Sheet 1 - 6 Sheets.

J. Mc Mullen.
Netting Machine.

No. 4,608. Patented Jun. 27, 1846.

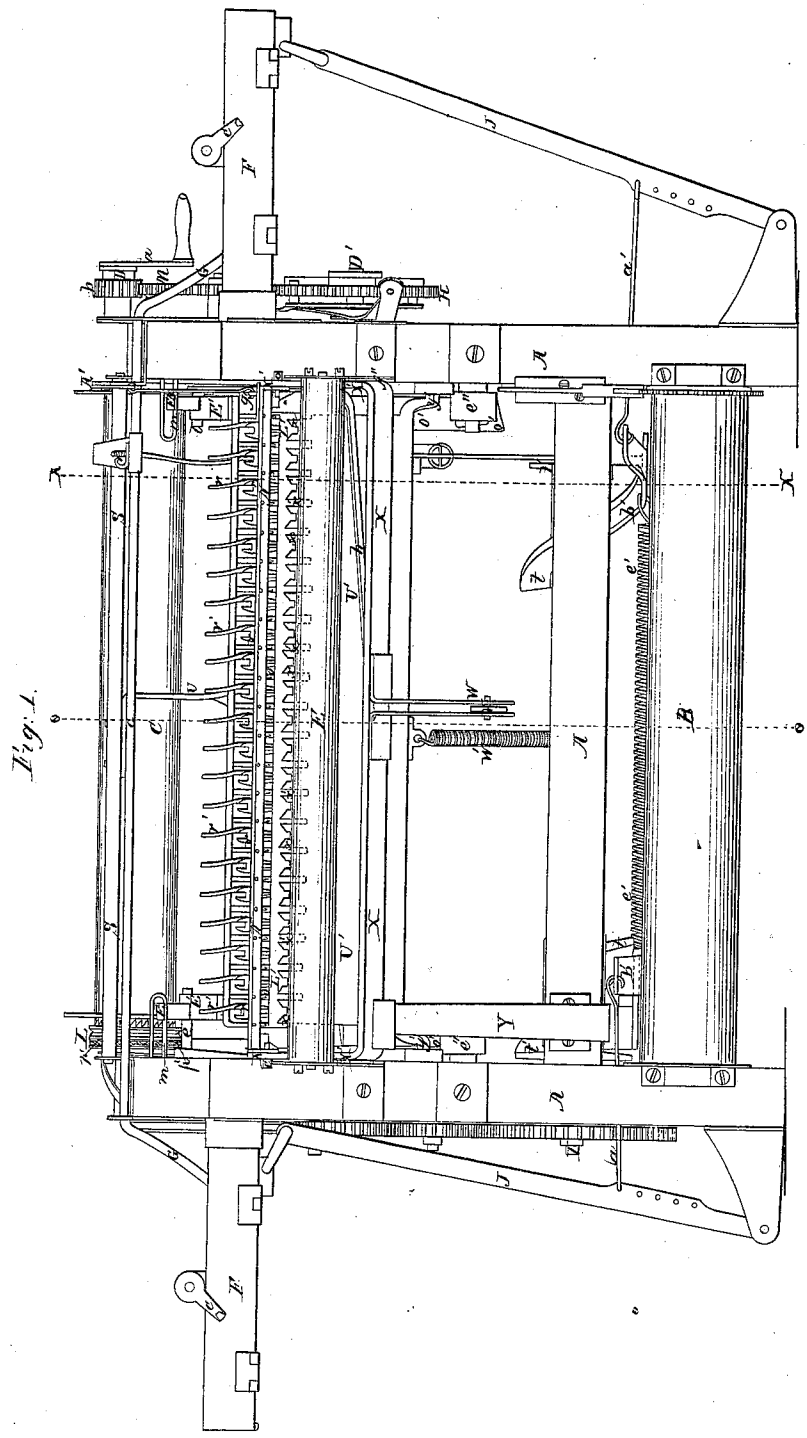

Fig. 1.

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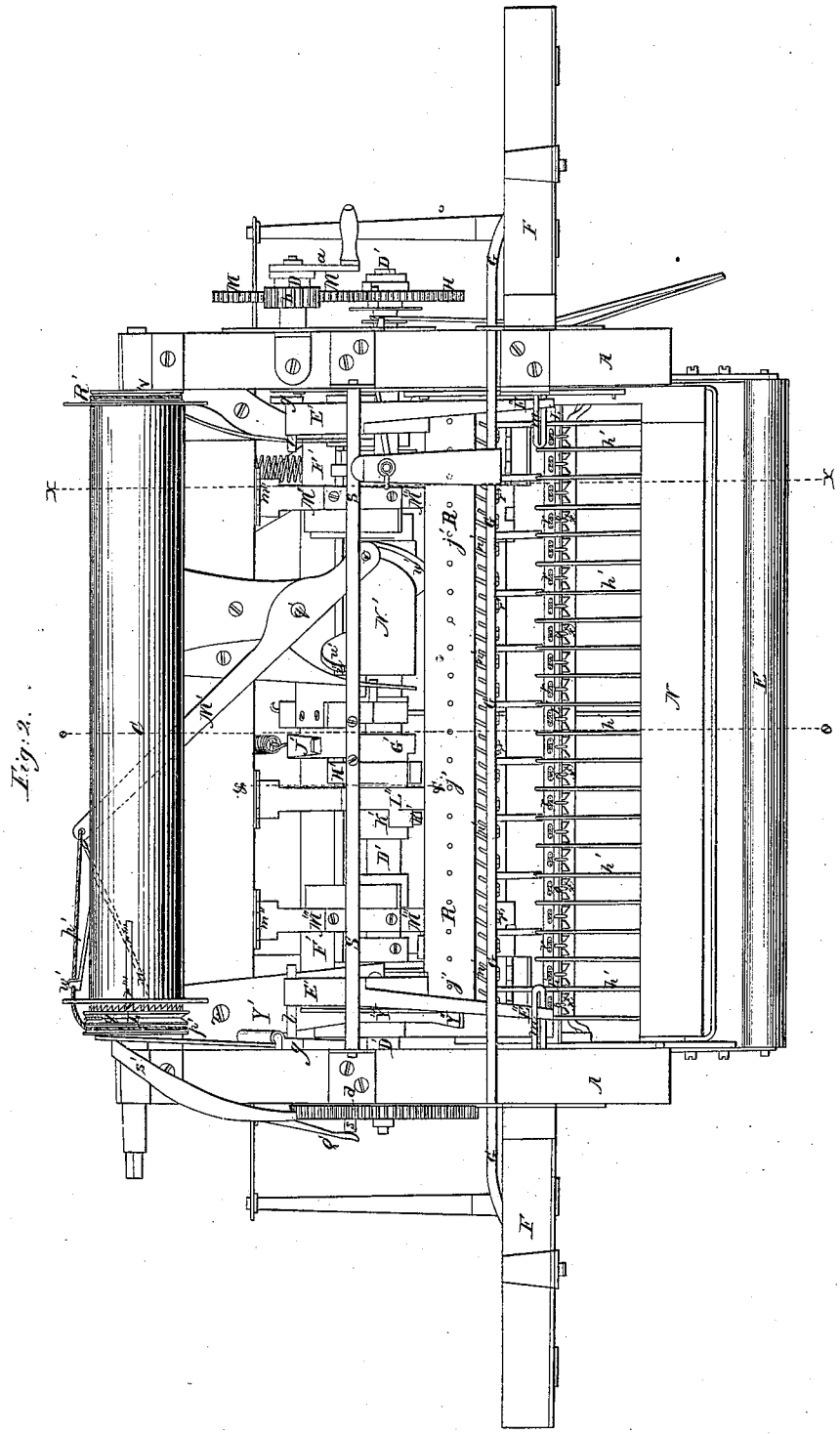

Fig. 2.

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Fig. 4

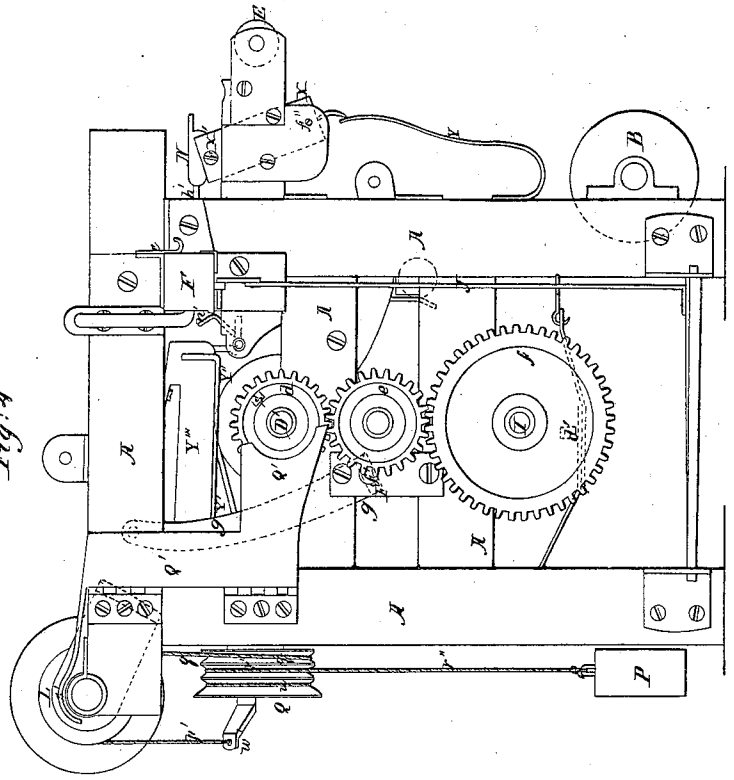
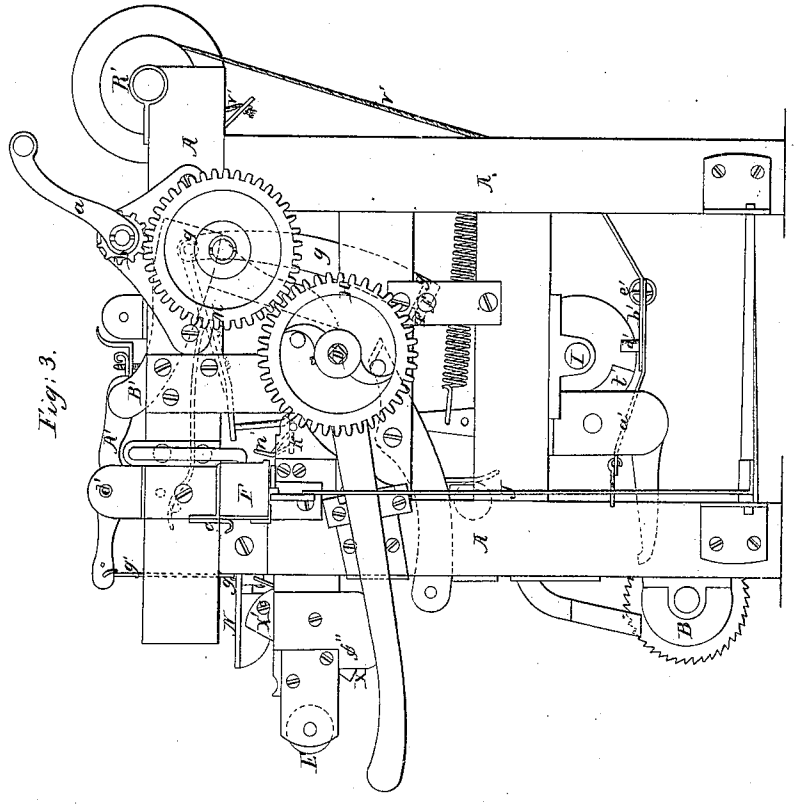


Fig. 3.



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J. Mc Mullen.
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Fig. 5.

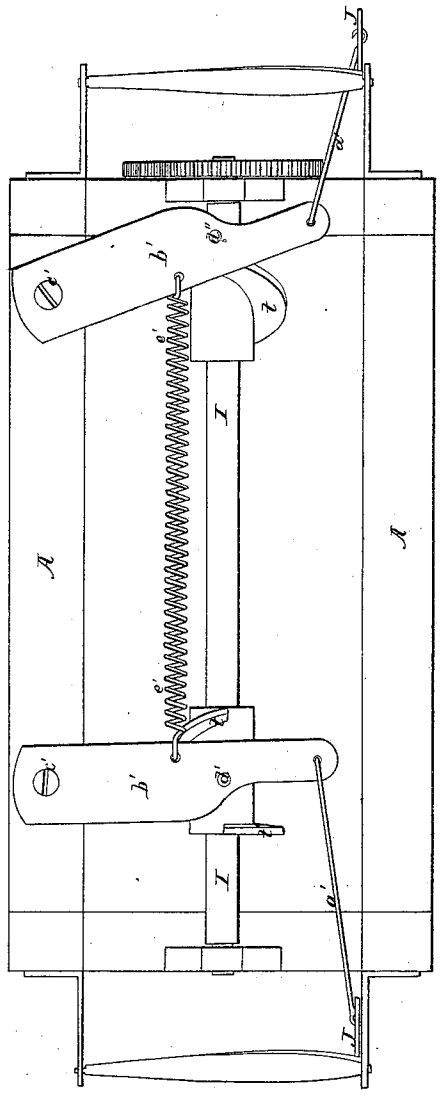


Fig. 15.

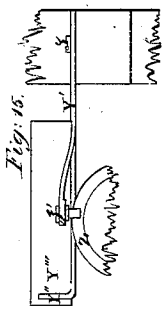
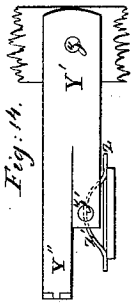


Fig. 14.



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J. Mc Mullen.
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Fig. 6.

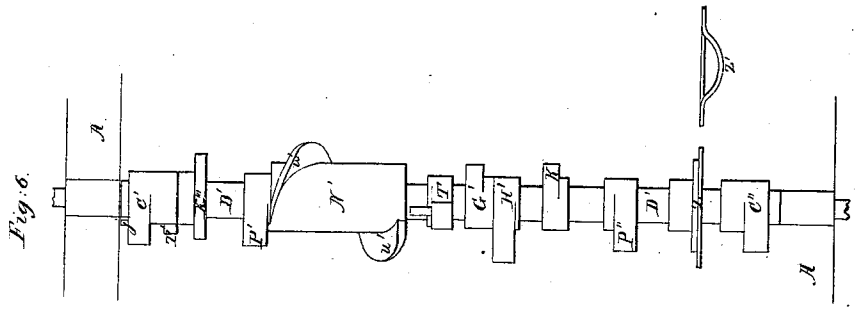
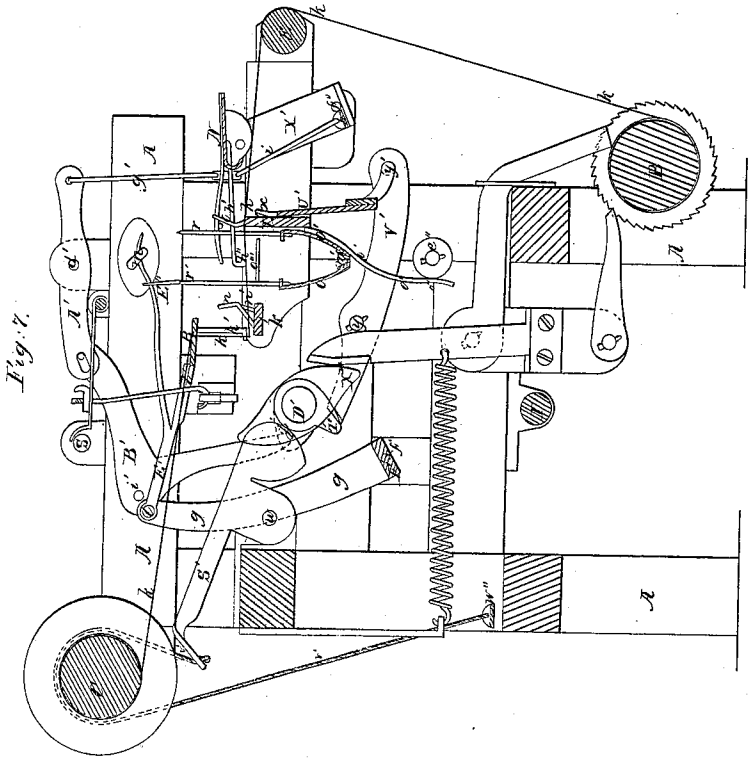


Fig. 7.



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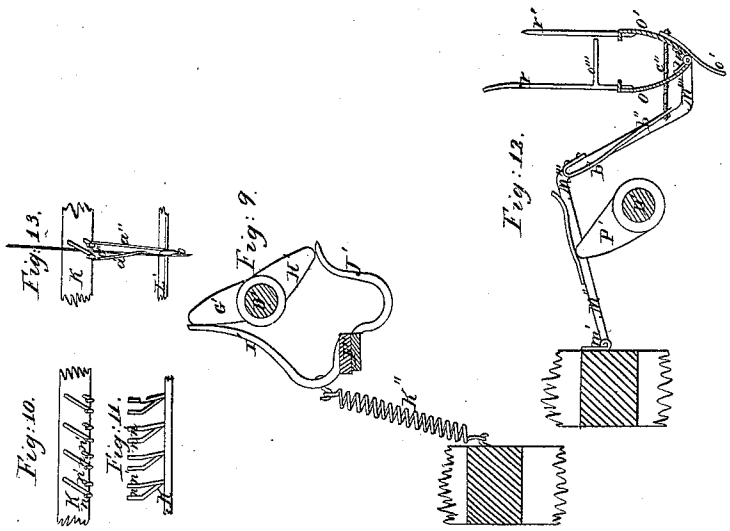

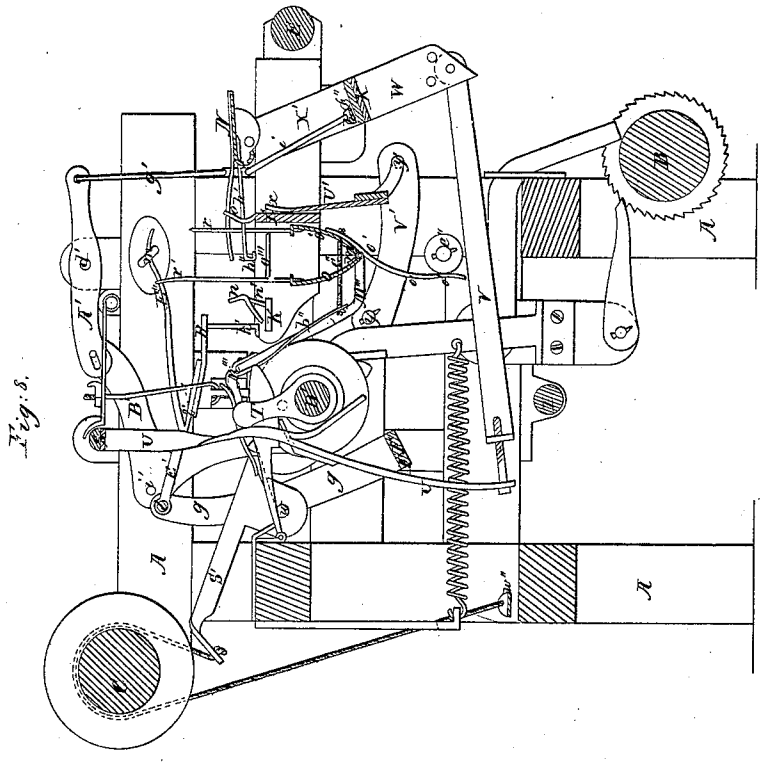

UNITED STATES PATENT OFFICE.

JOHN McMULLEN, OF BALTIMORE, MARYLAND.

NETTING-MACHINE.

Specification of Letters Patent No. 4,608, dated June 27, 1846.

To all whom it may concern:

Be it known that I, JOHN McMULLEN, of the city of Baltimore, in the State of Maryland, have invented a new and useful Machine for the Purpose of Weaving Nets and Netting, which machine is applicable not only to the manufacture of fishermen's nets of the larger and smaller kinds, but likewise to articles of a finer texture, such as fly-nets and nets for other purposes; and I do hereby declare that the following is a full and exact description thereof.

The meshes formed by my machine under the construction herein described and represented are rectangular, and they may be either square or oblong their sides running vertically and the ends being horizontal; the machine may however be so varied as to reverse the angles of the meshes without departing from the general principle of its action. The knots at the angles of the meshes, are not of the flat or looped kind but are the true fisherman's knot, or what is sometimes called the weaver's knot.

In the accompanying drawings Figure 1 is a front elevation of my machine; Fig. 2, a top or horizontal view, and Figs. 3 and 4 are end views thereof. Fig. 5 is a view of the under side of the machine, Fig. 6 the cam shaft separated from the other parts of the machine, and Fig. 7 a vertical section from front to back in the line *x x* of Figs. 1 and 2. In each of these figures as well as in those additional thereto, where like parts are represented, they are designated by the same letters of reference.

A is the frame of the machine, which may be made either of wood or iron.

B is the cloth beam on which the work is wound as the netting proceeds, said beam being made to turn by means of a ratchet wheel, and its appendages, as in other looms.

C is the yarn beam from which the thread or yarn is to be supplied to the thread conductors.

D is a shaft to which the motive power is to be applied; it is represented as furnished with a winch *a* by which the machine may be driven when moved by hand; the pinion *b* on the shaft D, gears into the intermediate cogwheel M, and this into the cog wheel H, on the main cam-shaft D′ shown in Fig. 2 and separately in Fig. 6.

E is the breast beam, over which the work passes on its way from the knotting apparatus to the cloth beam. This breast beam I usually cover with cloth. A concave formed of wood or metal may lie on the work as it passes over the breast beam and this may be borne down with any desired degree of force by means of weights or springs. This tends to keep the work taut between the breast beam and the cloth beam and to leave it slack between the breast beam and the knotting apparatus. Instead of the concave above spoken of there may be a pressing roller similar to the breast beam and resting on it, which will produce a like effect, and should it be desired, the breast beam may be furnished with a ratchet wheel in the same manner with the cloth beam which ratchet wheel may be moved by a feed hand on what I have called the reed to be presently described, and which in the operation of the machine is made to move back and forth, I have however used the machine without such ratchet, but as it may in some cases be desirable I have thought it best to mention it; it being however a common device understood by every machinist acquainted with looms, it is altogether unnecessary to describe it.

F F are two shuttle boxes which in their general construction are like those in ordinary use; *c c* are buttons that keep their fronts closed.

G G are vibrating rods or bars, the outer ends of which enter openings in the rear sides of the shuttle boxes. The parts which enter the shuttle boxes are connected with the apparatus for throwing the loom out of gear, and are acted on by the shuttle in a manner similar to that well known in the power loom, the non entrance of the shuttle into the shuttle box producing an action of the parts by which the apparatus is thrown out of gear.

The shaft I, seen most distinctly in the view Fig. 5 which is taken on the under side of the machine is that which carries two cams *t t* that operate on the picker staves, or shuttle drivers J, J. The shaft I may receive its motion from the principal cam shaft D′ by means of cogged gearing as shown in the end view Fig. 4, where *d* is a toothed wheel on the end of the shaft D′, which toothed wheel gears into an intermediate wheel *e* and this into the wheel *f* on the end of the shaft I. The threads or wings *t t*, that surround the shaft I,

spirally as seen in Fig. 5 are not spiral at their outer ends t' as they are not intended to act on the shuttle thrower during one half of the revolution of the shaft, but when this has revolved to that extent, the spiral portion of the thread then acts upon said drivers (J, J,) by forcing out the connecting rods a' a' that are attached to said drivers. In this figure b', b', are two levers or pieces of metal connected to the frame by joint pins at c' c', and these on their upper sides carry pins d' d'' against which the spirals t t operate; e' e' is a spiral spring connecting the two pieces b' b' and when the shaft has turned so far around as to free the pins d' d'' from the action of the threads t' t' the spring e' will forcibly draw in one of the drivers J J, and the shuttle will be thrown, each of them being alternately thus acted upon. The difference of this arrangement for operating the shuttle, from those adopted for producing a like result in the power loom will be evident to those conversant with that machinery, and is specially adapted to the action required in my machine. Instead of the spiral spring e' e', a separate spring may be employed for each of the levers b' b' or springs of other forms may be used, this not being a point of any importance. The warp through which the filling is to be thrown by the shuttle is to be taken from the yarn beam and disposed of around suitable teeth by what I denominate the thread conductor, which I will now proceed to describe.

R R Fig. 2 is a plate of metal forming a part of the thread conductor; this is attached to arms on a rocking shaft F', the pivots of which are seen at f' f' Figs. 3 and 4, the shaft which is represented as a flat bar, is shown by the dotted lines; g g are the arms that rise from it and operate on the thread conductor in a manner to be presently described.

L is a ratchet wheel and pulley on the axle of the yarn beam this ratchet wheel is thrown out of gear with the shaft by the revolving of the main cam wheel, as will presently appear.

O, O', (Figs. 8 and 12) are two metallic bars or bearers which extend from end to end of the machine; these are hinged together and each of them carries a row of forked teeth, which approach each other when the loops are being formed by the thread conductor and which subsequently rise and open out the warp for the passage of the shuttle. The bearers O O' are opened at the proper time by means of two arms or straps o' o' attached to each end of, and descending from the bearer O', the foremost of the hinged bearers, said arms or straps resting against friction rollers e'' e'' affixed to the frame, the arms being so curved as to cause the opening of the bearers as they are made to rise. One of the straps, or arms o', attached to the bearer O', and the forked teeth r r' that both the bearers carry, are shown distinctly in Figs. 7 and 8, where they are shown as opened out.

N (Figs. 2, 7, and 8) is a plate of metal extending from end to end of the loom and which carries a set of hooked teeth h' h', the inner ends of which curve downward and serve to draw the filling forward which is supplied by the shuttle and thereby to aid in the formation of the knots; the manner of forming the hook is seen at h'' in Figs. 7 and 8. This apparatus I denominate the reed. The hooked teeth on the reed serve to prevent any entangling of the warp at the time the knots are being run up, by drawing the filling against the front teeth on which said knots are formed. The reed has to vibrate up and down, and back and forth in the performance of its office, and these motions are given to it by means of the cam T on the main cam shaft, and by the pin j' on the cam C' Fig. 6. The manner in which this is effected is represented distinctly in Fig. 8 which is a transverse vertical section of the machine in the line ① ① of Figs. 1 and 2.

S is a rock shaft from which descends an arm U Figs. 1 and 8 against which the cam T operates; from the lower end of the arm U, the jointed rod V extends forward and is connected at its fore end by a joint pin to the arm W that is made fast to a flat shaft X. Y, Figs. 1 and 4, is a spring that bears against the lower side of the shaft X. This shaft is bent up at right angles at each of its ends and rocks on joint pins f'' f'' Figs. 3 and 4. The reed N with its hooked teeth is hung by joint pins c c Figs. 3 and 4 to the turned up ends X' of the shaft X; it is capable of vibrating up and down therefore on these pins, and of being moved in and out with the vibration of the shaft X on its joint pins f'' both of which motions are requisite to its proper action.

A' Figs. 1, 3, 7, and 8, is a lever working on a fulcrum d', which lever is connected by a link g' with the reed plate N which it is intended to lift by the action of the pin j projecting out from the cam C' on the shaft D'; when not so lifted it is drawn down by a spring h attached to the shaft X, and connected to the plate N by the ling i Figs. 7 and 8, its gravity not being sufficient to insure its descent; the lever A' is connected to the bell crank B' that has its fulcrum at i'; the pin that acts on the lower end of this crank, is, as above noticed, shown at j Fig. 6 projecting out from the cam C' the same pin is seen dotted at j, in Fig. 7 it is of course so situated as to lift the reed at the proper time.

The yarn beam C, has the yarn wound on it in the ordinary manner; from this beam

the threads pass through the holes *j' j'* Fig. 2, in the thread conductor, a section of which is shown at R Figs. 7 and 8; the red line *k* shows the threads passing from the yarn beam to the thread conductor and down through an eye in the lower end of the wire *k'* attached to the plate R, which wire is bent at right angles and drilled for that purpose, there being one such wire to each hole, performing in fact the same office as a tube descending from the plate R. The thread conductor has a complex motion forward and backward and endwise. The arms *g g* that rise from each end of the flat rock shaft F', above noticed communicate to its backward and forward motion. These arms are made fast to the rock shaft, but not to the thread conductor, as on the upper ends of said arms there are cylindrical pins *l, l*, that pass freely through holes in the slide straps E' E', seen distinctly in Figs. 2, 7 and 8, the form in which the straps are bent being seen in the two latter figures, as well also as their attachment to R at *l'* where they may be riveted together. The outer ends E'' of the slide straps pass through staples *m m* attached to the ends of the frame these staples as well as the cylindrical pins *l l* are of such length as to allow the necessary lateral motion to the thread conductor; it will be seen that by means of the pin *l*, and the staples *m* the thread conductor is supported and left free to move back and forth as well as laterally; its motion back and forth is not (under the arrangement represented) perfectly horizontal, its fore end being curved as represented at E'' by which it is made to lift and depress the threads so as to perform its office in the formation of the knots. I have however sometimes made these straps straight.

To cause the rock shaft E', of the thread conductor to vibrate back and forth, there rise from it two wipers upon which the cams G' and H' on the cam shaft D' operate alternately. In Fig. 9, I have given a section through the main cam shaft, and through the rock shaft F' in the line & & of Fig. 2 showing the cams G' and H' and the wipers I' and J' on which they operate. K'' is a spring by which the rock shaft is drawn back when not held by the wipers and cams. The parts above described give the backward and forward motions to the thread conductor; but in order to wind the threads around the respective teeth, there must be a lateral motion also given to it, in combination with those back and forth. This lateral motion is given by means of the cam Z on the shaft D' Fig. 6. This cam consists of a circular plate of metal, the outer edge of which is concentric with the shaft D' and the face of which is in part curved out as shown at Z'. The edge of this plate is embraced by a notched stud descending from a plate Y', Fig. 2 which vibrates laterally on a joint pin *z*. Fig. 14 is a top view of this plate Y' and of the cam Z that actuates it with its lateral swell Z'. The stud that the cam operates upon is shown at *z'*. This swivels in the plate Y' and a notch on its lower side embraces the edge of the cam, to the curvature of which it adapts itself and thereby moves the thread conductor laterally it being guided in this motion by the pins *l l* and the staples *m m* Figs. 1 and 2. To enable the conductor to move back and forth while the lateral motion is communicated to it, a part of the plate Y' is extended forward as seen at Y'' and its front end is bent up at right angles; in this bent up part a notch is made that receives a flat plate attached to the end of the thread conductor. Fig. 15 is a lateral view of the plate Y' and of that which is attached to and makes a part of the thread conductor and that enters the notch in Y'' which latter plate is marked Y'''. This last plate is seen also in Fig. 4, and its upper edge in Fig. 2; it is attached to the end of the conductor standing at right angles to it and extends back and forth sufficiently far to allow of the sliding motion in that direction.

In the sections 7 and 8 is shown a flat bar or plate of iron K which vibrates upon joint pins at its back edge at each end of the frame; it has rising from its face a double row of wire teeth *n n'*; Fig. 10, is a top, and Fig. 11, a front view of a part of this plate; it has two teeth for each thread of the thread conductor around which pairs of teeth the respective threads are wound by the motion of the conductor; the form and arrangement of these teeth are such as to place and keep the thread in a position suited to the action of other parts of the machine to be presently described.

When the loops are to be liberated from the teeth *n n'* the front of the plate K (Figs. 7 and 8) falls, and they are thereby freed therefrom; the plate K is made to tilt at the proper time by the action of a cam on the cam shaft which operates on the under side of a hinged plate L'' Fig. 2 which bears at its fore end against the under side of said plate K.

L' L' Figs. 1, 7 and 8, is a stationary plate extending from end to end of the machine and having on its upper edge a row of teeth *o o o* the form of one of which is shown distinctly in Figs. 7 and 8. The thread conductors, as they advance, pass on one side of the pairs of teeth *n n'* on the plate K and advance so as to carry the thread around one of the teeth *o* and returning back, carry the thread on the opposite side of the pairs of teeth *n n'* which causes the thread to leave an opening in the rear part of the loop which it forms, equal to the distance of the teeth *n n'* from each other.

The hinged bearers O, O′ before referred to and seen opened out in Figs. 7 and 8 with the forked teeth *r r′* which they carry are now ready to be brought into action. The bearers are hinged together at *m′* Figs. 7 and 8 and from them rise the rows of forked teeth *r r′* Figs. 1, 7, and 8; in Fig. 1, the whole of the rear row *r′* of the forked teeth is hidden by the fore row with the exception of the long prong *r′* on the rear row, which is allowed to project up for the purpose of aiding in preventing the entangling of the threads; in other respects the forked teeth are precisely alike; the lengthening of one prong it not absolutely necessary but is very useful in its effective operation. While the thread conductor is winding the threads around the teeth *n n′*, and *o* the forked teeth are depressed, as in Figs. 1 and 2 so that their upper ends are below the level of the teeth *n n′* and *o;* and the upper ends of the two rows of forked teeth are in contact with each other; they are drawn together by the action of a spring *b″* that is attached to the arms or levers M″ M‴ Figs. 8 and 12, from which a cord or rod *c″*, proceeds passing through an opening in the bearer O and attached to O′. This of course always tends to close them, but as they rise they are opened by the bearing of the straps *o′ o′* against the friction roller *e″*, Figs. 7 and 8. When the bearers and forked teeth are raised and opened out, the shuttle carrying the filling is to be thrown. The manner of raising the bearers and forked teeth is as follows: M″ M″ Figs. 2 and 12 are two arms or levers, hinged at their rear ends *m′*, as seen in Fig. 12, and acted upon simultaneously by the cams P′ and P″ on the shaft D′; the inner ends of the arms M″ M″ extend forward and downward as shown at M‴ and are attached to the bearers O O′ at the hinged part *m* of said bearers, and raise them at the proper time; Fig. 12 shows, separated from the other parts the arrangement and action of those concerned in giving this motion being a transverse vertical section of the machine near one of the cams P′ or Q′; they are also in part shown in Fig. 8.

The reed N with its hooked teeth *h′ h″* is brought into action immediately after the throwing of the filling by the passing of the shuttle the manner of operating which has been already described. The hooked teeth are raised to the proper height for taking hold on the filling, and the whole reed is moved back by the action of the cam T, in a manner and under an arrangement of parts which are fully set forth in the description already given of that instrument. The hooked teeth *h″* lay hold on the thread of filling and draw it forward into contact with the teeth *o o* on the edge of the permanent plate L′ L′ where the knots are to be formed, simultaneously with the drawing forward of the thread of filling the forked teeth *r r′* descend.

The manner in which the yarn beam C, is made to operate in taking up the slack warp which is liberated in the tying of the knots, constitutes a very important feature of my invention, and I will now therefore proceed to describe the arrangement of the parts by which said yarn beam is connected with the machine so as to accomplish that object.

L is a ratchet wheel and pulley on the axle of the yarn beam, which ratchet wheel and pulley are to be thrown out of, and into gear on the formation of each row of meshes. The pulley, which is in one piece with the ratchet wheel, has two cords attached to it *p′* and *q′;* the outer end of *p′* is attached to the lever M′ Fig. 2 that has its fulcrum at *q′* and is operated on by the spiral cam N′ on the shaft D′. The cord *q* which is also attached to the pulley L is made fast by its outer end, to a grooved pulley Q from which hangs the weight P suspended by a cord *r″* attached to said pulley. The cord *p′* which is attached to the pulley L descends from it and passing through a guide loop *w′*, has its other end made fast to the lever M′ Fig. 2. The ratchet and pulley L on the axis of the yarn beam, are kept out of gear with said beam, by means of a spiral or other spring between the two so as to allow the pulley to turn freely on the axis of the beam when not forced up against it; *r‴* Fig. 2 is a tooth attached to the beam, which takes into the ratchet wheel when the two are in gear. The ratchet wheel is forced into gear in the following manner. Q′ Fig. 4 is a hinged plate that rests, when the ratchet and pulley L are out of gear, upon the face of the wheel *d* on the cam shaft D′; on the face of the wheel *d* there is a bevel faced pin *s* that in its revolution passes under the ends of the plate Q′; from the upper end of this plate proceeds an arm *s′* that, bearing on the pulley L, forces the ratchet into gear during the action of the pin *s* on Q′; the arrangement of this part is also shown in Fig. 2. From the lever M′ there passes a cord to the pulley Q; this is shown by the dotted lines *u* Fig. 2 and the cord is also seen on the pulley at *u* Fig. 4. On the cam N′ constituting the spiral cam before named, there is a spiral thread *u′ u′* by which the lever M′ is carried back, and the weight P on the pulley Q is raised, the cord *u* producing this effect. At the point *v* there is a pin projecting down from the lever M′ aganist which the spiral thread operates as the shaft D′ revolves and when this pin arrives at the end *u″* of the spiral thread it escapes therefrom; the weight P then descends and the lever M′ resumes the position shown in the drawing.

At the end of the yarn beam opposite to

that containing the pulley L there is also a pulley R′ around which passes a cord *v′;* the manner of connecting this cord is distinctly shown in Figs. 7 & 8; one end of it is made fast to a lever S′ having its fulcrum at *w*. The other end is made fast to a spring at *w″* which serves to keep the cord taut. The intention of this part of the apparatus is to produce a slight counter action on the yarn beam immediately after the thread conductor has wound the thread around the pins, as above described, when this winding is completed there will be a slight slackness of the yarn which must be taken up in order to render the work perfect. The inner end of the lever S′, is acted on by a cam at T′ on the cam shaft; this cam and the end of the lever S′ on which it operates, are, in Fig. 7, shown in red lines, as they are obscured by other parts. When the cam T′ raises the ends of the lever S′ it depresses that end to which the cord *v′* is attached, and causes it to give the required reversed motion to the yarn beam.

I will now describe the purpose answered by the spiral cam N′, the lever M′ the pulley and ratchet wheel L, the pulley Q, and their appendages. After the thread conductor has operated in winding the thread around the teeth, the shuttle has been thrown and the reed has drawn the filling forward into contact with the teeth *o o* there will have been a considerable surplus quantity of warp taken off the yarn beam, which quantity was necessary in the formation of the loops, and this must be again taken up in order to the tying of the knots against the teeth *o o* this is effected in the following manner. The first operation is the throwing of the ratchet wheel L into gear with the yarn beam; as this is effected the spiral cam which had been operating in raising the weight P, arrives at that point which allows the pin *v* to escape at the end *u″* of the spiral thread on N′, and the lever M′ is consequently drawn forward by the descent of the weight P; the cord *q* which passes around both the pulleys L and Q causes the yarn beam to retrograde and thereby to take up the portion of yarn which is to be given back to it in the formation of the knots. The use of the cord *p′* which passes around the pulley L in a direction, the reverse of that of the cord *q*, is to keep the latter taut as the weight P is being raised.

I have contemplated another and less complex maner of taking up the slack warp which is liberated in the drawing up, or tying of the knots; namely, by means of a roller, or other similar device, situated above or below the warp between the yarn beam and the thread conductors which may be made to raise or depress the warp as it is given back such roller being regulated in its action by weights passing over pulleys, or in any other convenient manner. The knots having been completely tied in the manner above set forth, the next operation is the lifting them from the teeth *o o* preparatory to the winding of a corresponding portion of the netting on to the cloth beam. In front of the stationary plate L′ Fig. 1 which sustains the teeth *o o* there is a vertical sliding plate U′ U′ having forked teeth *x x* on its upper edge. The plate U′ is raised while the hooked teeth of the reed still hold the filling against the teeth *o o*, the notches *x′* between the forked teeth *x* admitting the teeth *h′* of the reed to pass into them. The forked teeth *x x* when the plate U′ U′ is raised rise sufficiently high to lift the knots clear of the teeth *o o;* the reed is then again drawn forward and the knots rest on the back of the forked teeth *x;* the plate U′ then sinks and leaves the knots free, and the work ready to be taken up by the cloth beam.

The manner of actuating the plate U′ is as follows: V′ Fig. 7 is a lever having its fulcrum at *y*, (there being a like lever at the opposite end of the machine) this lever is connected by a joint at *y′* with the plate U′. The opposite ends of these levers are operated upon by the cams C′, C″, on the shaft D′ so as to raise the plate U′ at the proper time. The plate U′ is drawn down by the spiral spring W.

The cloth beam B is moved by a cam X‴ on the cam shaft D′ Figs. 6 and 7 but its operation and the arrangement of its parts being similar to that of the cloth beam of the ordinary power loom description thereof is unnecessary.

Operation of the machine.—The general operation of this machine is subservient to the discovery made by me that the regular netting or fisherman's knot might be made in a loom by beaming a regular warp attached to the yarn and cloth beam, and my invention of the manner of forming the loop, and passing the filling through the same as herein set forth.

In putting the machine into operation the warp is first wound upon the yarn beam in the usual manner; the respective threads are then passed through the holes *j′*, *j′*, in the thread conductor, and passing between the teeth *n n′* on the plate K and over the respective forked teeth *r*, *r′*, is conducted down to the cloth beam by the breast beam as shown by the rod lines *k k* Fig. 7. This having been done and the machine being set into action by any adequate power the thread conductor performs the first operation by passing the respective threads that are to form the meshes, around the teeth *n n′* on the plate K, and the teeth *o o* on the plate L′. A view of one thread so wound is given at *a″* in Fig. 13 the other parts of the apparatus being omitted. When the threads are in this position, the forked teeth *r r′*

are in contact with each other, the bearers o' o', being in their lowest position and closed and the forked teeth standing also directly under the part c'' of the wound thread; the forked teeth then rise and carry the part c'' of the thread up with them, and as they rise, they open out as seen in Figs. 7 and 8, and the thread which they have lifted is of course stretched out between them; a pick of the shuttle is then made and a thread of filling is thrown in between the parts of the warp raised by the forked teeth and the portions around the teeth n n' and o. To one of the bearers O', O', is attached a series of wires, or rods, o''' Figs. 7, 8, and 12, that stand in a horizontal position, and serve as supports to the shuttle in its passage back and forth. The hooked teeth of the reed are then advanced so as to enable them to lay hold on the thread of filling; as they are again drawn forward they bring up this thread against the teeth o o. During this operation the forked teeth r r' are depressed and closed ready for another operation.

The remainder of the action of the machine in completing the tying of the knots by the counter motion of the yarn beam and the manner of removing them from the teeth o o preparatory to the taking up of the finished article by the cloth beam has been already fully made known in describing the manner in which the yarn beam C is made to operate in taking up the slack of the warp, and of the moving parts connected therewith, and need not be repeated.

When the netting is taken up on the cloth beam the knots are not fully tightened and a subsequent stretching lengthwise of the warp is necessary to render them firm; this I have sometimes effected by winding the netting upon the yarn beam holding the cloth beam back to give the necessary tension. I however prefer to use a second beam, similar to the cloth beam on which to wind it from said cloth beam.

Having thus fully described the nature of my invention and shown the manner in which the same is carried into operation, what I claim therein as new and desire to secure by Letters Patent is—

1. The forming of a true fisherman's or weaver's knot in netting woven in a loom by beaming a regular warp from the yarn to the cloth beam, and the forming of loops thereon, of the nature of those herein described through which loops a thread of filling is thrown by a shuttle these operations being effected under an arrangement of parts substantially the same with that herein set forth.

2. I claim the combination of parts as herein made known, for giving motion to the thread conductors so as to wind the threads of warp, beamed as described around the teeth n n' and o in such manner as to constitute a loop such as is represented in Fig. 13 leaving a middle thread c'' to be carried up by the forked teeth. I do not claim the use of thread conductors for winding threads around teeth they having been used in other manners and for other purposes; but I limit my claim in this particular to the arrangement and combination of parts by which I form, simltaneously, a series of loops of the particular kind herein described for producing the so called fisherman's knot.

3. I claim the employment of the bearers and forked teeth r r' which are made to raise the thread c'', and then to open out, so as to leave spaces between the threads a'' and c'' through which a thread of filling is to be thrown by a shuttle.

4. I claim the employment of the reed as herein described, with its hooked teeth as combined with my machine, for drawing up the thread of filling against the teeth o to aid by its respective movements herein made known in the regular formation of the knots.

5. I claim the taking up of the portion of the warp that is liberated in the drawing up or tying of the knots, whether the same be effected by the action of the weight P operating on a pulley Q and the other parts concerned in giving the reversed motion to the yarn beam at the proper time, or by the aid of a roller, or other analogous device made to raise or depress the warp between the yarn beam and the thread conductor or in any other way that is substantially the same, producing a like effect by analogous means.

And I do hereby declare that I do not intend by the foregoing claims to limit myself to the particular form of the respective parts herein described, or to the particular position of the angles of the meshes, but to vary these as I may think expedient, while I do not depart from the general principle upon which my machine is made to operate, as herein set forth.

JOHN McMULLEN.

Witnesses:
THOS. P. JONES,
EDWIN L. BRUNDAGE.