

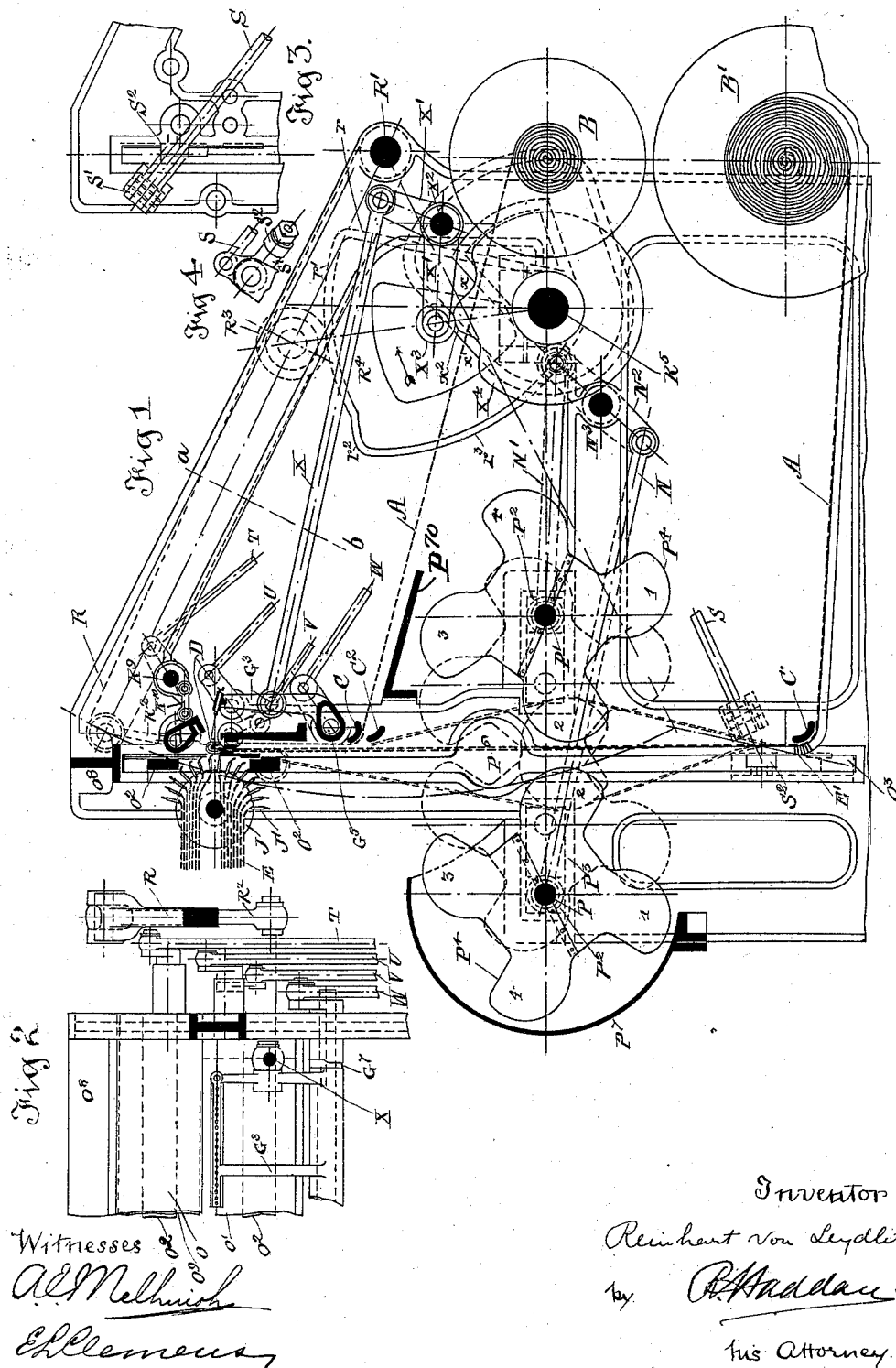
(No Model.)

18 Sheets—Sheet 1.

R. VON SEYDLITZ.  
LOOM FOR WEAVING TURKISH CARPETS.

No. 533,330.

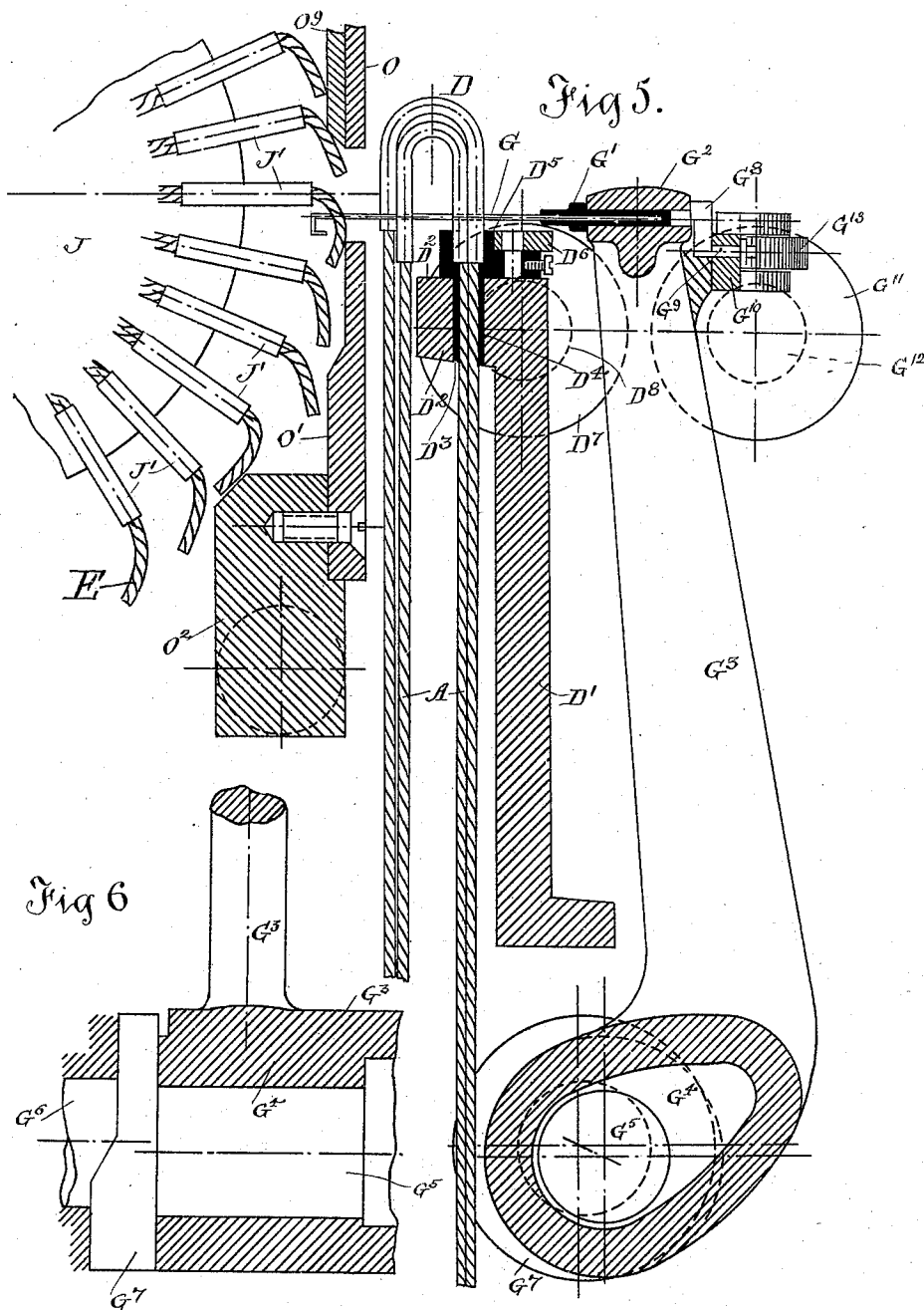
Patented Jan. 29, 1895.



18 Sheets—Sheet 2.

No. 533,330.

Patented Jan. 29, 1895.



Witnesses

A. Melhuish  
E. Clemens

Inventor

Reinhardt von Seydlitz  
by P. Andrau  
his Attorney.

R. VON SEYDLITZ.  
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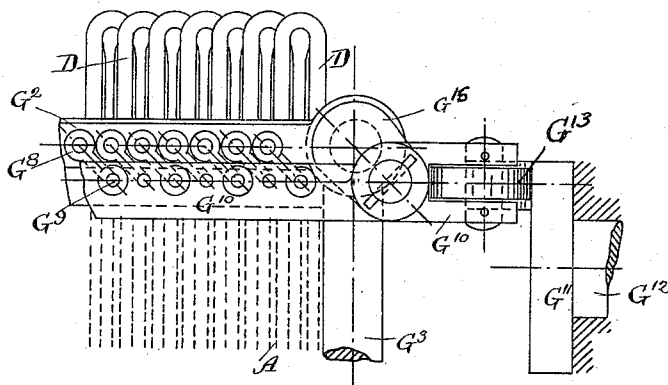


Fig 7.

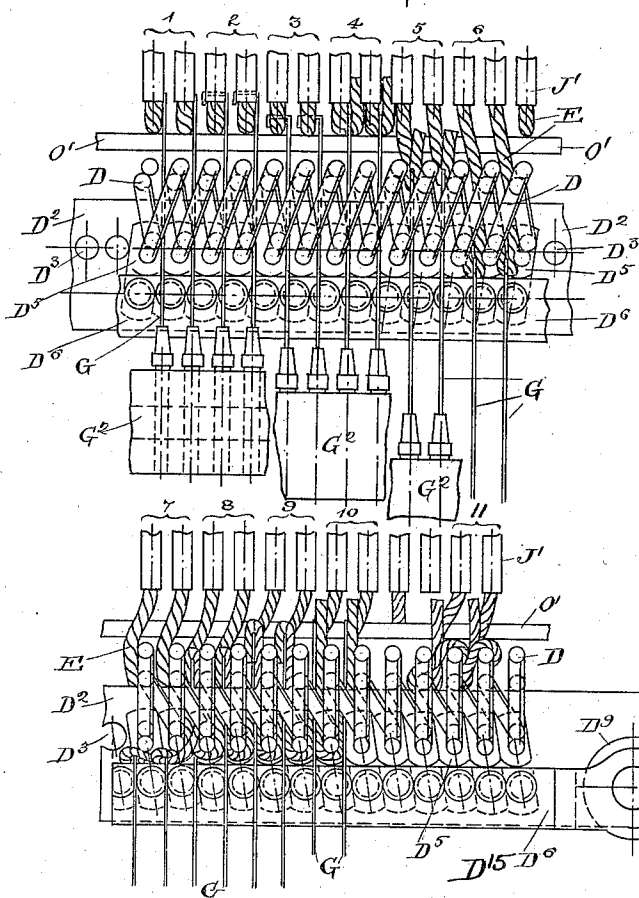


Fig 8.

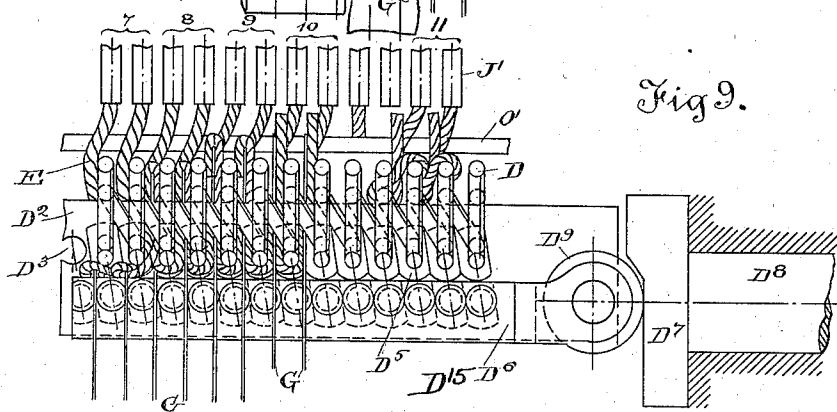


Fig 9.

Witnesses

*A. Melhuish*  
*E. Clemens*

Inventor

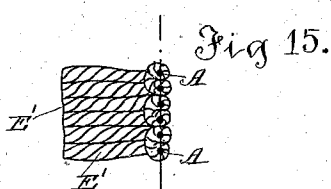
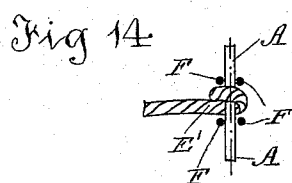
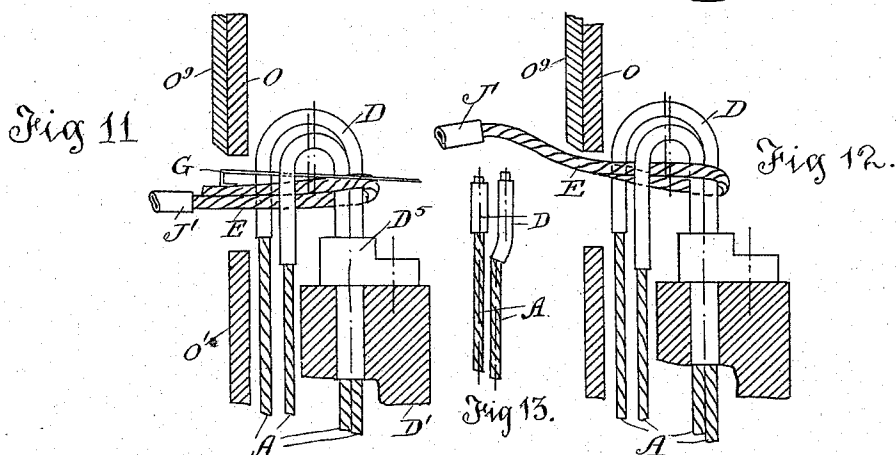
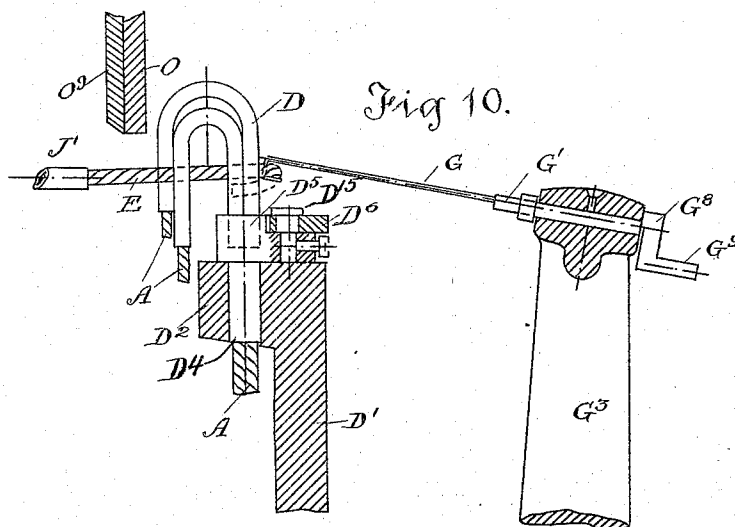
*Reinhard von Seydlitz*  
by *E. H. Adams*

*his Attorney.*

R. VON SEYDLITZ.  
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Patented Jan. 29, 1895.



Witnesses

*Al. Melhus*  
*E. L. Lennarz*

Inventor

*Rene von Seydlitz*  
by *Att. Ad. d. d. d.*  
his Attorney.



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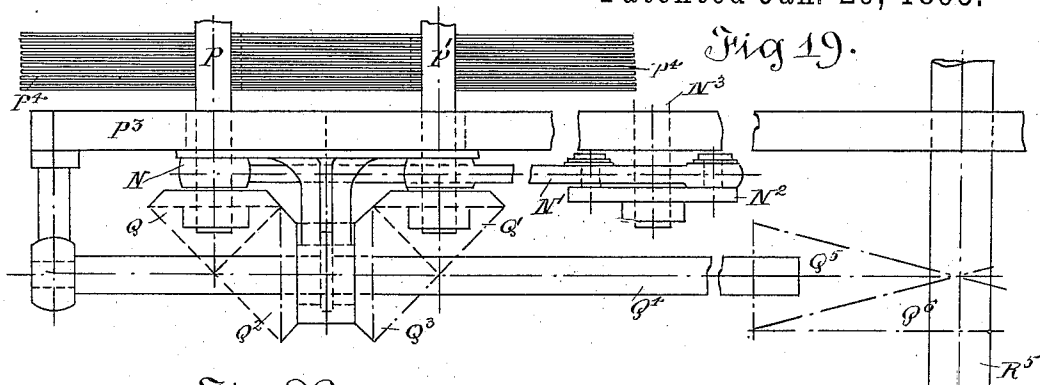


Fig 20.

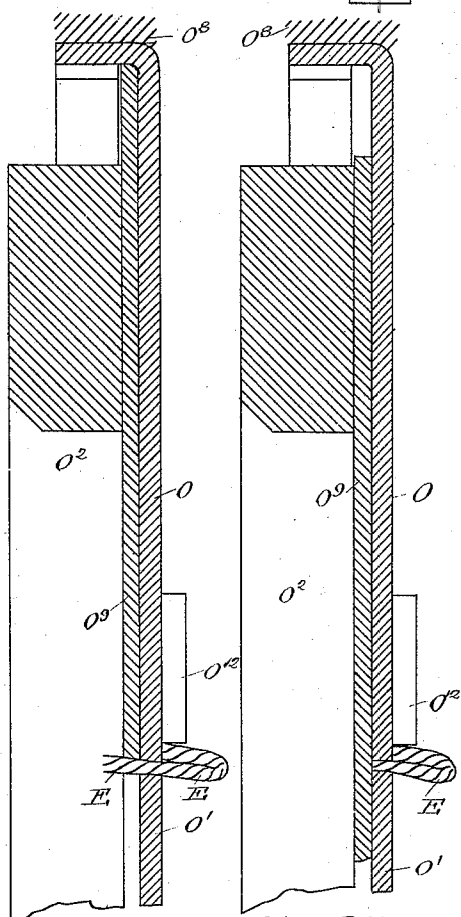
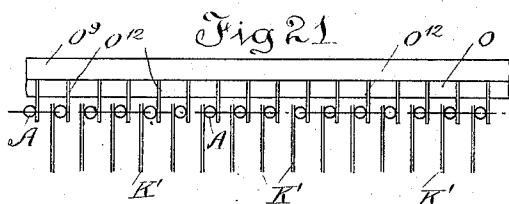
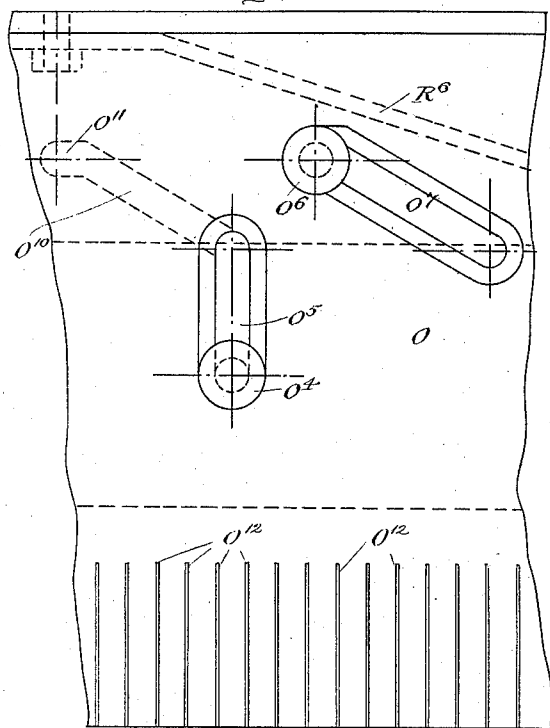


Fig 22

Fig 23.

Witnesses

*A. Melhuish*  
*E. Clemens*

Inventor.

*Reinhard von Seydlitz*

by *A. Haddau*

his Attorney



R. VON SEYDLITZ.  
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Fig 26

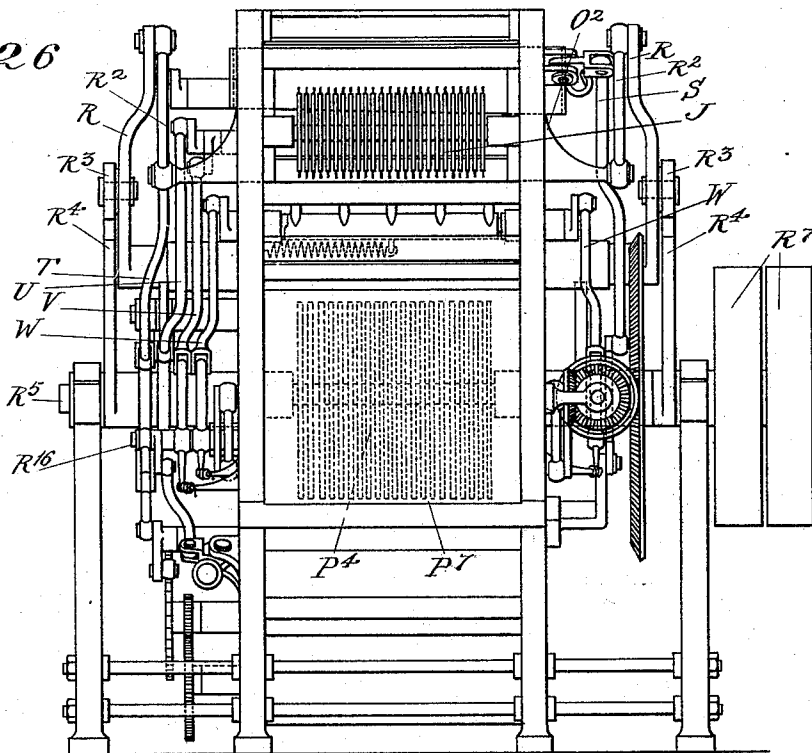
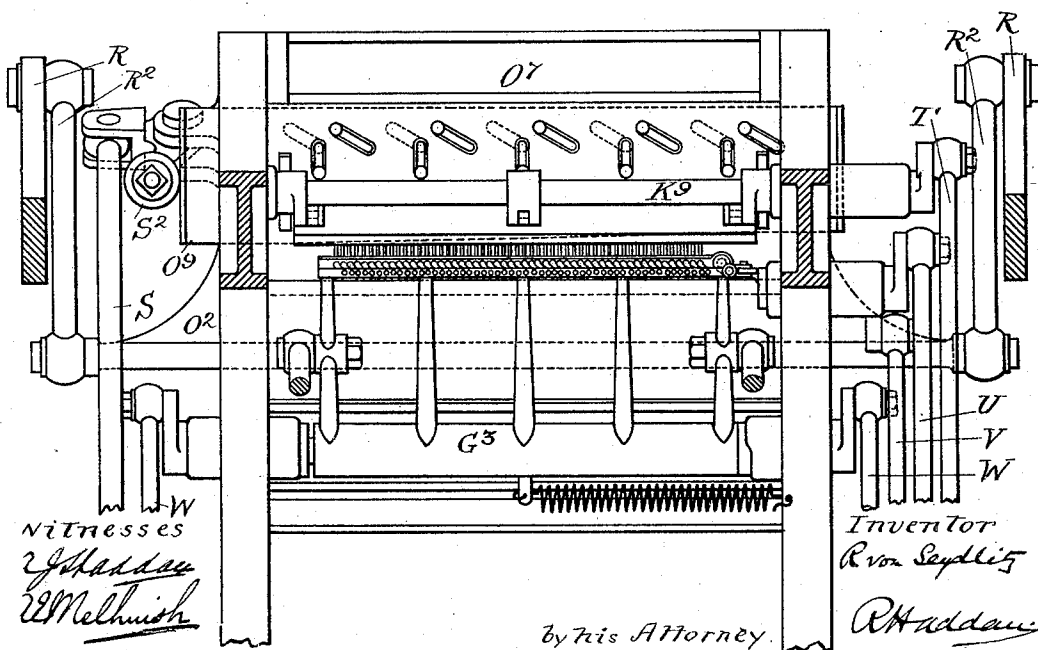


Fig 27



(No Model.)

18 Sheets—Sheet 9.

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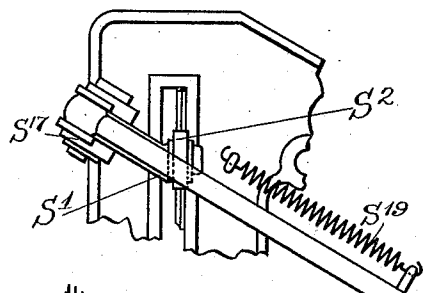


Fig 28

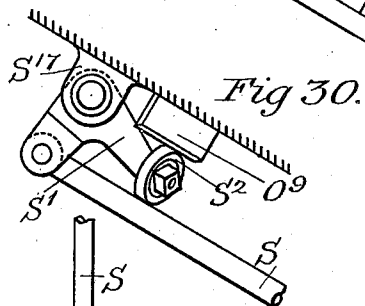


Fig 30.

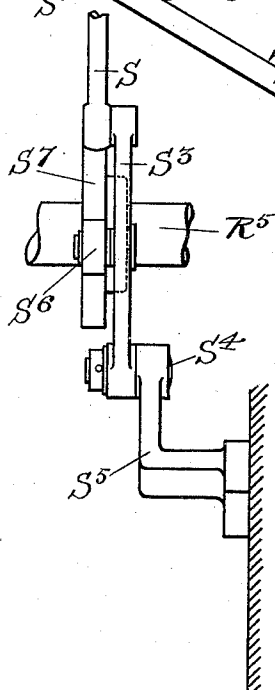


Fig 29.

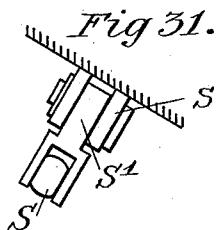
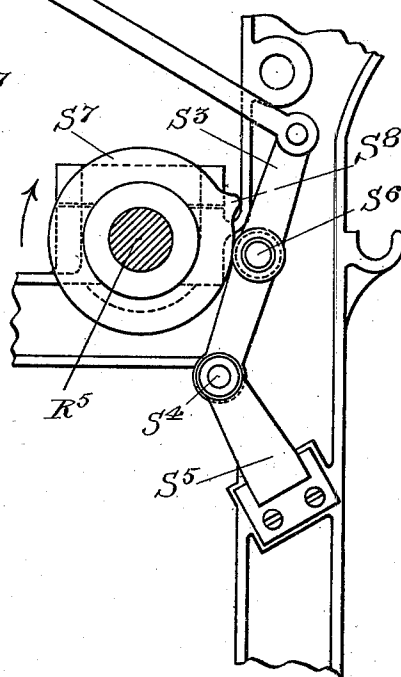


Fig 31.



Witnesses  
*A. J. Shaddan*  
*A. J. Melhuish*

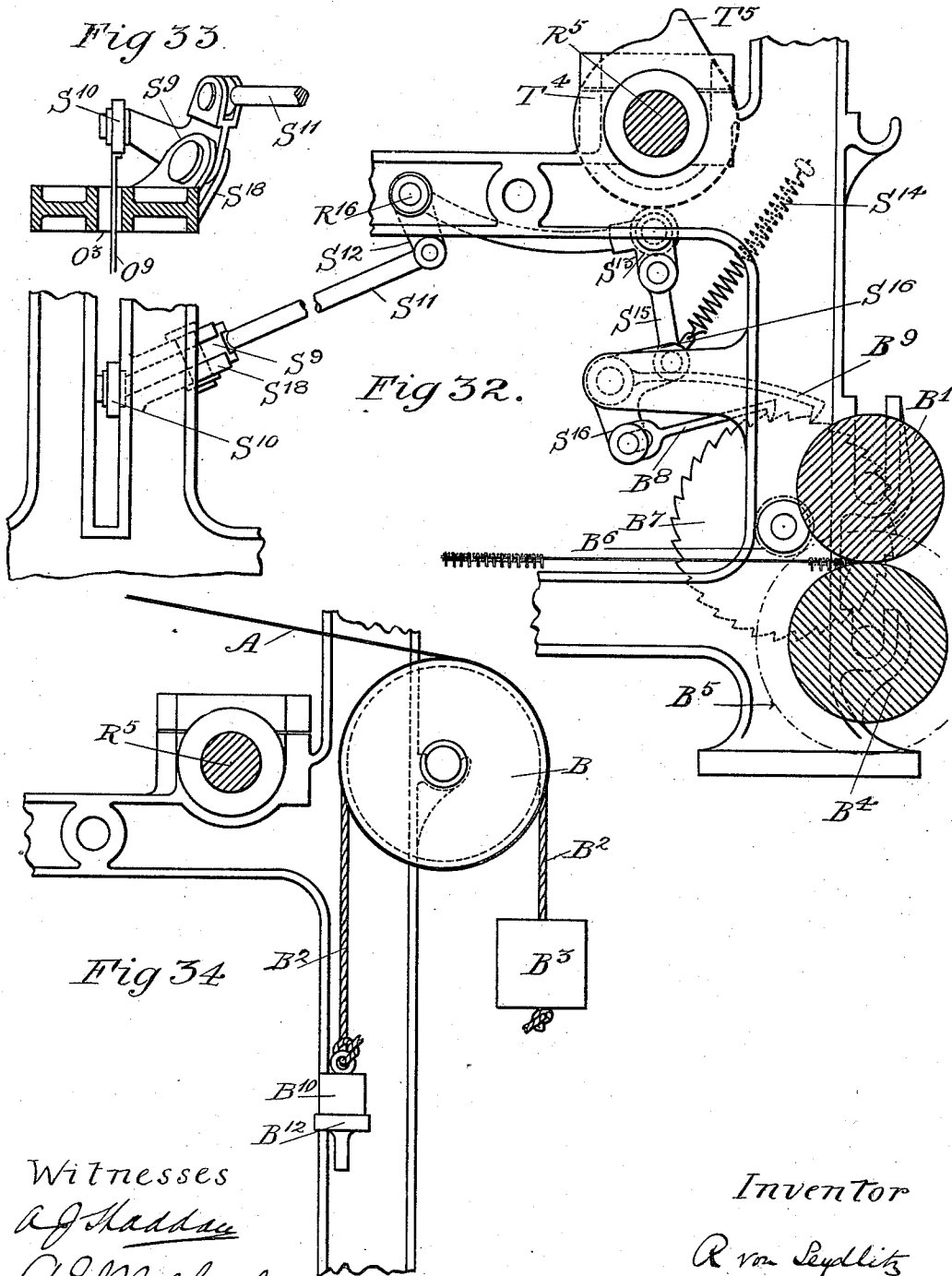
Inventor  
*R. von Seydlitz*

by his Attorney *R. Shaddan*

R. VON SEYDLITZ.  
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No. 533,330.

Patented Jan. 29, 1895.



Witnesses  
*A. J. Haddau*  
*A. E. Melhuish*

Inventor  
*R. von Seydlitz*

by his Attorney. *R. Haddau*

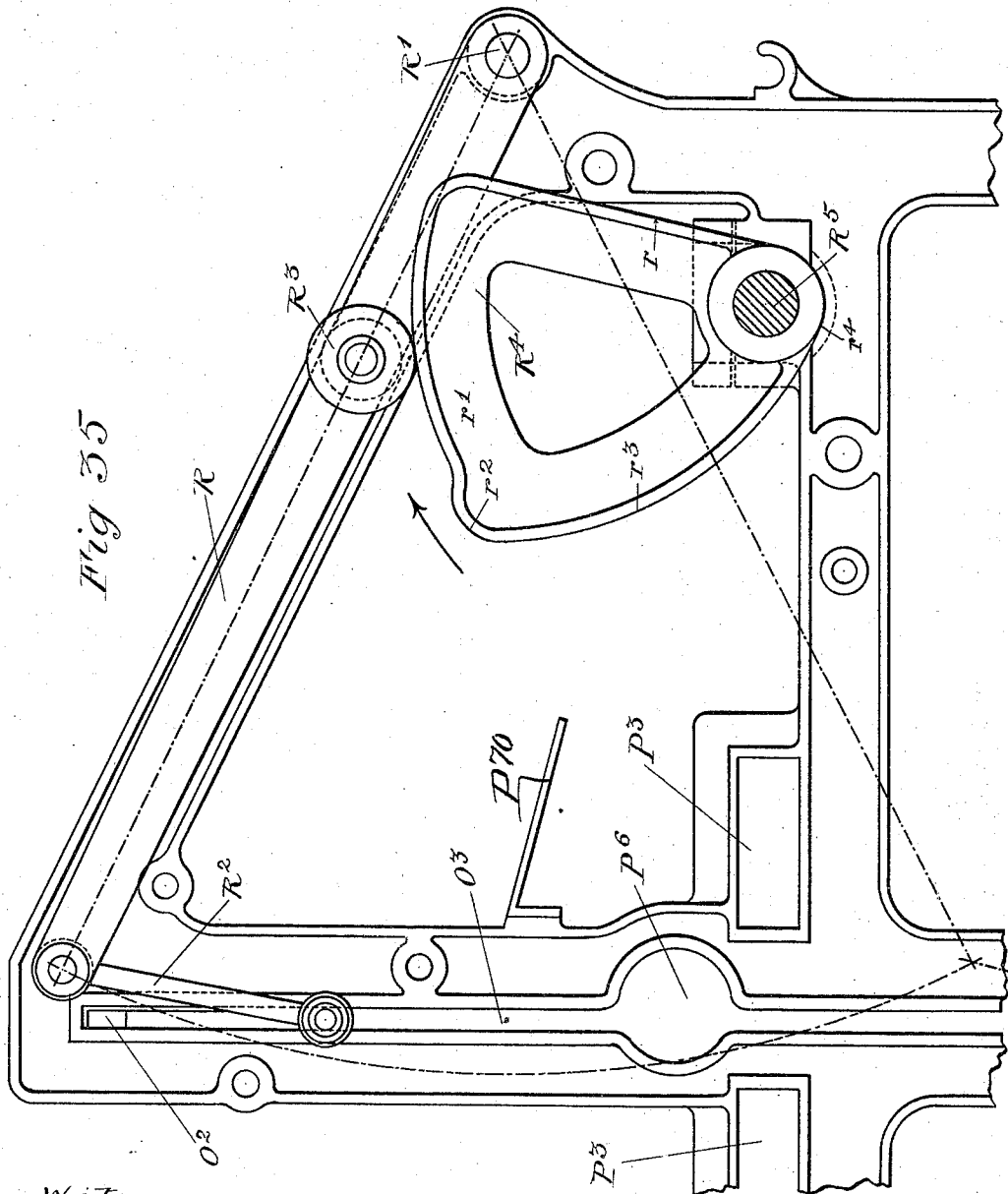
(No Model.)

18 Sheets—Sheet 11.

R. VON SEYDLITZ.  
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Patented Jan. 29, 1895.



Witnesses  
*A J Maddy*  
*Al Melhuish*

Inventor  
*R von Seydlitz*

by his Attorney *R Maddy*

R. VON SEYDLITZ.  
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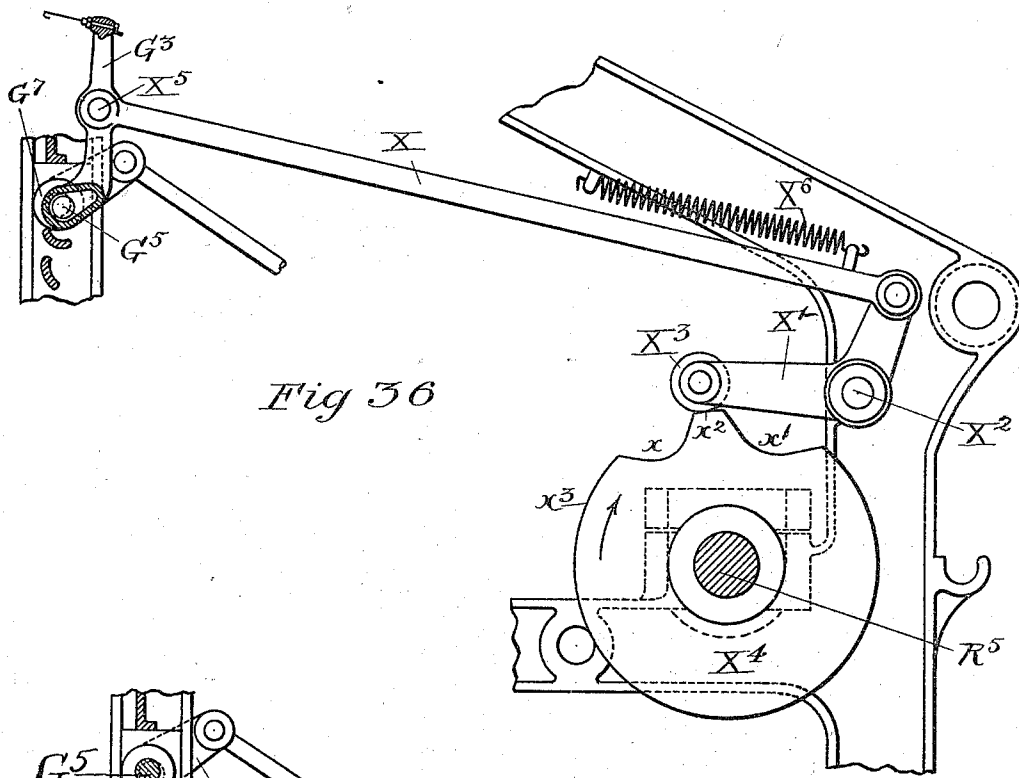


Fig 36

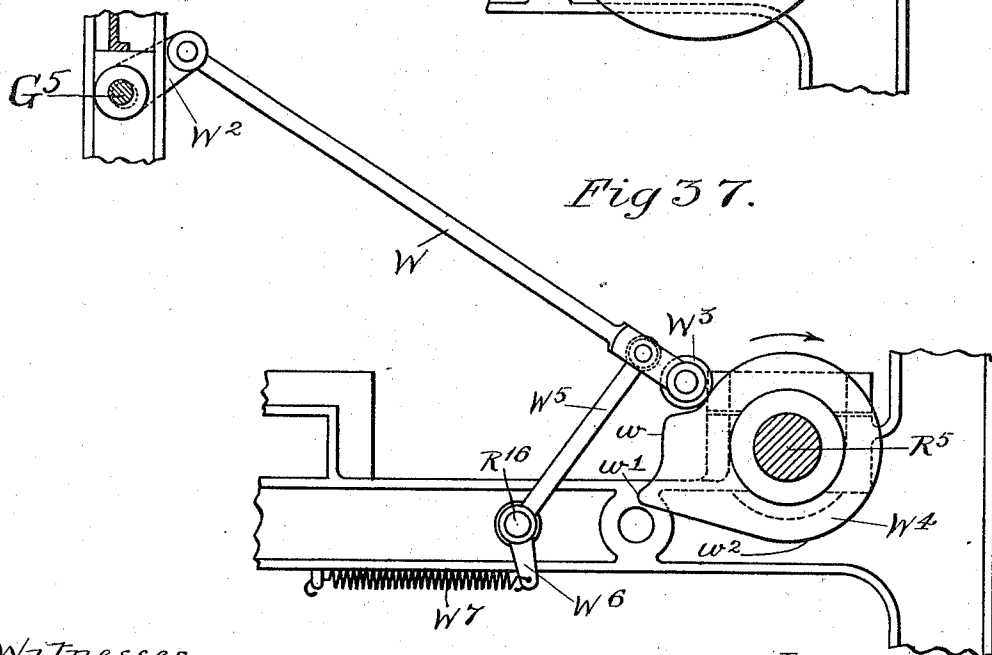


Fig 37.

Witnesses

*A. J. Haddan*  
*A. E. Melhuish*

Inventor

*R. von Seydlitz*

by his Attorney. *A. J. Haddan*



(No Model.)

18 Sheets—Sheet 14.

R. VON SEYDLITZ.  
LOOM FOR WEAVING TURKISH CARPETS.

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Patented Jan. 29, 1895.

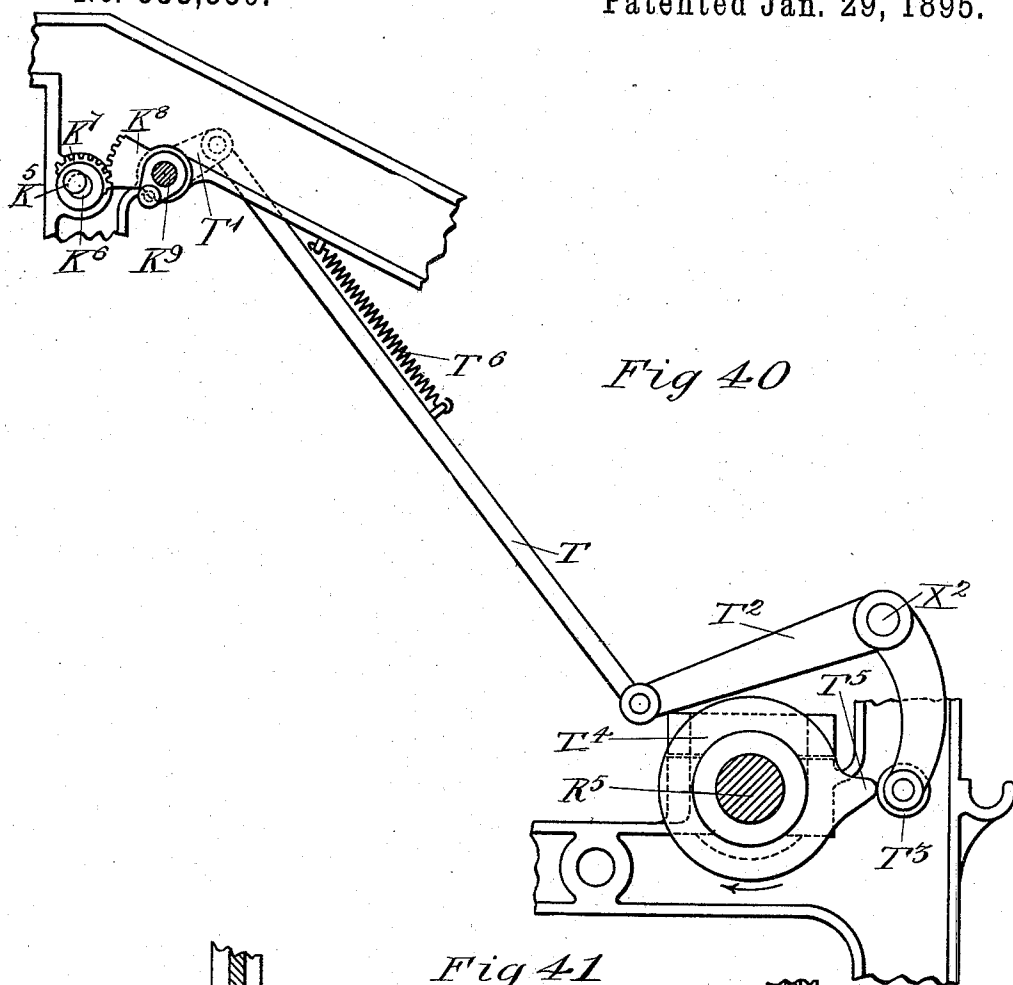


Fig 40

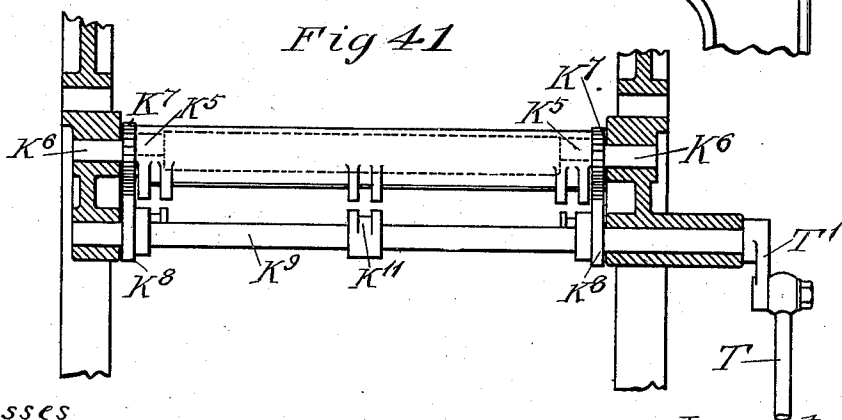


Fig 41

Witnesses

*R J Maddaw*  
*Al Melhuish*

Inventor

*R von Seydlitz*

by his Attorney *R Maddaw*

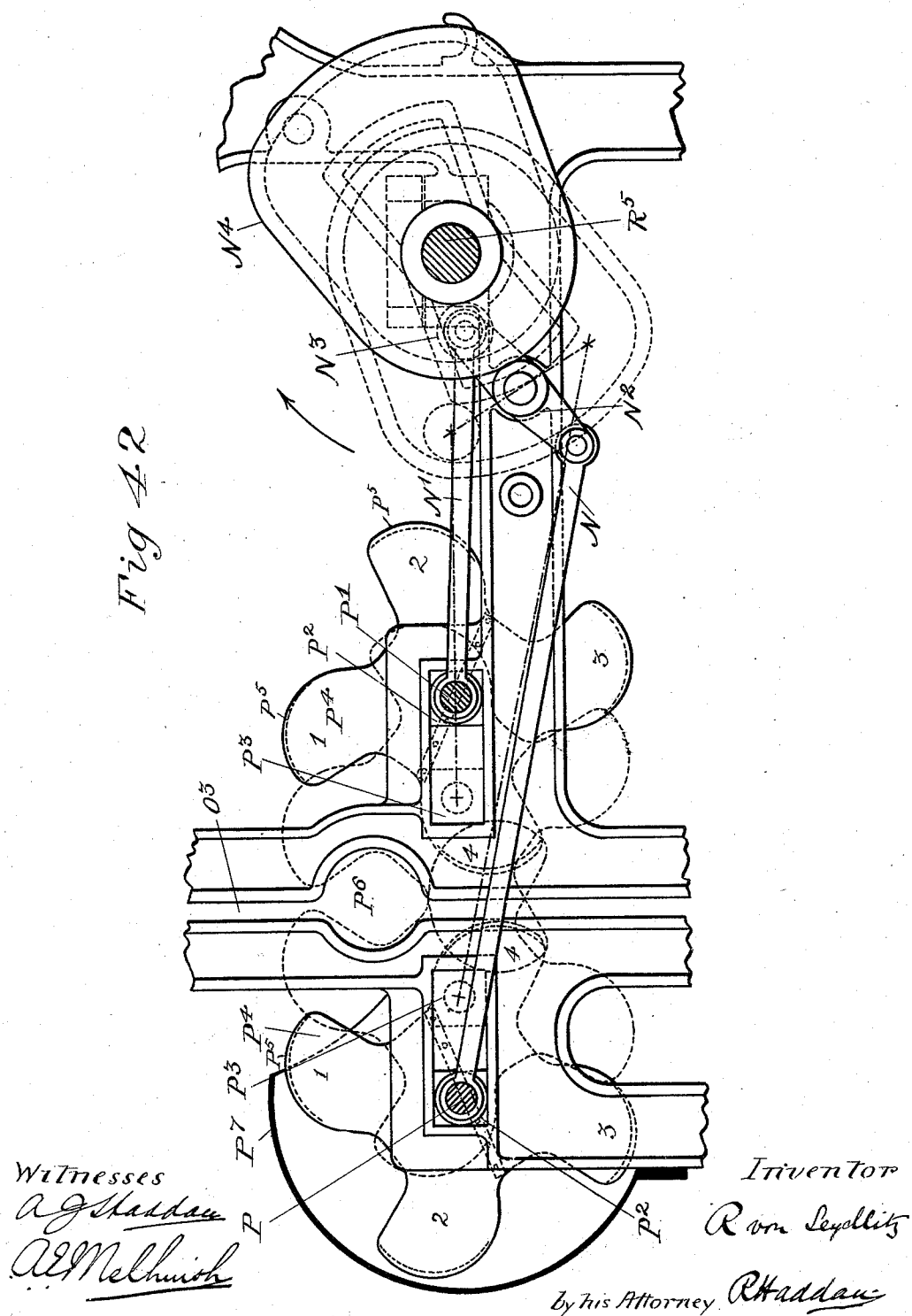
(No Model.)

18 Sheets—Sheet 15.

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R. VON SEYDLITZ.  
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Fig 43

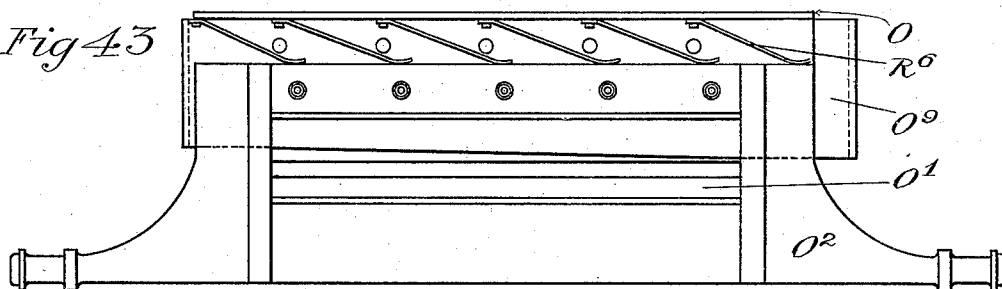


Fig 44

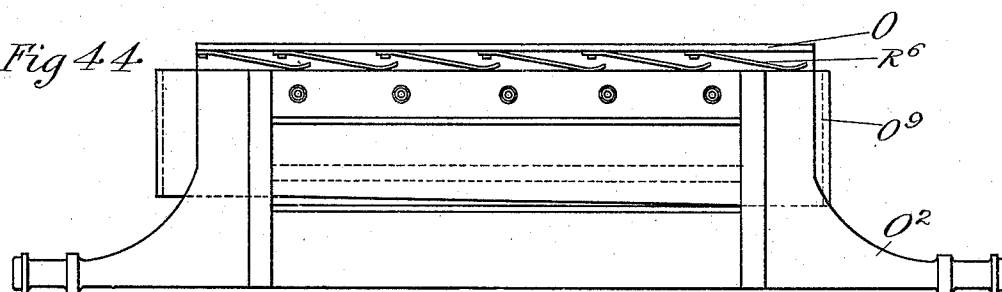


Fig 45

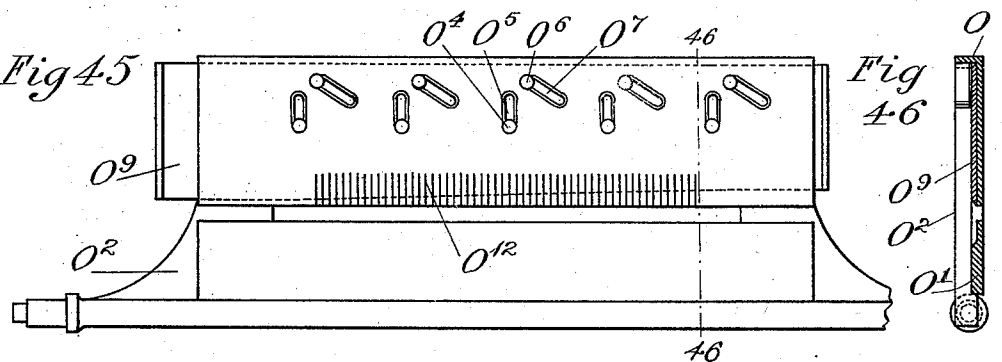


Fig 46

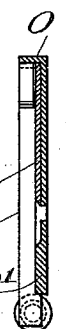
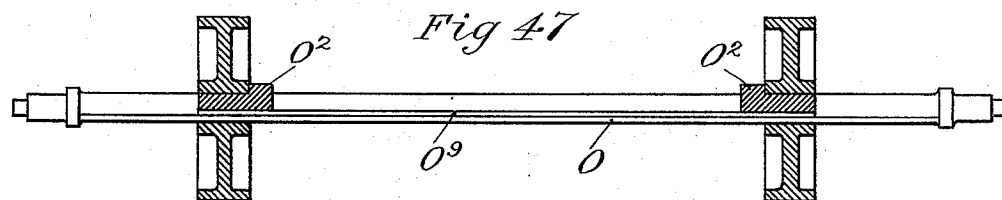


Fig 47



Witnesses  
*A. J. Shaddan*  
*A. E. Melhuish*

Inventor  
*R. von Seydlitz*  
by his Attorney *R. Shaddan*

R. VON SEYDLITZ.  
LOOM FOR WEAVING TURKISH CARPETS.

No. 533,330.

Patented Jan. 29, 1895.

Fig 48.

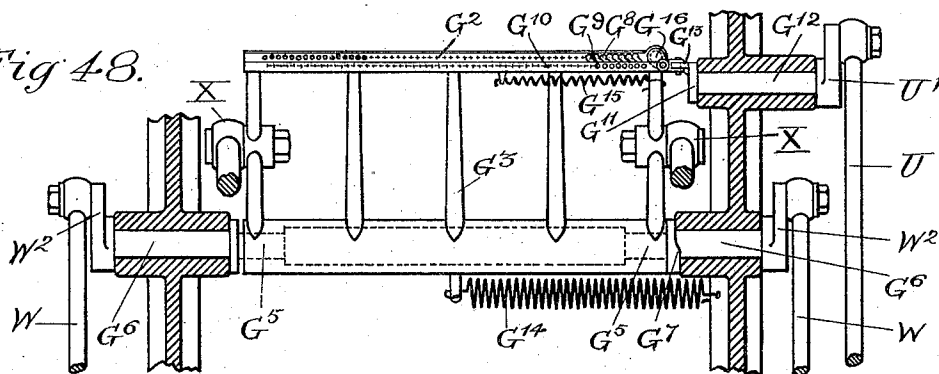


Fig 49.

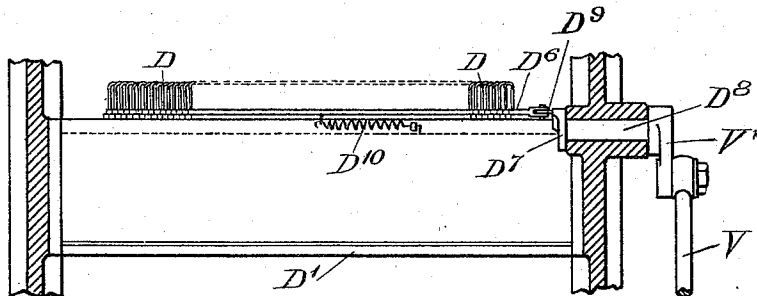


Fig 50.

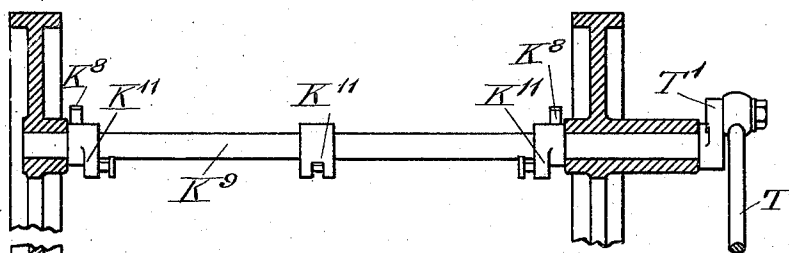


Fig 51

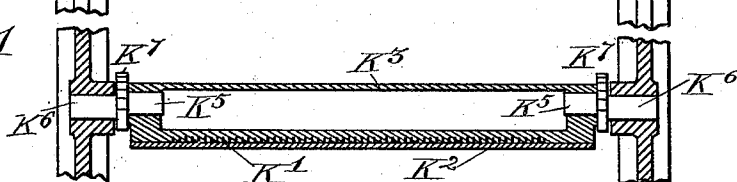
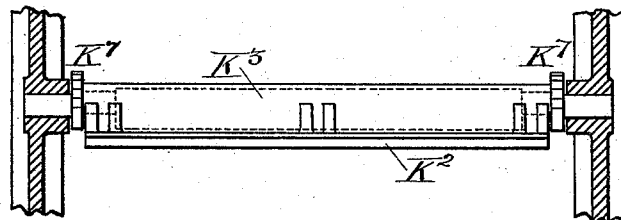


Fig 52.



Witnesses

A J Haddan

Al Melhuish

Inventor

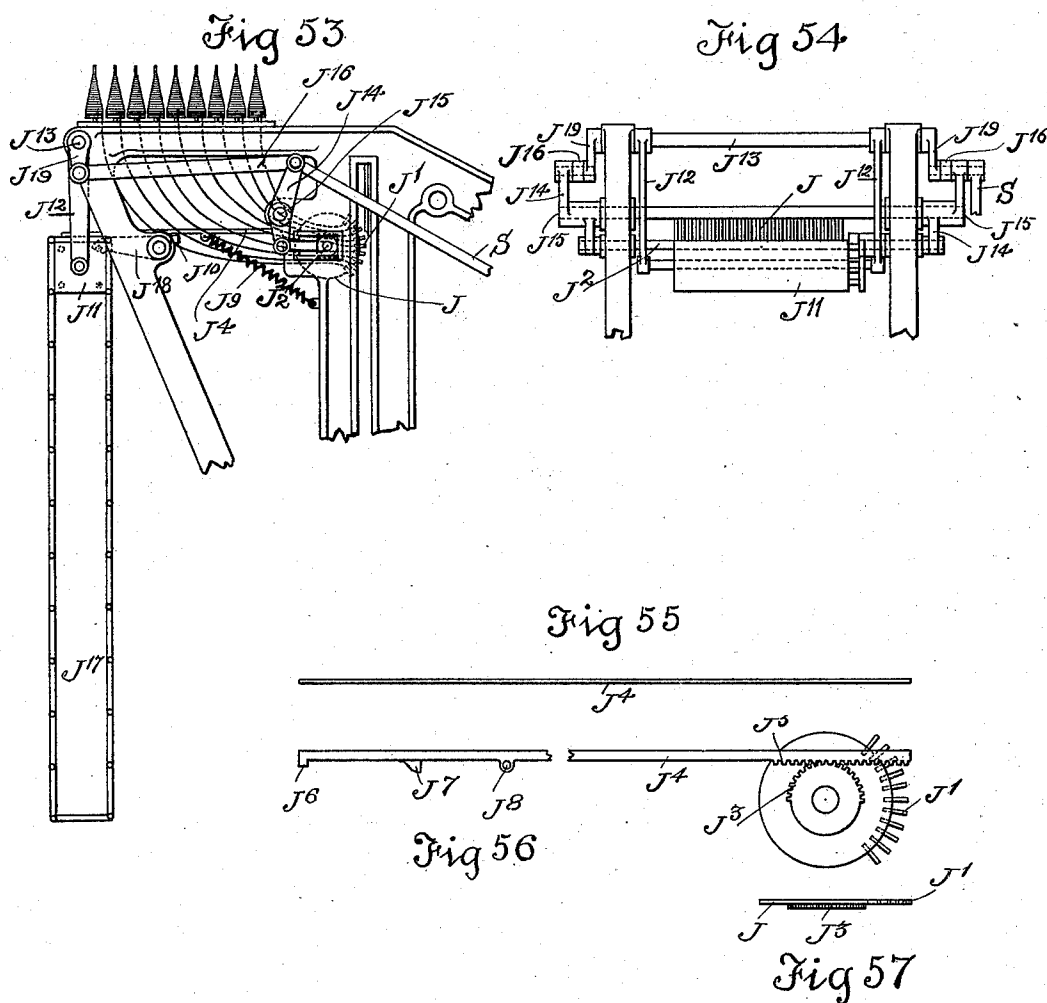
R von Seydlitz

by his Attorney R Haddan.

R. VON SEYDLITZ.  
LOOM FOR WEAVING TURKISH CARPETS.

No. 533,330.

Patented Jan. 29, 1895.



Witnesses.

*A. J. Stadden*  
*A. E. Melhuish*

Inventor

*R. von Seydlitz*  
by his Attorney *A. J. Stadden*

# UNITED STATES PATENT OFFICE.

REINHART VON SEYDLITZ, OF MUNICH, GERMANY.

## LOOM FOR WEAVING TURKISH CARPETS.

SPECIFICATION forming part of Letters Patent No. 533,330, dated January 29, 1895.

Application filed March 21, 1890. Serial No. 344,987. (No model.) Patented in Germany March 12, 1889, No. 51,429; in England April 1, 1889, No. 5,560; in Belgium April 15, 1889, No. 85,632; in France May 27, 1889, No. 197,108; in Italy August 1, 1889, No. 25,390, and in Austria-Hungary September 28, 1889, No. 14,743 and No. 32,758.

*To all whom it may concern:*

Be it known that I, REINHART VON SEYDLITZ, a subject of the King of Bavaria, and a resident of Munich, Bavaria, Germany, have invented a new and useful Improvement in Looms for Weaving Turkish Carpets and Like Fabrics, (for which I have obtained patents in Austria-Hungary, No. 14,743 and No. 32,758, dated September 28, 1889; in France, No. 197,108, dated May 27, 1889; in Belgium, No. 85,632, dated April 15, 1889; in England, No. 5,560, dated April 1, 1889; in Germany No. 51,429, dated March 12, 1889, and in Italy, No. 25,390, dated August 1, 1889,) of which the following is a specification.

This invention relates to the weaving of Turkish carpets, and other pile fabrics woven or made on the same system, and the object of the improvement is to facilitate the introduction and knotting of the wool or material of which the pile is formed and to provide mechanical means for this purpose and generally for the weaving of such goods.

The improvement consists first in devices for bending the warp at the place of introduction of the wool for the pile so that the yarn may be passed between, around and over the warp threads in a manner necessary to form a "Turkish" knot by a combination of fewer movements than heretofore, namely by two longitudinal movements one forward and one back combined with an intermittent lateral movement, this bending of the warp being effected by said devices which consist of a series of curved tubes, each warp thread being supported in a separate tube, these tubes being preferably bent so that the parts of the warp threads passing from the ends of said tubes lie parallel the one to the other or nearly so.

Further improvement lies in the mechanism by which the warp threads are separated to form a shed or sheds for the weft while obviating direct attachment of the said mechanism or any part of it to the warp threads by which the carrying down of the knots onto the fabric would be obstructed.

Further improvement lies in the various parts and operating combinations of the mechanical loom which are hereinafter described and specifically claimed and serve for the

weaving of a true Turkish carpet fabric or the like without hand knotting.

Reference being made to the accompanying drawings: Figure 1 is a vertical cross section from front to rear of a loom embodying my invention. Fig. 2 is a section of a portion of the upper part thereof in a plane parallel to the warp threads and illustrating the end of the loom as seen from the back with the part to the right of the line *ab* Fig. 1 removed. Fig. 3 illustrates the connection with the knot holding frame of the mechanism for operating the knife to sever the knot from the yarn feed. Fig. 4 is a detail view of said mechanism. Fig. 5 is a section on a larger scale in the same plane as Fig. 1 showing more particularly the warp tubes, the yarn hooks for passing the yarn through and around the warps and the frame holding the shanks of said yarn hooks. Fig. 6 is a longitudinal section through part of the shaft of the said frame illustrating the cross throw cam for occasioning lateral movement of said frame. Fig. 7 is a vertical view from the rear of part of the said frame, the warp tubes and mechanism for giving to the shanks of the yarn hooks their partial rotatory movements. Fig. 8 is a plan view of part of the tubes, yarn hooks and yarn feeds, each pair commencing from the left being so drawn as to illustrate a successive stage in the drawing of the yarn. Fig. 9 is a similar view of the same parts the first four pairs from the left showing each pair a further successive stage of the movement of the tubes the pair on the right showing the back loop of yarn shifted over onto the front bend of the tubes and the formation of the Turkish knot. This figure also shows in plan the operating mechanism for the tubes. Fig. 10 is a vertical section showing the yarn drawn to position 6 in Fig. 8. Fig. 11 is a similar view with the drawing of the yarn completed as in position 10 Fig. 9. Fig. 12 shows the same with an additional length of yarn drawn from the feed to leave, after the knot is cut off from the feed, a sufficient quantity of yarn projecting from the feed tubes for engagement of the yarn hook when another knot of that colored yarn is to be made. Fig. 13 illustrates a modification in the form of the free

end of the inner yarn tube which is curved outward to bring the warps more nearly into one plane. Fig. 14 is a section in direction of the warp and Fig. 15 is a section across the warp showing finished knots. Fig. 16 is a section showing a prong of a comb and its operating mechanism for moving the loops of yarn over onto the front of the yarn tubes (position 9 Fig. 9). Fig. 17 is a plan view of part of the comb aforesaid. Fig. 18 shows said mechanism (Fig. 16) in position when the loop is moved over as aforesaid (position 10 Fig. 9) and also the knot carrier and its knife 9. Fig. 19 shows in plan part of the two systems of disks forming substitutes for the leashes or healds and the mechanism for bringing into action and drawing same. Fig. 20 is a broken elevation of the upper part of the knot carrier. Fig. 21 is a sectional plan view of the face thereof showing guides for the knots therein and also the ends of the prongs of the loop throwing comb. Fig. 22 is a section illustrating the knot carrier embracing the knot ends and knife about to sever the knot. Fig. 23 is a similar view showing the knife in position after severance of the knot from the yarn feed. Fig. 24 is a side elevation of the loom showing parts omitted in Fig. 1. Fig. 25 is a plan view and Fig. 26 a front elevation thereof. Fig. 27 is a rear elevation of the upper part of the loom on a larger scale. Fig. 28 is a side elevation of the devices for operating the knot carrier and its knife. Fig. 29 is a rear elevation of part of said devices. Fig. 30 is an oblique plan and Fig. 31 an oblique front elevation of the head of said devices nearest the carrier. Fig. 32 is a side elevation of that part of the devices for operating the knot carrier which causes the latter to be unlocked when in its lowest position, and also causes the rolling up of the carpet as it is woven. Fig. 33 is a plan view of part of the devices for unlocking the knot carrier as aforesaid. Fig. 34 illustrates in side elevation the automatic tensioner for the warp beam. Fig. 35 is a side elevation of the devices for moving the knot carrier. Fig. 36 is a side elevation of the devices for reciprocating the yarn drawing hooks. Fig. 37 is a side elevation of the devices for causing the vertical reciprocation and also lateral reciprocal displacement of the said yarn drawing hooks. Fig. 38 is a side elevation of the devices for causing the aforesaid yarn drawing hooks to be twisted on their respective axes. Fig. 39 is a side elevation of the devices for twisting the warp tubes. Fig. 40 is a side elevation of the devices for operating the comb which throws over the loops of yarn. Fig. 41 is a plan view of part of the said devices. Fig. 42 is a side elevation of the devices for operating the shedding disks. Fig. 43 is a front elevation of the knot carrier with its upper batten lifted. Fig. 44 is a similar view showing the upper batten locked down on the lower. Fig. 45 is a rear elevation of the parts shown in Fig. 44. Fig. 46 is a cross section thereof on line 46—46 of

Fig. 45. Fig. 47 is a sectional plan view thereof. Fig. 48 is a rear elevation of the yarn hook frame. Fig. 49 is a rear elevation of the warp tube frame. Fig. 50 is a rear elevation of the comb rocking shaft. Fig. 51 is a sectional view of the comb, and Fig. 52 is a rear elevation of the latter. Fig. 53 is an elevation from the side and Fig. 54 an elevation from the left of Fig. 53 showing the mechanism for feeding different colored yarns for the pile of the fabric with part of the framework of the loom adjacent thereto. Fig. 55 shows in plan one of the Jacquard rods of this mechanism. Fig. 56 shows this rod in side elevation with the yarn feed disk that it governs. Fig. 57 shows said disk in plan view.

Referring to Fig. 1, A is the warp which is wound on the warp beam B conveniently placed in the loom. From the warp beam B the warp passes under a cross rail C whence it passes upward to the curved tubes B, where the pile knots are formed (these tubes being hereinafter called warp tubes) and through said tubes, each warp thread through a separate tube, down under the second cross rail C' near which the fell of the fabric will be, thence to the cloth beam B'. The warp between the rail C and the tubes D is substantially parallel to that between the said tubes and the rail C' for saving of space and better arrangement of the yarn hook frame and parts behind the warp tubes. The warp between the warp beam and the rail C must pass in a direction to be clear of that part of the mechanism being a series of disks with grooved edges which as a substitute for leashes and healds throws outward and inward alternately certain of the warp threads to form a shed for the passage of the weft shuttle, these parts being hereinafter referred to as wing disks. The distance from the warp tubes to the rail C' should be sufficient for the proper formation of a shed by alternate side thrusts of the warp threads by the wing disks, a cross rail C<sup>2</sup> being arranged below the cross rail C to prevent those warp threads which are thrust inward when the shed is formed from interfering with the warp threads where they pass under the cross rail C.

Referring more particularly to Figs. 5 to 15 which illustrate the warp tubes and yarn hooks the object being to form knots of yarn about each two warps as shown in plan in Fig. 15, in side view in Fig. 14 (where E' is the completed yarn knot F the weft) to make the ordinary Turkish carpet knot it is necessary to pass the yarn back between the respective warp threads, around one warp thread, over the front of the two warp threads back around the second warp thread and through to the front again between the respective warp threads. The ends of the tuft so inserted form the pile. By bending the warp threads however according to this invention the same knot can be made by drawing the yarn between the warps at the front around them

behind and through again between them in front (a combination of three movements only) sliding afterward the loop formed round the back of the bend over onto the front of the bend. To allow passage of the yarn hooks for drawing the yarn, the warp tubes must be movable in pairs about one of their limbs.

D' is a cross frame, a part of the framework of the loom, and on the upper end of this frame is a forwardly projecting flange D<sup>2</sup> having a row of vertical holes D<sup>3</sup> drilled through it equal in number to half the number of warp threads. In each of said holes D<sup>3</sup> is fitted the tubular extension D<sup>4</sup> of a block D<sup>5</sup> supported on the upper face of the flange D<sup>2</sup>. Each block D<sup>5</sup> carries two inverted U-shaped tubes D, one limb of each tube being firmly fixed in the block, in a line with the tubular extension D<sup>4</sup> aforesaid so that the two tubes move together as a pair when the block D<sup>5</sup> is revolved in its socket, and always maintain the same relative position to each other and to the block in which they are fixed. The tubes D rise with their limbs perpendicular to the block, the one slightly inside the other, and are curved round at a suitable distance from the block, where the one is curved somewhat to the right and the other to the left so that the depending free limbs of the said tubes are parted sufficiently each to come close to the adjacent tube of the pair of tubes respectively on the right and left. These free depending limbs of the said tubes project downward beyond the edge of the block supporting it (Fig. 5). One of each pair of said tubes is bent to a smaller curve than the other so that the smaller tube of each pair may pass under the larger tube of the next pair (Figs. 8 and 9). The blocks D<sup>5</sup> extend to a certain distance rearward of the tubes and are provided with studs or pins D<sup>15</sup> by which attachment of all the blocks to one common cross bar D<sup>6</sup> is contrived so that by longitudinal reciprocation of this cross bar (Fig. 9) by means of the cross throw cam D<sup>7</sup> on the shaft D<sup>8</sup> acting on the wheel D<sup>9</sup>, journaled in the end of said cross bar and counter action of a spring D<sup>10</sup> Fig. 49, the blocks D<sup>5</sup> with the warp tubes D are vibrated at certain times from the position shown in Fig. 8 to that in Fig. 9, and vice versa, so that direct passage is arranged for the yarn hooks in going and returning in the direction required for the proper arrangement of the yarn.

The cam D<sup>7</sup> is operated from the main shaft R<sup>5</sup> as follows:—On the shaft D<sup>8</sup> of cam D<sup>8</sup> is an arm V' (Figs. 49 and 39) to which the rod V is connected. The rod V carries a roller V<sup>2</sup> riding on cam V<sup>3</sup> on shaft R<sup>5</sup>, the said cam being for about three quarters of its circumference shaped as an arc  $v$  of a circle of larger radius than the arc  $v'$  forming the remaining quarter, allowance being made for inclines  $v^2$  from one arc  $v$  to the other  $v'$ . The rod V is upheld by the arm V<sup>4</sup> loose upon the gudgeon R<sup>16</sup> and having integral with it the arm

V<sup>5</sup> connected to the framework by a spring V<sup>6</sup> which causes the roller V<sup>2</sup> to follow closely the curvature of the cam V<sup>3</sup>.

The yarn hooks are constructed and operated as follows: Each yarn hook G is mounted with its shank on a holder G', all the holders being journaled in a row on the cross beam G<sup>2</sup> of a frame G<sup>3</sup>, provided with bearings G<sup>4</sup> on crank pins G<sup>5</sup> eccentrically placed on shafts G<sup>6</sup> so that oscillating movement may be given to the said frame about said crank pins by rods X as hereinafter explained and a certain amount of vertical or radial movement be given at certain times to said frame for a purpose hereinafter specified by rotation of said shaft G<sup>6</sup>. Reciprocal movement in the direction of its length of the beam G<sup>2</sup> is also given by the action of a cross throw cam G<sup>7</sup> (Fig. 6) on the shaft G<sup>6</sup> and counter action of a spring G<sup>14</sup> Fig. 48. The holder G' of each hook G extends through the beam G<sup>2</sup> and is provided with a crank G<sup>8</sup> each with a wrist pin or stud G<sup>9</sup> by which connection is made with a common cross bar G<sup>10</sup> to which a reciprocating motion is given by the action of the cross throw cam G<sup>11</sup> on shaft G<sup>12</sup> acting on the wheel G<sup>13</sup> journaled in the end of said bar and counter action of a spring G<sup>15</sup>, Fig. 48. For strength and durability, a crank of extra size G<sup>16</sup>, Figs. 7 and 48 is provided with gudgeons journaled in the end of the cross beam G<sup>2</sup> and in the bar G<sup>10</sup>, respectively. This mechanism provides for the simultaneous quarter rotation or oscillation of each yarn hook about its axis for engagement of the yarn previous to drawing it between the tubes.

The rocking of the frame G<sup>3</sup> on its crank pins G<sup>5</sup> is provided for as follows:—The rods X, Figs. 1, 36 and 48, are attached to frame G<sup>3</sup> at X<sup>5</sup>, and are moved each by an exactly similar mechanism, consisting of a cam X<sup>4</sup> on the shaft R<sup>5</sup> operating a bell crank lever X' pivoted on a gudgeon X<sup>2</sup> and connected at one end to rod X and having at the other end a roller X<sup>3</sup> moving on cam X<sup>4</sup>. The spring X<sup>5</sup> holds the roller to the cam. The cam X<sup>4</sup> consists for about three quarters of its circumference of an arc of a circle  $x^3$ , the remaining quarter comprising two bags  $x'$   $x$  divided by a part  $x^2$  of larger radius equal to that of part  $x^3$ .

The vertical and lateral reciprocating movements of the frame G<sup>3</sup> are given thereto by the mechanism in Fig. 37. The shafts G<sup>6</sup> (Fig. 48) of the crank pins G<sup>5</sup> carry respectively arms W<sup>2</sup> to each of which a rod W is attached having at its other end a roller W<sup>3</sup> riding on cam W<sup>4</sup> on shaft R<sup>5</sup>, and supported by an arm W<sup>5</sup> on the beforementioned gudgeon R<sup>16</sup>, the said arm W<sup>5</sup> having integral with it an arm W<sup>6</sup> connected by spring W<sup>7</sup> to the framework so that the roller W<sup>3</sup> is caused to closely follow the curvature of the cam W<sup>4</sup>. The said cam W<sup>4</sup> consists for nearly three quarters of its circumference of an arc of a circle  $w^2$  and has in the remaining quar-

ter a face  $w$  of greater elevation followed by a nose  $w'$  of yet greater elevation whence a tangential plane leads back to the arc  $w^3$ .

The yarn hooks are rotated by the following mechanism:—The shaft  $G^{12}$  of the cam  $G^{11}$  carries an arm  $U'$  connected by rod  $U$  to the bell crank lever  $U^2$  Fig. 38 pivoted on the beforementioned gudgeon  $X^2$  and carrying a roller  $U^4$  riding on the cam  $U^5$  on the shaft  $R^5$ . This cam is for nearly the whole of its circumference an arc of a circle with the exception of an elevation  $U^6$  on its periphery. The spring  $U^7$  holds the roller  $U^4$  to the cam.

The yarn feed consists for each hook of a disk  $J$  journaled to revolve and controlled by Jacquard mechanism to bring the respective tube  $J'$  with the colored yarn  $E$  required by the pattern in position for engagement of the yarn hook. The yarn feed tubes  $J'$  are arranged radially on the circumference of the disk  $J$  each tube carrying a different yarn supplied from a creel of bobbins behind the disks  $J$ .

The yarn feed disks  $J$  and the means for operating them are as follows:—Each disk  $J$  is, as shown in Fig. 57 composed of two flat and thin circular plates or disks mounted on the central boss which revolves loosely on the shaft  $J^2$  (Figs. 53 and 54) supporting all the disks. The yarn tubes  $J'$  are set radially between these plates. On the side of each disk  $J$  is a thin toothed wheel  $J^3$ , Fig. 56 and on the latter rests one of a series of rods  $J^4$  having teeth  $J^5$  for engagement with the wheel  $J^3$ . These rods  $J^4$  have at their outer ends the hooks  $J^6$  and at suitable places the lugs  $J^7$  and the eyelets  $J^8$ . By means of the eyelets  $J^8$  the rods are fastened to the frame of the loom by springs  $J^9$ , (Fig. 53) the tension of which tends to draw the rods  $J^4$  inward toward the loom. The lugs  $J^7$  arriving against a cross bar  $J^{10}$  limit the movement of the rods in this direction. Under the hooked ends of the rods  $J^4$  is suspended the Jacquard beam  $J^{11}$  carried by two arms  $J^{12}$ ,  $J^{12}$ , fixed on the shaft  $J^{13}$ . On the shaft  $J^2$  are two connecting rods by which the said shaft is connected to two bell crank levers  $J^{14}$ ,  $J^{14}$  pivoted at  $J^{15}$  and connected respectively, by connecting rods  $J^{16}$ ,  $J^{16}$ , to two cranks  $J^{19}$  on the shaft  $J^{18}$ . The rod  $S$  is continued sufficiently to connect it to one of the levers  $J^{14}$ . The Jacquard beam  $J^{11}$  is of usual construction, being four sided or faced and provided with projections to engage the cards of the series  $J^{17}$  having perforations according to the pattern in which the hooks  $J^6$  are intended to engage. The detent  $J^{18}$  is provided to revolve the beam  $J^{11}$ . The operation of these parts is as follows:—The movement of the rod  $S$  causes the lever  $J^{14}$  to be moved simultaneously with the knife  $O^9$  so that the lever  $J^{14}$  is drawn inward moving outward the shaft  $J^2$  and drawing inward the Jacquard beam, by which means it is revolved for a quarter turn. The rods  $J^4$  resting with their hooks in the holes of the previous card, are lifted clear of such holes by

the edge of the card, and being drawn back by the springs  $J$  arrive with their lugs  $J^7$  against the cross bar  $J^{10}$ , the succeeding card rising under the hooks, while the beam is moved outward again, the hooks fall into the respective holes therefor in the card as each passes under the respective hook, after which the rods  $J^4$  are respectively drawn along with the card, revolving the disks  $J$  until the respective color is in position for the next drawing of yarn.

The method of drawing the yarn is as follows: The warp tubes  $D$  being in their first position (Fig. 8) the frame  $G^3$  moves forward, the hooks  $G$  pass between the tubes (through the larger tubes) and arrive beside the dependent ends of yarn  $E$  (position 1 Fig. 8). The hooks are then rotated (into position 2 Fig. 8) then slightly drawn back (position 3 Fig. 8) to engage the yarn and again turned downward (position 4) with the yarn hooked in them. The frame then retires and draws the yarn (position 5) behind the warp tubes  $D$  (position 6 Fig. 8) and at this point the warp tubes are vibrated to the left into the position shown in Fig. 9. The frame  $G^3$  is then moved, laterally to the left and the yarn is carried into the position 7 shown on the left of Fig. 9. The hooks  $G$  are then again thrust forward between the warp tubes (successive positions 8 and 9 Fig. 9) until the trailing end of the yarn arriving free of the tubes  $D$  straightens out of its own elasticity (position 10 and Fig. 11), and frees the end of the hook so that the latter can be and is then withdrawn (Fig. 12). The lifting of the frame  $G^3$  occurs between the positions 6 and 7 so that the hooks lift the yarn sufficiently that in passing back between the tubes, the yarn does not interfere with, or disturb the drawing of, the yarn around the next pair of warp tubes to the left. The loop of yarn being in the position shown at 10 Fig. 9 and in Fig. 12 and the ends of the tube  $D$  being parallel, it is necessary to shift the light of the loop over onto the front of the warp tubes before gripping the ends of said knot, cutting off from the yarn feed and carrying down the knot and tightening it on the fabric. To carry over the loops as aforesaid a comb  $K$ , Fig. 16, is provided consisting of a number of parallel fingers or prongs  $K'$  having serrated or recessed ends for better hold of the yarn. These fingers  $K'$  are secured by the plate  $K^2$  bolted onto the frame  $K^3$ , the bearings  $K^4$  of which are supported on gudgeons or crank wrists  $K^5$  eccentrically placed on the shaft or shafts  $K^6$  to which oscillating motion is given by toothed segments  $K^7$   $K^8$  from rock shaft  $K^9$  for the lifting movement of the comb, the frame  $K^3$  being also connected by rod  $K^{10}$  to crank  $K^{11}$  on the said rock shaft  $K^9$  to give oscillation to the frame  $K^3$  on its bearings, the combination of these motions giving movement to the fingers  $K'$  so that their ends follow the curved path necessary for engaging, carrying over and releasing the loops, the latter being

thereafter in the position shown in Fig. 18 or on the extreme right (position 11) of Fig. 9. This comb and its operating parts are also shown in Figs. 40 and 41, and 50 to 52. The shaft K<sup>9</sup> is provided with an arm T<sup>7</sup> connected by rod T to the bell crank lever T<sup>2</sup> pivoted on gudgeon X<sup>2</sup> and having a roller T<sup>3</sup> riding on cam T<sup>4</sup> on the shaft R<sup>5</sup>. The spring T<sup>6</sup> holds the roller T<sup>3</sup> to the cam, which is for the greater part of its circumference an arc of a circle with an elevation T<sup>5</sup> for the remainder.

The knot carrier for gripping the ends of the knots (after cutting off) and carrying them down onto the fabric, tightening the knots in the operation consists of two plates O O' arranged in the same vertical plane to seize both the loose end of the knot and the yarn still connected with the yarn feed between their opposite parallel edges. O<sup>2</sup> is a cross frame consisting of two beams movable up and down in the guide slots O<sup>3</sup> in the side frames of the loom. The upper beam carries the plate O which is fastened to it by bolts O<sup>4</sup> passing through vertical slots O<sup>5</sup> in the plate O and fastened in the beam so that the upper plate O has a certain amount of free vertical movement on its supporting beam limited by the length of the slot. The lower plate O' is firmly secured to the lower beam of the frame O<sup>2</sup>. The upper edge of the plate O is turned back as shown in Figs. 22 and 23 and on the under side of the flange so formed are secured the springs R<sup>6</sup> which press upon the upper edge of the frame O<sup>2</sup> and tend to lift the plate O so as to hold it separated from the plate O'.

The knife O<sup>9</sup> for severing the knots from the yarn feed is located between the upper plate O and the beam supporting it, the said knife being in the form of a plate having slots O<sup>10</sup> for its passage over the bolts O<sup>4</sup> connecting the plate O with the beam and also itself connected to the plate O by bolts O<sup>6</sup> fastened in it, projecting into slots O<sup>7</sup> in the plate O. The slots O<sup>10</sup> are in their upper part inclined, such part being equal in length to and parallel with the slots O<sup>7</sup>. From the upper end of this inclined part the slot is continued horizontally at O<sup>11</sup>, and from the lower end of the said inclined part, the slots O<sup>10</sup> are continued vertically downward to correspond with the slots O<sup>5</sup>. These parts are operated in the following manner:—The yarn feed disks are drawn outward as previously described with reference to Figs. 53 to 57 to be free of the course of the frame O<sup>2</sup> and also so that a certain amount of yarn may be drawn from the feed tube to leave, after the knot is cut off, sufficient yarn hanging from the tube for engagement of the yarn hook when the next knot is made from that supply (position in Fig. 12). The frame O<sup>2</sup> then rises until the lower fixed plate O' presses against the upper plate O (the upper edge of which lies against the cross beam O<sup>8</sup> of the loom frame) and firmly grips the ends of the yarn between the plates O and O'. This movement of the frame O<sup>2</sup> will have brought the bolts O<sup>4</sup> to the top of the slots O<sup>5</sup>,

and will have also brought the springs R<sup>6</sup> into compression. The knot is then severed from the yarn feed by a horizontal thrust given to the knife O<sup>9</sup> this thrust being transferred into an oblique downward movement by the inclination of the slots O<sup>7</sup> and O<sup>10</sup>. This motion cuts the yarn and also locks the plate O down on the plate O' against the tendency of the springs R<sup>6</sup> to separate these plates by the locking of the bolts O<sup>4</sup> in the upper ends of the slots O<sup>5</sup> by the end O<sup>11</sup> of the slots O<sup>10</sup>. The frame O<sup>2</sup> then moving downward carries the plates O O' so locked together until the knot is carried down onto the fabric located at the cross rail C'.

To carry down the knots equally and without disarrangement, the plate O is provided on its outer face with thin projecting ribs O<sup>12</sup> so that as the knot holder descends, its distance from the warp is gradually increased and the knots are thus drawn tight. Figs. 43 to 47 show the full extent of the knot carrier, Figs. 4, 28 to 31 the mechanism for locking it by intrust of the knife. On a bracket S<sup>7</sup> near the top of the loom is pivoted the angle lever S' having on one arm the roller S<sup>2</sup> adapted to bear on the end of the knife O<sup>9</sup> when the knot carrier is in the upper end of its passage way O<sup>3</sup>. The other arm of lever S' is connected by rod S to the lever S<sup>3</sup> pivoted at S<sup>4</sup> on the bracket S<sup>5</sup> and having a roller S<sup>6</sup> bearing against the periphery of cam S<sup>7</sup> whose circumference consists of a circle with but one projection S<sup>8</sup>. The cam S<sup>7</sup> is fixed on the shaft R<sup>5</sup> by which this and other parts of the loom are driven, the said shaft R<sup>5</sup> being provided with fast and loose pulleys R<sup>7</sup>, Fig. 25, for belt driving. After the knot carrier has taken the row of knots to the fabric, the bars O, O' must be unlocked so as to free the knot ends. This is effected by the mechanism shown in Figs. 32 and 33. On the opposite side of the loom to that on which the angle lever S' is situated, is a similar lever S<sup>9</sup> in a bracket S<sup>18</sup> near the bottom of the passage way O<sup>3</sup>. This lever S<sup>9</sup> carries on one arm a roller S<sup>10</sup> adapted to meet the end of the knife O<sup>9</sup> and thrust it inward when moved by the rod S<sup>11</sup> operated by the bell crank lever S<sup>12</sup> pivoted on gudgeon R<sup>16</sup> and having a roller S<sup>13</sup> riding on the same cam T<sup>4</sup> which operates the comb mechanism before described. The spring S<sup>14</sup> holds the roller S<sup>13</sup> to the cam, this spring acting through the rod S<sup>15</sup> which connects the lever S<sup>12</sup> to the bell crank lever S<sup>16</sup> which is used to operate the winding up its of the finished carpet on its beam B'. This winding is done as follows:—The beam B' rests by its weight on the roller B<sup>4</sup> which is revolved through the gear B<sup>5</sup> B<sup>6</sup> from

the ratchet wheel B<sup>7</sup> which is turned one tooth at each stroke by the hook B<sup>8</sup> on the lever S<sup>16</sup>. B<sup>9</sup> is a pawl to prevent back turn of ratchet wheel B<sup>7</sup>. The knot carrier is moved in its passage way as follows: To gudgeons on the frame O<sup>2</sup> are connected rods R<sup>2</sup> connected severally to levers R pivoted at R' (Fig. 35) and carrying rollers R<sup>3</sup>. At each end of the loom is a cam R<sup>4</sup> operating against the roller B<sup>3</sup> of the respective lever R and mounted on the shaft R<sup>5</sup>. This cam comprises a surface  $r'$  being an arc of a circle subtending an angle of about forty-five degrees followed by a short elevation  $r^2$  and the latter by a curved slope  $r^3$  to an arc of a circle  $r^4$  subtending an angle of about one hundred and twenty degrees whence a tangential incline  $r$  leads back to the arc  $r'$ . Having completed a row of knots in this manner, the warp threads are separated to form a shed for the passage of the shuttle. For this purpose two shafts P P' are arranged in the same horizontal plane parallel to each other and to the plane of the warp threads one on each side of the latter at a suitable place between the warp tubes D and the cross rail C'. These shafts are journaled in bearing blocks P<sup>2</sup> sliding in horizontal guides P<sup>3</sup> in the frame of the loom. On these shafts P P' are a number of wing disks P<sup>4</sup> each with four projecting wings equal and similar in shape or substantially so, projecting radially from them. The disks P<sup>4</sup> are so arranged on each shaft P' and P<sup>2</sup> at slight intervals apart that when the shafts are moved together the projecting wings of the set of disks on the one shaft pass between the wings of the set of disks on the other shaft. The distance from center to center of any two adjacent disks on either shaft is equal to the distance from the center of one warp thread to that of the next warp thread but one so that when the shafts are moved together, the horizontally placed wings of the one set are interposed between those of the other set and the warp threads which were respectively met by said wings are deflected alternately outward and inward to form a shed for the shuttle which is thereupon thrown in the race made by the rear or upper edge of said interposed wings. Figs. 1 and 42 illustrate the wing disks in full lines in their separated positions in dotted lines in their positions of engagement. By rotation of the shafts P P' in contrary directions, the interposed wings are moved downward and the shoot of weft lying in the race falls down onto the fabric this being facilitated by the continued or renewed spreading of the warp threads in the same direction by the next following wings. For the return shoot of weft however the warp threads which were deflected to the left (Fig. 1) must now be pressed to the right, and those which were formerly pressed to the right must now be pressed to the left. This is rendered possible by constructing the wing disks so that one half of each disk with two wings is set laterally with regard to the other half with the other two

wings for an amount equal to the distance from center to center of two adjacent warp threads. Wings 1 and 2 therefore having acted as aforesaid wings 3 will change the shed and afford a race for return of the shuttle, and wings 4 will in turn continue the deflection of the warp so that the second shoot of weft falls in place. A complete revolution of the shafts P P' being thus made the latter retire to the limits of the guides of the bearings and the warp is tightened by the usual method of elastic winding employed. The outer system of wing disks is protected by the guard cover P<sup>4</sup>. A guard plate P<sup>70</sup> may be also placed over the inner set of disks as shown in Figs. 1, 24 and 35, between the said disks and the warp A coming from the warp beam. The slot O<sup>3</sup> is broadened at P<sup>6</sup> to give space for passage of the shuttle, the latter with its housing boxes and driving gear being of any usual construction.

The means for moving the shafts P P' toward and from each other comprises the following gear, (Fig. 42): The ends of the shafts P P' are respectively connected by rods N N' to the opposite ends of two centrally pivoted levers N<sup>2</sup> one at each side of the loom, and each of these two levers N<sup>2</sup> carries a roller N<sup>3</sup> moving in a track on the side of the cam disk N<sup>4</sup> also provided at each side of the machine. These cams N<sup>4</sup> cause the rocking movement of the levers N<sup>2</sup> which alternately moves the disks P<sup>4</sup> toward and from each other. The cams N<sup>4</sup> are on the shaft R<sup>5</sup>.

The revolution of the disks P<sup>4</sup> when in engagement is effected by the following mechanism: On the shaft R<sup>5</sup> (Figs. 19, 24 and 25) is a beveled toothed wheel Q<sup>6</sup> meshing with a beveled pinion Q<sup>5</sup> on the shaft Q<sup>4</sup>. The latter has keyed to slide on it, but not to revolve independently of the shaft, two beveled wheels Q<sup>2</sup> Q<sup>3</sup> meshing respectively with beveled wheels Q Q' on the ends of the shafts P P'. The wheels Q<sup>2</sup> Q<sup>3</sup> being carried in collars Q' Q<sup>3</sup> being parts of the bearing blocks P<sup>2</sup> P<sup>2</sup> of the shafts P P' follow the back and forth movement of these shafts. The outer edges of the wings of the disks P<sup>4</sup> are grooved as at P<sup>5</sup> Fig. 42 so that the warps are prevented from slipping off said wings when pressed apart thereby. The warps are tightened after deflection by the disks P<sup>4</sup> and at other times throughout the weaving by winding on the warp beam B in a contrary direction to the warp, a cord B<sup>3</sup> (Fig. 34) with a weight B<sup>3</sup> at one end thereof. The device is made self-compensating by passing the cord B<sup>3</sup> once or twice over the beam and attaching to one end the weight B<sup>3</sup> and to the other end a lighter weight B<sup>10</sup>, placing under the latter a shelf B<sup>12</sup>. Whenever the weight B<sup>10</sup> comes to rest on this shelf the cord B<sup>3</sup> slips slightly so that the weight B<sup>3</sup> cannot be overwound.

I claim for the weaving of Turkish carpet fabric and the like—

1. In a loom the combination of a series of curved tubes connected in pairs, a cross rail

supporting said tubes each at one end the said cross rail having open passages each in continuation of the openings of each pair of tubes for the purpose set forth.

2. In a loom the combination of a cross rail having a series of perforations therein a series of oscillatory blocks having tubular extensions fitting in said perforations and a series of curved tubes fitted in pairs at one end in said blocks respectively, the passages in said pairs of tubes being in continuation of the openings in said tubular extensions for passage of the warps through said tubes.

3. In a loom the combination of a cross rail having a series of perforations therein, a series of oscillatory blocks having tubular extensions fitting in said perforations and a series of curved tubes fitted in pairs at one end in said blocks respectively, the passages in said pairs of tubes being in continuation of the openings in said tubular extensions for passage of the warps through said tubes, wrist pins on said blocks and an oscillatory cross bar connecting all said wrist pins for simultaneous movement of said blocks and tubes.

4. In a loom the combination of a cross rail having a series of perforations therein, a series of oscillatory blocks having tubular extensions fitting in said perforations and a series of curved tubes fitted in pairs at one end in said blocks respectively, the passages in said pairs of tubes being in continuation of the openings in said tubular extensions for passage of the warps through said tubes, one tube of each pair being curved to a smaller radius than the other and directed underneath the larger tube of the next pair in the series substantially as set forth.

5. In a loom the combination of a series of curved warp holders D, a yarn feed in front of said tubes a series of yarn hooks G and means to operate said hooks to pass them between said tubes to draw the yarn between the tubes of each pair in front around the back of said pair of tubes and between them again to the front.

6. The combination of a yarn feed, a series of warp holders D movable in pairs a series of parallel yarn hooks G and means for imparting a reciprocal longitudinal movement to the said hooks to pass them between the tubes and to give them an alternate lateral movement across the back of the tubes substantially as set forth.

7. The combination of a yarn feed, a series of tubes D movable in pairs a series of parallel yarn hooks G and means for imparting a reciprocal longitudinal movement to the said hooks to pass them between the tubes and to give them a lateral movement alternating therewith across the back of the tubes, and a reciprocating rotary movement for engagement of the yarn substantially as set forth.

8. The combination of a yarn feed, a series of warp tubes D movable in pairs, a series of parallel yarn hooks G, rotary holders G'

for the shanks of said hooks a frame G<sup>3</sup> having the cross rail G<sup>2</sup> carrying said holders, shaft G<sup>6</sup> having cranks G<sup>5</sup> supporting said frame, cross throw cam G<sup>7</sup> on said shaft G<sup>6</sup>, crank levers G<sup>8</sup> on said holders G, reciprocating connecting rod G<sup>10</sup> attached to said crank levers and reciprocating rod X connected to said frame G<sup>3</sup> for the purpose set forth.

9. The combination with the curved warp holders D of means for passing a yarn round said warp holders the comb K and means to actuate the said comb to carry the loops of yarn formed round said holders over the curve thereof for the purpose set forth.

10 The combination with the curved warp holders D of the comb K consisting of blades K', frame K<sup>2</sup> K<sup>3</sup>, rock shafts K<sup>6</sup> with cranks K<sup>5</sup> for said frame and rock shaft K<sup>9</sup> with crank K<sup>11</sup> and connecting rod K<sup>10</sup> and gear segments K<sup>7</sup> and K<sup>8</sup> on said shafts respectively the whole substantially as and for the purpose set forth.

11. In a loom the combination of two series of parallel blades adapted to interleave the one series with the other, and means for moving the same respectively from contrary directions into and from such position of interleaf whereby the extremities of said blades are adapted to respectively meet and deflect in opposite directions warp threads lying in the plane of said blades, the said blades having that part of their upper lying edges which lies within the shed formed by the deflected warp threads parallel each to each and in the same plane when the blades are in position of interleaf whereby said edges form a track for supporting the weft shuttle in its throw through said shed.

12. In a loom the combination of two series of rotary disks P<sup>4</sup> P<sup>4</sup> each disk having four wings 1, 2, 3, 4, the wings 1 and 2 being in a plane distant from the plane of the wings 3 and 4 equivalent to the distance apart of the warp threads, and means for moving said disks from contrary directions against the warp to deflect the warp threads alternately for passage of the weft shuttle substantially as set forth.

13. In a loom the combination of a series of yarn feeds and yarn knotting mechanism of a frame O<sup>2</sup>, a plate O' fixed in said frame, a plate O, whose edge is parallel to the edge of plate O', vertically movable on said frame, the said plate O having slots O<sup>5</sup> O<sup>7</sup> therein, a knife O<sup>9</sup> having slots O<sup>10</sup> behind said plate O, bolts O<sup>6</sup> passing through slots O<sup>7</sup> and fixed in said knife, and bolts O<sup>4</sup> passing through the slots O<sup>5</sup> and O<sup>10</sup> and fixed in said frame O<sup>2</sup> substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

R. VON SEYDLITZ.

Witnesses:

J. MEICKAEDTS,

C. MEYER.