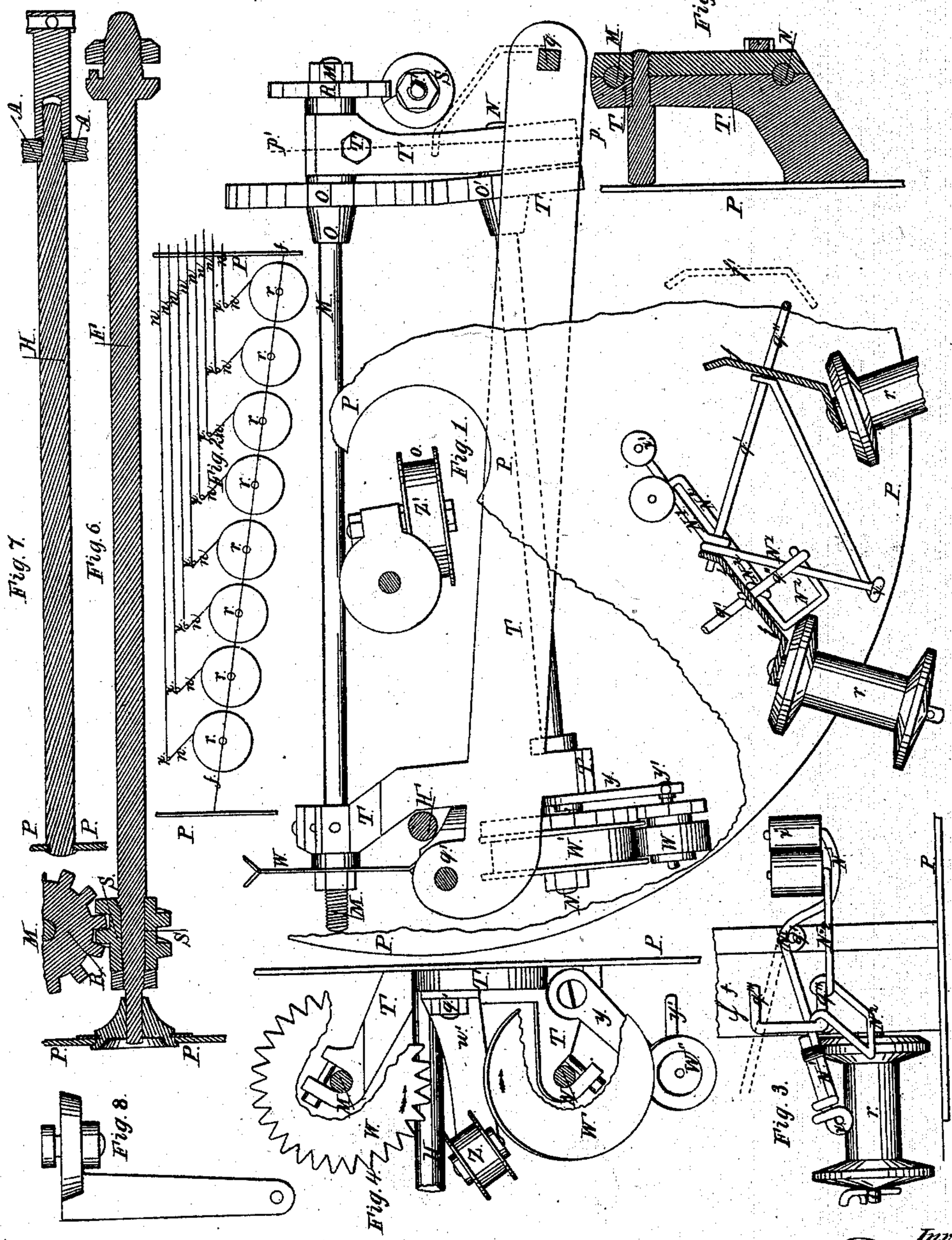
4 Sheets—Sheet 1.

J. A. GRÜNWALD.

CIRCULAR LOOM.

No. 26,585. Patented Dec. 27, 1859.



Witnesses.
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4 Sheets—Sheet 2.

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CIRCULAR LOOM.

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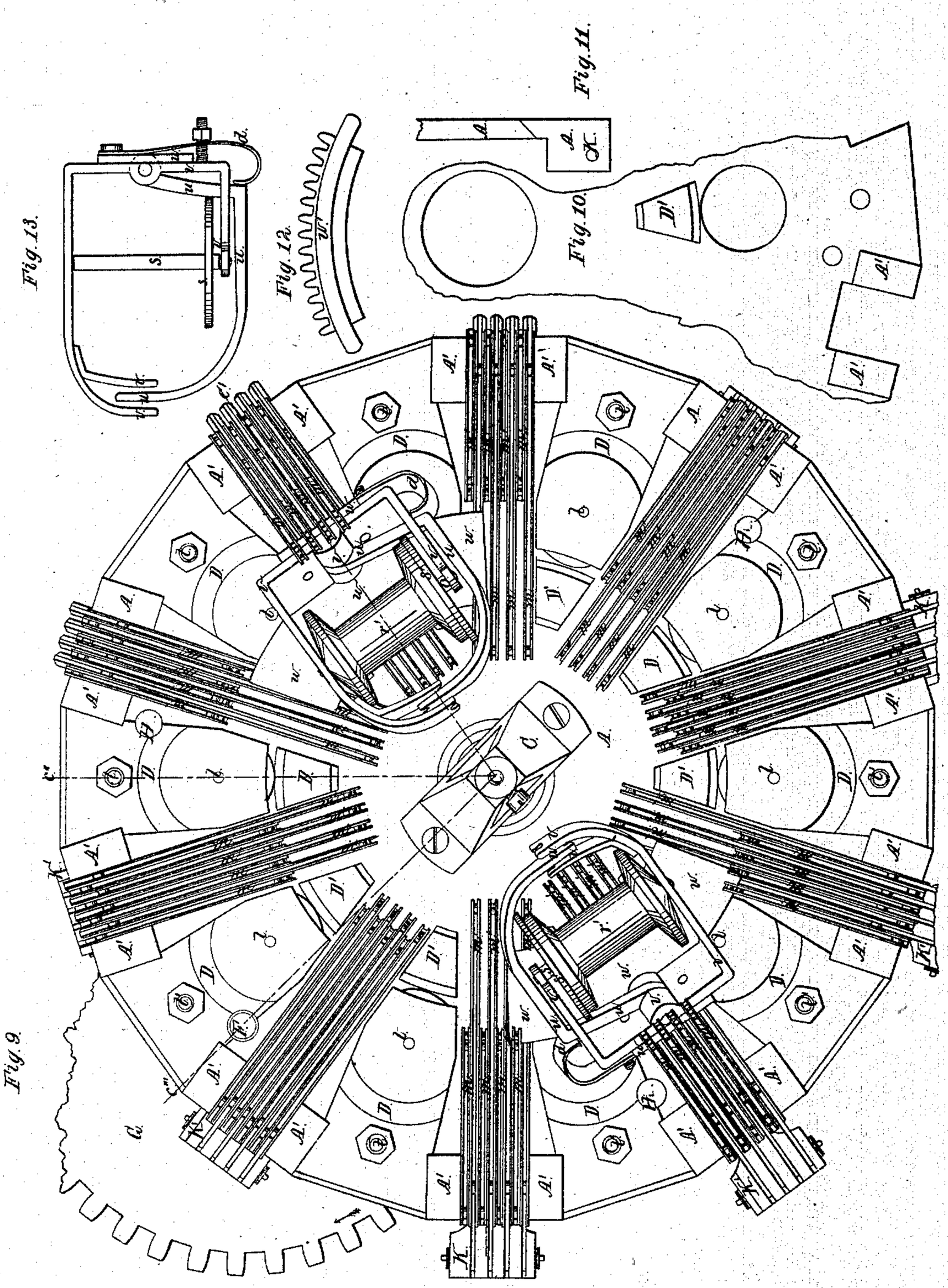

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4 Sheets—Sheet 3.

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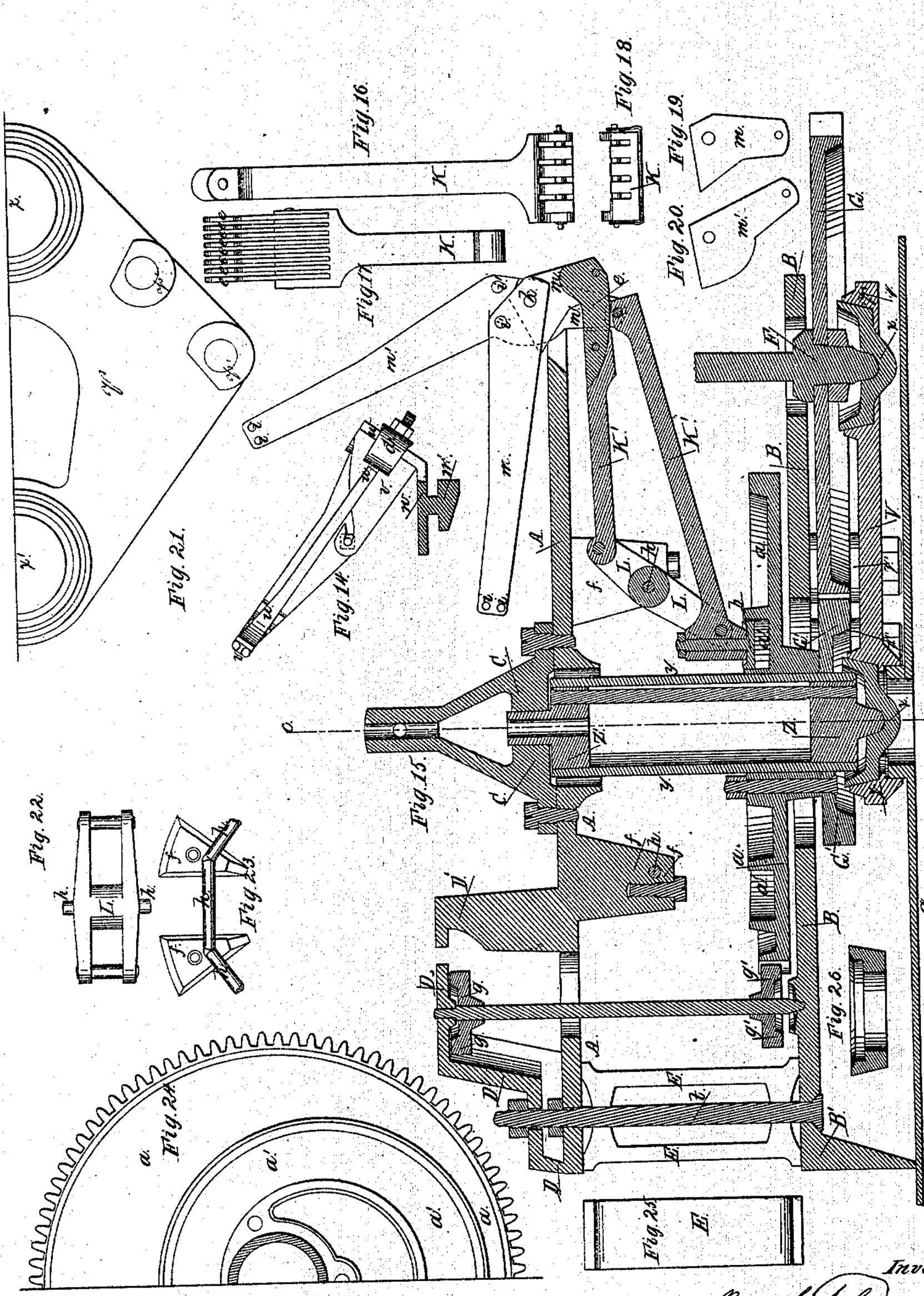
CIRCULAR LOOM.

No. 26,585. Patented Dec. 27, 1859.



Witnesses.
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4 Sheets—Sheet 4.

J. A. GRÜNWALD.

CIRCULAR LOOM.

No. 26,585. Patented Dec. 27, 1859.

Fig. 1.

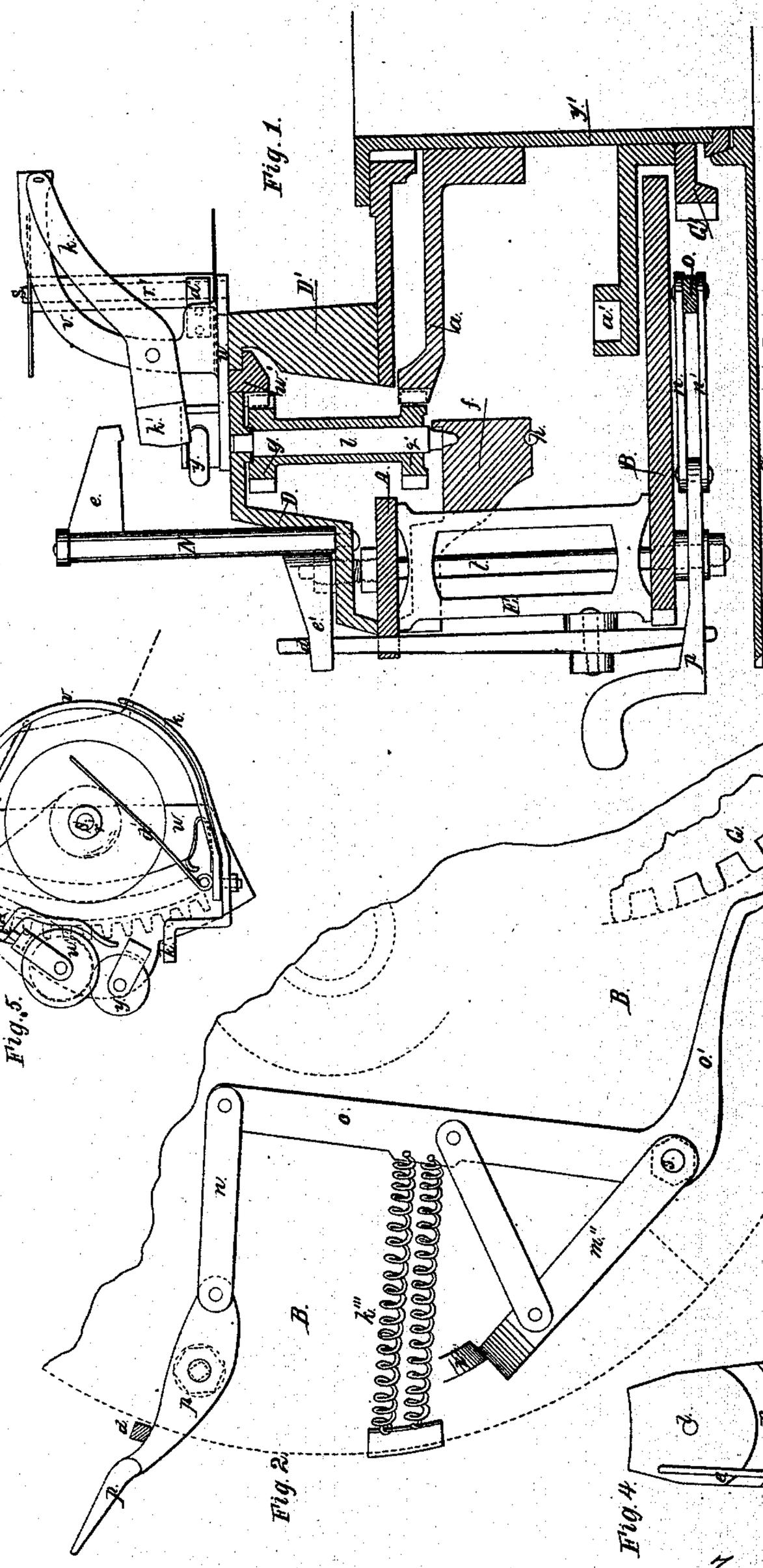

Fig. 3.

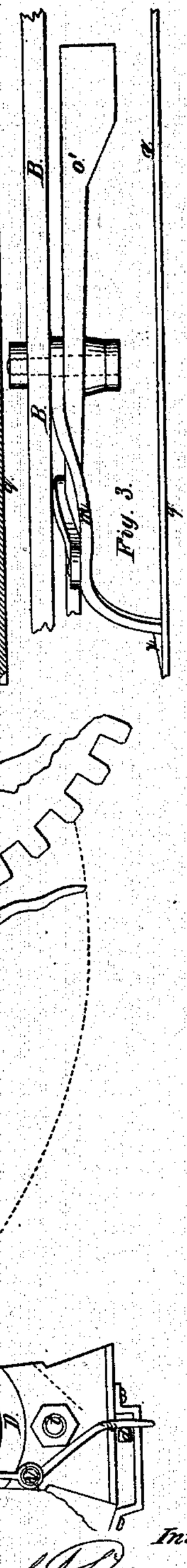

Fig. 5.

Fig. 2.

Fig. 4.

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UNITED STATES PATENT OFFICE.

JOSEF A. GRÜNWALD, OF NEW YORK, N. Y.

CIRCULAR LOOM.

Specification forming part of Letters Patent No. **26,585**, dated December 27, 1859.

To all whom it may concern:

Be it known that I, JOSEF A. GRÜNWALD, of New York, in the county and State of New York, have invented a new and Improved Circular Loom for Weaving; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

In the accompanying drawings, the Sheets I, II, III, and IV exhibit views of the different parts drawn in full size, except Fig. 2 on Sheet III, which is drawn half-size and shows the direction of the warps and position of the bobbins.

My invention consists in the application of certain improvements to that description of looms known as "circular looms," by which various kinds of articles are produced having the warps and wefts laid alternately or interwoven with each other.

The improvement consists in the arrangement of self-acting machinery by which the tissues or textures are woven in a circular form resembling tubes, and in order to accomplish which the machine performs the following operations: First, the loom is arranged to take up a number of warps in such a manner as to admit of their running off again successively during the process of weaving, maintaining, however, the necessary tension on each spool and thread; second, the warps are placed alternately above and below the weft-threads, and carried then alternately and ultimately to that part where they are joined to one another; third, the spooled weft-threads are run off the spools while the spool-carriages are revolving, with suitable arrangements on the same to maintain the required tension of the weft-threads in order to join the warps; fourth, the machine is thrown out of gear and stopped as soon as any one of the weft-threads break off; fifth, the manufactured article is taken away from the machine as fast as it is finished and at a regular tension.

The loom consists of three principal subdivisions—namely, the upper portion, which contains the spooling-frames or supports for the warp-bobbins; secondly, the next or middle part, where the warps and wefts are joined and the manufactured product is made and delivered, and, thirdly, the lower part, which contains the weaving machinery. The warps are brought down from the bobbins and pass between guides or levers, which are alternately elevated and depressed toward the center of the machine. The wefts are made to revolve in a horizontal circular plane, by which, in conjunction with the alternate motion of the warps, the weaving is accomplished.

Sheet I, Fig. 9, shows a horizontal section through the middle part and represents a plan of the weaving machinery. Fig. 15, Sheet II, represents a vertical section of the same and of the driving mechanism in the lower part of the loom.

A and B are plates to which the machinery is attached. The same are connected with each other through suitable distance-pieces so as to leave sufficient space between them for the necessary mechanism. The lower plate, B, has feet B′ attached, which rest on the foundation-plate *q*, on which the loom is centered capable of turning, for the purpose hereinafter described, sufficient space being left between those plates B and *q* for the wheels G and G′ and their necessary supports. The wheel G, which receives motion by any ordinary means, is attached to an upright shaft or spindle, F, and gears into the pinion G′, which latter is fixed on the vertical or main shaft Y in the center of the machine. To this shaft Y a wheel, *a*, is fixed, (the half-plan of which is shown in Fig. 24, Sheet II,) which has an eccentric groove, *a′*, on its upper surface.

A′ are projections on the upper surface of the plate A, (see Figs. 9 and 10, Sheet I,) placed equidistant from the central axis of the loom, with sufficient distance between each pair for the warp-guides *m* and *m′* to move. To these projections A′ pins *k′* are fastened to act as fulcrums for the warp-guides.

D D′ are projections on the upper surface of the plate A, and so arranged as to form between them on their top surface portions of a circular groove in which the weft-carriages move. That portion of the weft-carriage which enters and fits said groove between the projections C and C′ is made sufficient length to enter one groove before leaving the other, and is represented in Fig. 12, Sheet I, marked *w′*, and by the dotted lines in Fig. 5, Sheet IV, and is provided with a spur-segment, which is acted upon at all times by the spur-pinions *g*, one taking on before the other has left off.

These spur-pinions *g* are fastened to the upper end of the spindles *l*, provided with similar pinions, *g'*, fastened near the lower end, and which latter gear into the wheel *a*, fast to the shaft Y.

f are projections on the under side of the plate A, and serve as supports or bearings for the spindles *h*, (see Figs. 15 and 23, Sheet II,) on which the levers L are fixed. The levers L are connected by means of the connecting-rods K and K' with the warp-guides *m* and *m'*. The lower ends of the rods K' are provided with projections fitting into the groove *a'* on the wheel *a*, by which means, by the revolution of the wheel *a*, said projections on the end of the levers K', by their motion in the eccentric groove *a'*, vibrate the levers L, which communicates a rising and falling motion to the levers or warp guides *m m'*.

H, Fig. 9, Sheet I, are columns fastened to the plate A, which support on their top the plate P, Sheet III. To this plate P upright stands *j* (shown in Figs. 1 and 3, Sheet III) are attached at equal distances apart to support and carry the warp-bobbins *r*, as well as the thread-guides and tension arrangement. The upper ends of the stands *j* are fastened together by a plate which covers up the machine. The warps descend from the spools or bobbins *r* downward on the outside of the machine, then over guides *i'*, near the fulcrum of the warp-guides *m* and *m'*, along and between said guides to their ends, then between pins *i i* in the ends of said warp-guides, and then toward the center of the machine. The weft-bobbins *r'* have the weft-threads passing from them, tending toward the center of the machine, as will be hereinafter described. It may be here that two weft-bobbins are absolutely necessary, and for manufacturing some descriptions of material more than two are requisite. It will be seen that by the alternate rising and falling of the warp-guides the weft is by means of its rotation interwoven with the warp. The levers L operate upon the warp-guides in such a manner as to cause every other one of these guides, together with their warp-thread, to be alternately elevated and depressed, one weft being on one side of the machine over the warp-guides marked *m*, and under those marked *m'*, and on the other side of the machine over those marked *m'* and under those marked *m*. (See Fig. 9, Sheet I.)

To insure uniformity of tension on the warps, levers and weights are applied, as seen in plan in Fig. 1, and in elevation in Fig. 3, Sheet III. Fig. 2 on Sheet III represents the position of the bobbins *r* and the direction of the warps *n* from bobbins to the warp-guides below. At one end of a lever (marked No. 1) a small open ring, *x*, is provided, which receives the warp-thread from the bobbin *r*, (in the manufacture of silk fabrics glass is preferred for this purpose,) and to the other end of this lever a small weight, *x'*, is fixed. The axis of this lever is formed by a bent wire, *q'*, attached to the upright stand *j*, and which acts first as an axis to the lever marked No. 1, passes then through the next upright stand *j*, and acts, where marked *q''*, as axis to the lever No. 2. This wire is then bent upward and back again, so as to limit, where marked *q'''*, the upward motion of lever No. 1. The lever No. 2 presses with its foremost end on the angular edge of the spool or bobbin *r* in proportion to its weight *x''* fixed on the other end of the same, and thus serves as a brake. The lever No. 1 passes with its weighted arm under the weighted end of the lever No. 2, so that the part which constitutes the brake is thereby relieved when necessary, and thereby any inequality of tension corrected. The weight *x''* on the lever No. 2 should be regulated according to the nature of the material manufactured, but the same should never be so light as to cause the spool to let the thread go before lever No. 1 has lifted up the weight *x''* on the end of the lever No. 2.

The contrivance by which the loom takes up the spooled weft-threads in such a manner as to allow the same being delivered during the process of weaving, and at the same time maintain the necessary tension to join the warps, is shown on Sheet IV, in which Fig. 1 represents an elevation, and Fig. 5 a plan, of the weft-bobbin carriage. The bow (marked *v*) is fastened to the bottom of the carriage *w*, and bent sufficiently large for the weft bobbin *r'* to turn freely, and at the same time keep the warp-threads coming from the end of the warp-guides and running toward the center of the loom clear of the weft-bobbin. The weft-bobbin *r'* revolves around an upright spindle or pin, *s*, fastened to the piece *w*, and is prevented from flying round faster than the weft is drawn off by the spring *d* acting against its face. The weft-thread passes from the bobbin *r* through an eye or hook, *v*, then between two pulleys, *u* and *y*, and through an eye, *v''*, then through a hole in the extreme end of the longest arm of the lever *f*, passes then through a hole near the center in the bow *v*, and through the end of the lever *k*, from whence it passes toward the center of the loom to join the warps. The pulley *u* is grooved and is attached to a sliding piece, *c*, capable of turning freely in the same. This sliding piece *c* passes through one side of the bow *v*, and is acted upon by a spiral spring, *z*, which presses the pulley *u* against the pulley or roller *y*, so as to produce the required tension on the weft-thread while passing between the pulley *u* and roller *y*. The roller *y* is rounded on its circumference and fits into the groove of the pulley *u*. The same turns freely on a pin fastened to the piece *w*, which forms the bottom of the carriage. The lever *f'* turns on a fulcrum, C, fast to the piece *w*. The lower and shortest arm of said lever *f'* is attached to the sliding piece *c*, and, as before mentioned, the weft-thread passes through the end of the longest arm of said lever. Any extreme tension, therefore, of the weft-thread acts upon long arm of this lever *f'* in such a manner as to pull this

end inward, so that its other end, connected with the sliding piece *c*, pulls said sliding piece, together with the grooved pulley *u*, away from the roller *y*, and thus releases the pressure on the weft-thread in its passage from the bobbin *r'*. The lever *k* moves on a fulcrum attached to the lower part of the bow *v* on the opposite side of the lever *f''*, and is kept in its position by the tension and strength of the weft-thread, which passes through the end of its longest and heaviest arm, as before mentioned. In case the weft-thread breaks, this arm of the lever *k* falls down by its own weight, while its other and shorter arm, *k'*, is thereby moved upward, so as to come in contact with a projection, *c*, on the spindle N' for the purpose of stopping the machine, as will be hereinafter explained.

The mode adapted for delivering the manufactured articles is represented on Sheet III. Near the top of the upright spindle or shaft F, on which the wheel G is fastened, (see Fig. 15, Sheet II,) a small worm, S, is fastened, which works into a small worm-wheel, R, Figs. 1 and 6, fixed to the horizontal shaft M, revolving in bearings provided on the frame T, which is united to the under side of the plate P, which latter carries the warp-bobbins. On the shaft M is a toothed wheel, C, which gears into the wheel O', fixed on the horizontal shaft N. At the opposite end of the horizontal shaft M a pulley, W, is fixed, having its periphery serrated, (the edges, however, are smooth,) each alternate tooth being set in a contrary direction, and thus form a groove, the revolution of which draws out the manufactured article without the possibility of its slipping off. At the opposite end of that already referred to of the horizontal shaft N is a roller, W', which bears upon a smaller roller, W'', to which latter motion is communicated by means of spur-pinions, and a slight pressure is given to the manufactured article, which passes between these rollers, by means of a spiral spring. The material is conducted from the center of the loom over guide-pulleys *z z'* toward the serrated pulley W, from thence between the rollers W' and W'', and removed to any convenient place.

The mode of stopping the machine when one of the weft-threads breaks is represented on Sheet IV. As soon as a weft-thread breaks, the arm *k*, which, as before described, is held up by the strength of the thread, falls down by its own weight, by which its other end or arm, *k'*, is brought upward. In one or more places upright spindles N' are attached to the plate A, or to any projection on the same, having on both ends arms *e* and *e'*, projecting horizontally and situated in opposite directions. Against the upper arm, *e*, the arm *k'* (which clears said arm *e* while the arm *k* is held up by the strength of the thread) will strike as soon as the weft-thread breaks and the arm *k* falls down by its own weight, turning thereby the spindle N' partly round, so that its lower arm, *e'*, strikes against the lever *d*, whose lower part moves the lever *p*, which is connected through the rod *n'* with the bell-crank *o*, operating the same so that its other arm, *o'*, comes against the periphery of the wheel G, acting as a brake on said wheel and holding the same fast, in which case the motive power, which gears into said wheel G, turns thereby the whole loom around its own axis in the plate *q*, and thus throws the machine out of motion. The bell-crank *o o'* is acted upon by spiral springs *k'''*. To the bell-crank *o o'* a lever, *m''*, is attached, whose lower end comes in contact with a small projection, *x'''*, fastened on the plate *q*, for the purpose of counteracting the effect of the springs *k'''* while the machine is in motion. When the machine requires to be stopped, the lever *m''* is brought clear of the stop or projection *x'''* by acting on the end of the lever *p*, which allows then the springs *k'''* to act as before described, so as to force the arm *o'* of the bell crank against the periphery of the wheel G.

Instead of arranging the mechanism for driving the weft-bobbin carriages and the warp-guides as above described, the same may be arranged as represented in Fig. 1, Sheet IV. The main shaft in this case is made hollow, or consists of a tube, *y'*, having suitable bearings in the bottom plate, *q*. This arrangement facilitates the introduction through the center of different articles which require to be woven over. To this shaft or tube Y' the wheel G' is attached between the plates B and *q*. The eccentric *a'* is separated from the wheel *a*, which latter is attached to the tube Y' near its upper end, and close to the under side of the plate A, while the eccentric *a'* is attached lower down and near to the plate B. By this arrangement more space is given for the levers which work the warp-guides, as well as for the eccentric itself, and allows a variety of eccentrics suitable to the different kind of articles to be manufactured to be introduced with facility, as well as the application of four, six, or more weft-bobbin carriages. Another advantage of this arrangement is that the pinions *g* and *g'*, instead of requiring to be attached separately to the spindle *l*, on account of the great distance between the wheel *a* and the weft-carriage, may be cast both together in one piece, which not only reduces the expense, but gives a greater security, as the successful operation of the loom depends much on the accuracy of its moving parts.

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

1. The manner of weaving in a horizontal circular plane by means of two or more wefts and an arrangement of warps placed alternately above and below the weft-threads, arranged and constructed in the manner substantially as described.

2. The arrangement of the weft-bobbin car-

riage, in combination with the arrangement of regulating the tension on the weft-thread, substantially as described.

3. The arrangement and construction of the tension-levers for the purpose of maintaining the tension of the warp-threads, as well as the friction against the warp-bobbins, acting together in the manner and for the purpose substantially as set forth.

4. The arrangement of the serrated pulley W, in combination with the rollers W′ and W″, operating together in the manner described, and for the purpose of delivering the manufactured article as fast as finished and at a regular tension, substantially as specified.

5. The arrangement of the disengaging-gear, constructed as described, and for the purpose of throwing the loom out of gear as soon as one of the weft-threads breaks, the same being operated by a lever attached to the weft-bobbin carriage and acted upon by the weft-thread, in the manner substantially as set forth.

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