No. 843,107. PATENTED FEB. 5, 1907.

# W. F. ROPER.

## WEFT REPLENISHING LOOM.

APPLICATION FILED OCT. 16, 1905.

9 SHEETS—SHEET 1.

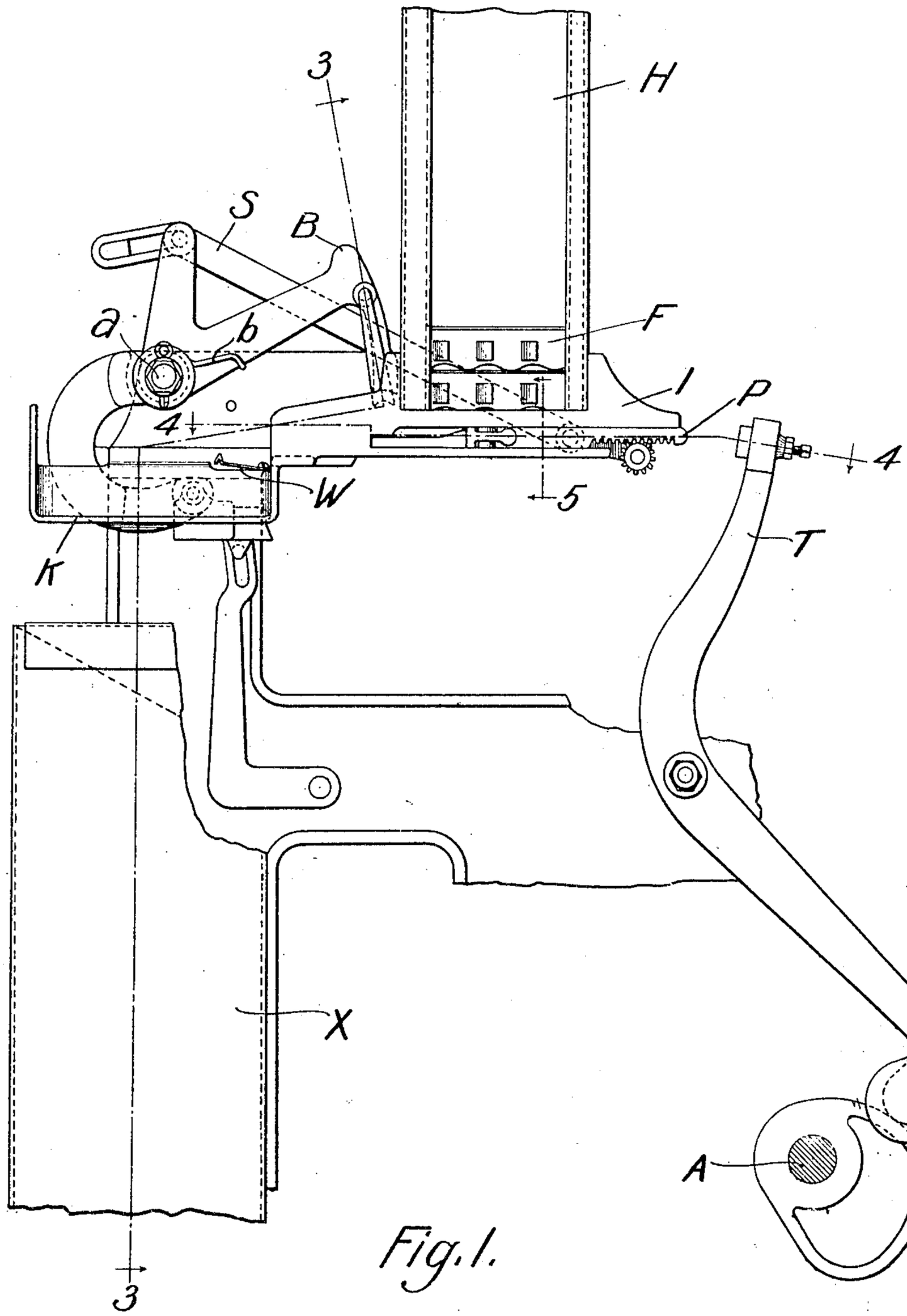


Fig. 1.

Witnesses:
C. H. Grey
E. W. Bond.

Inventor:
Walter Frederic Roper.
by Arthur G. Brown
his attorney

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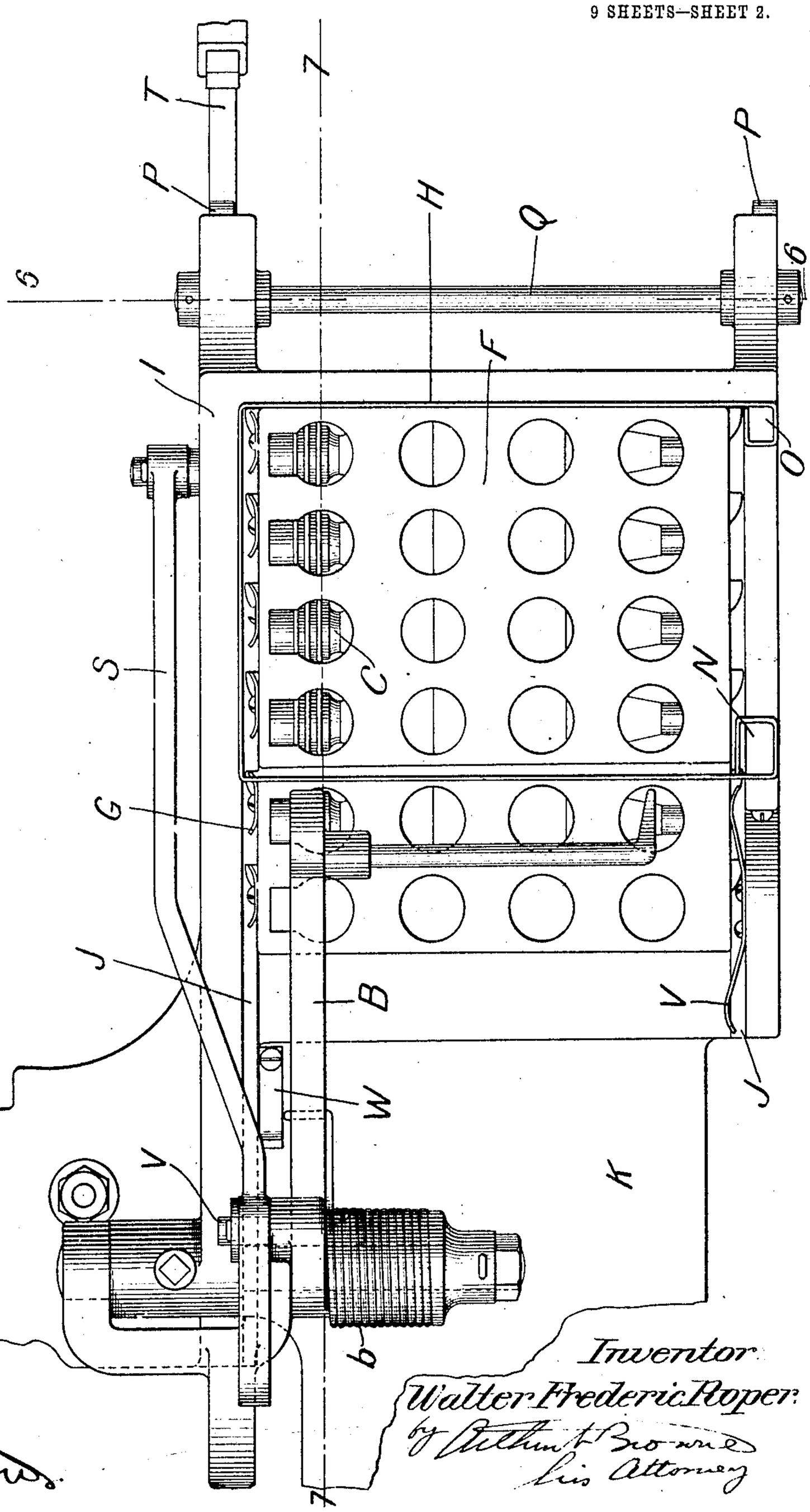


Fig. 2.

Witnesses:
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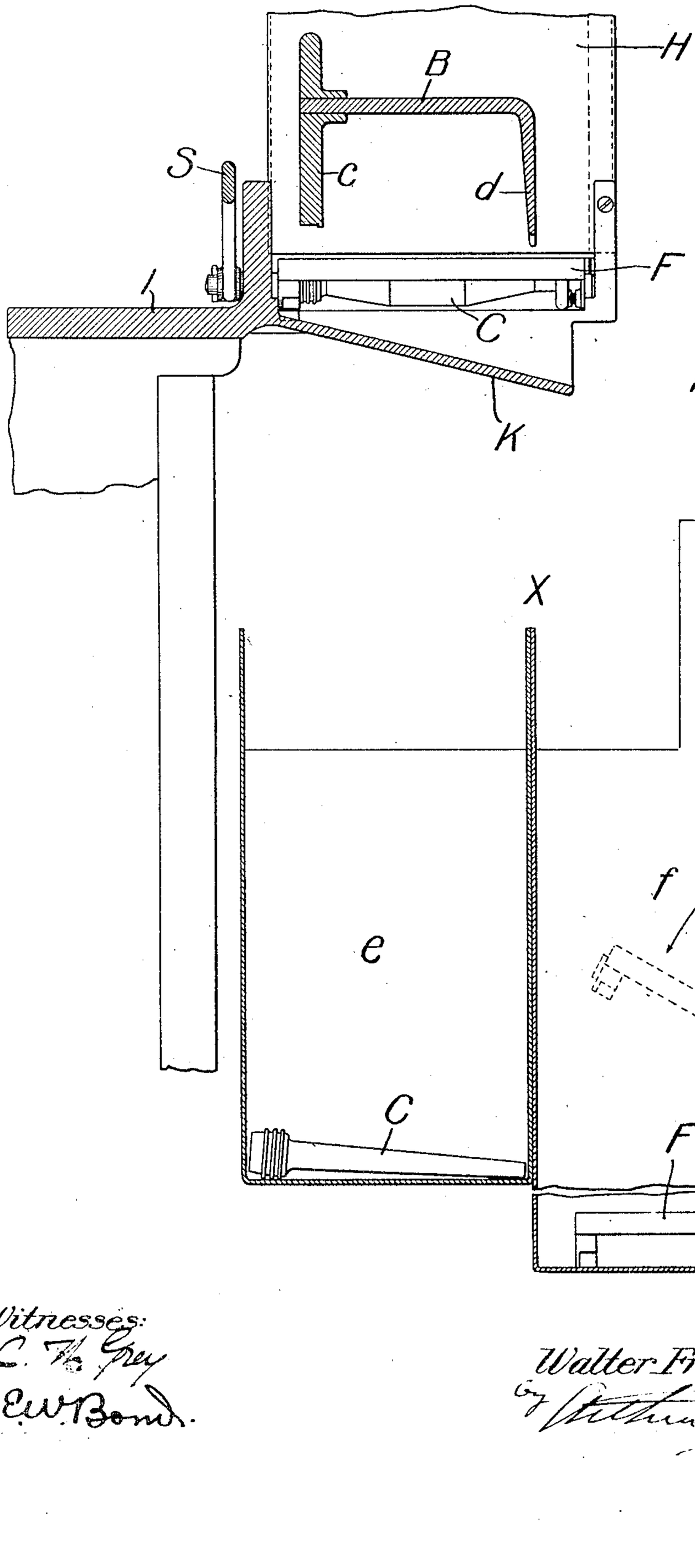


Fig. 3.

Witnesses:
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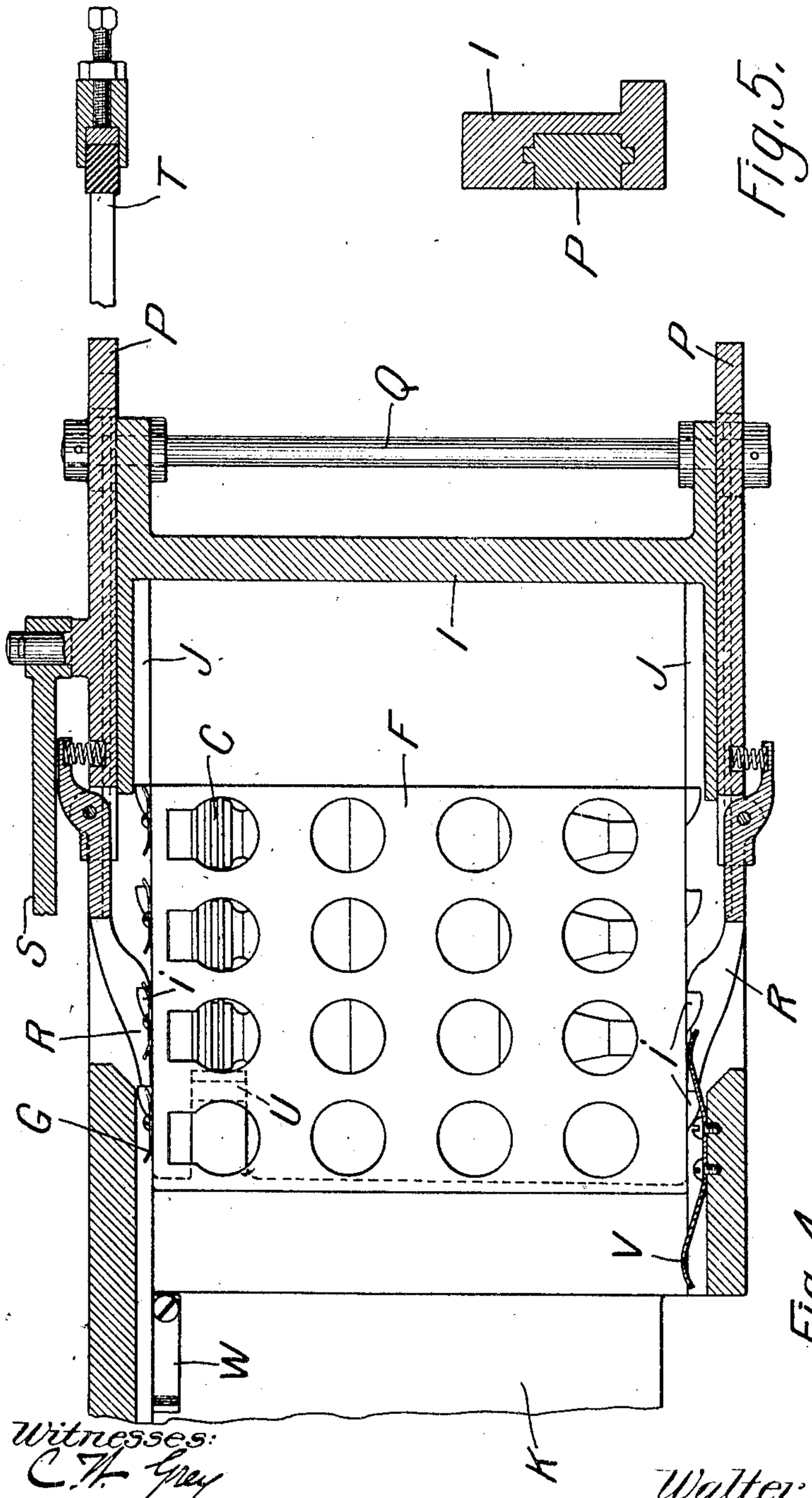


Fig. 5.

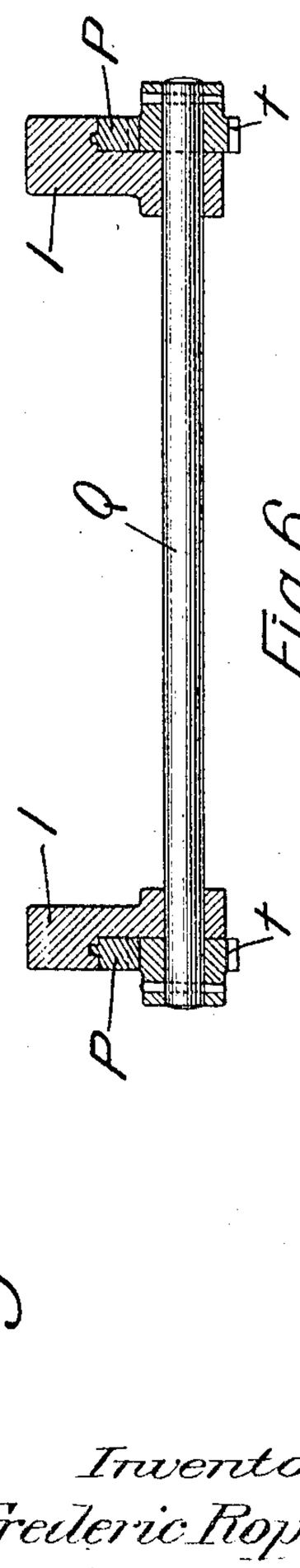


Fig. 6.

Fig. 4.

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his Attorneys

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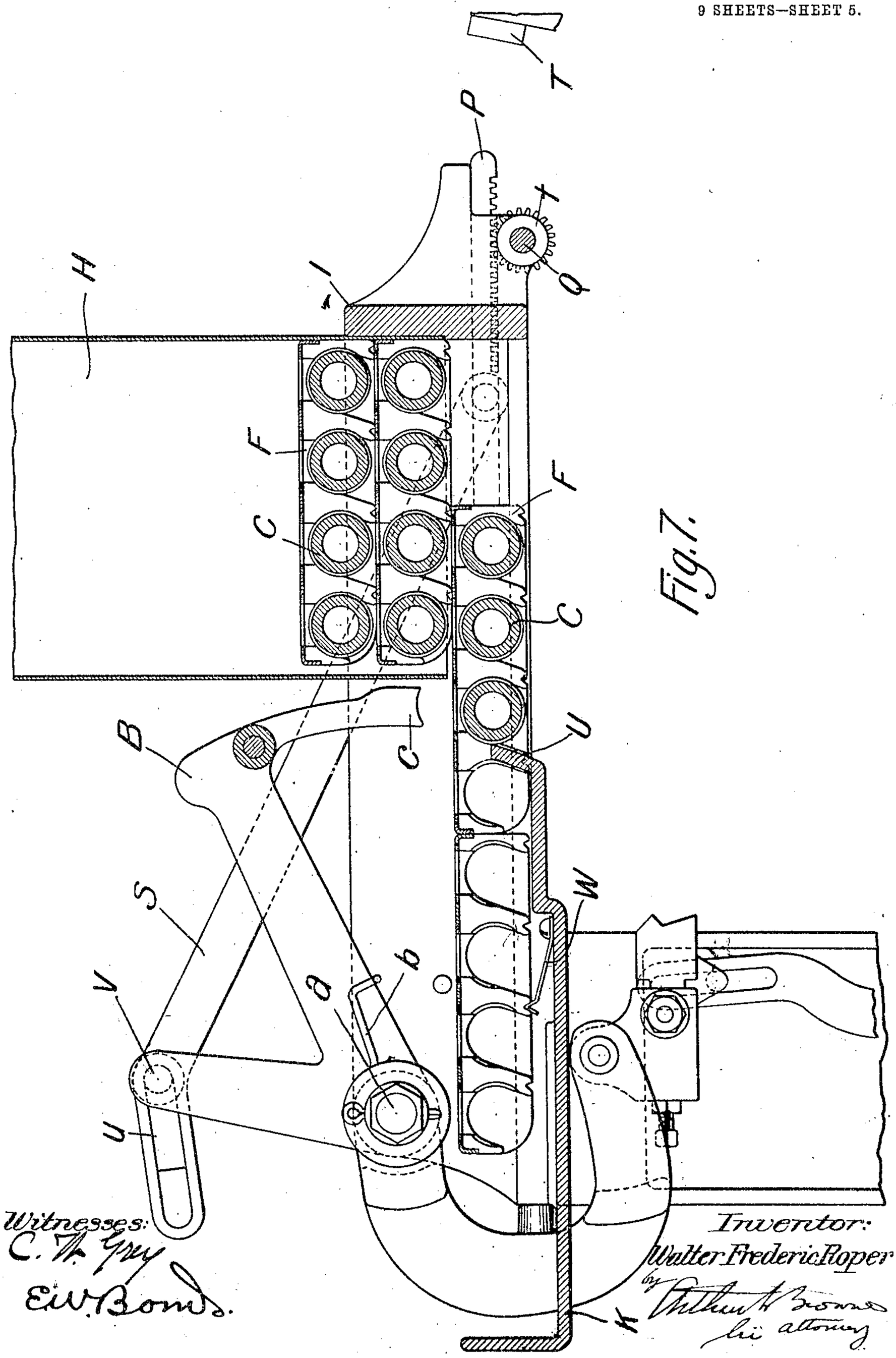


Fig. 7.

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9 SHEETS—SHEET 6.

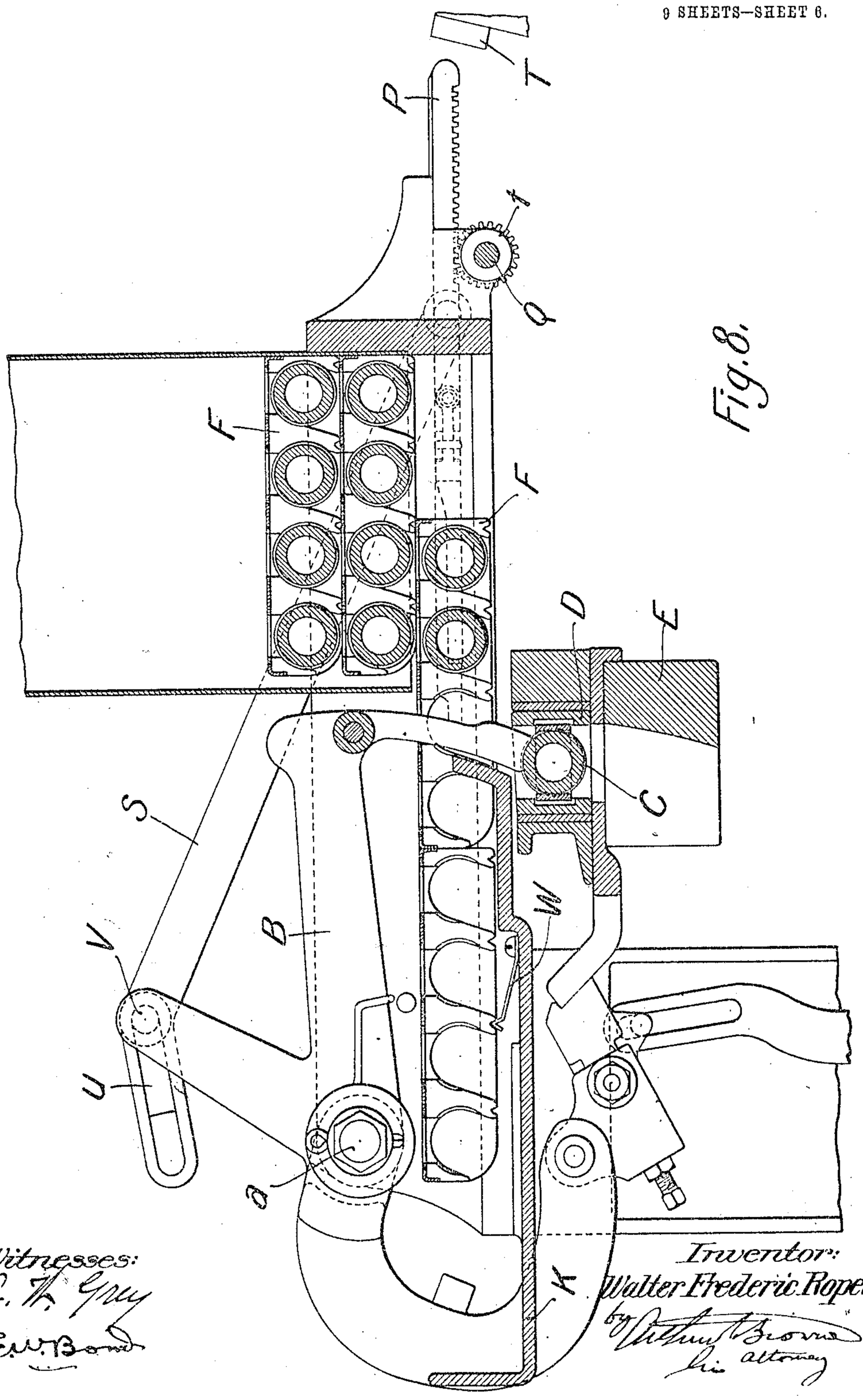


Fig. 8.

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9 SHEETS—SHEET 7.

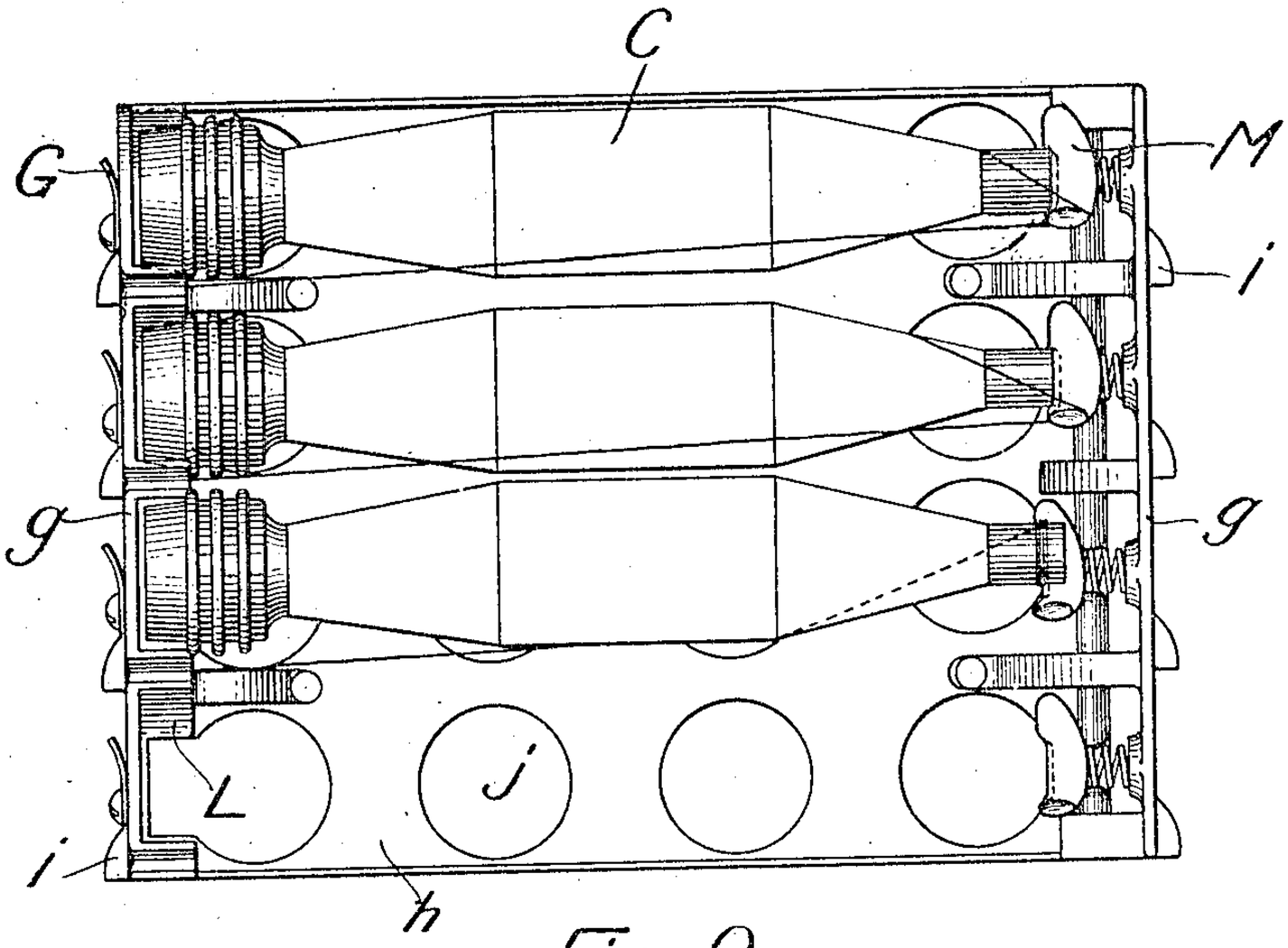


Fig. 9.

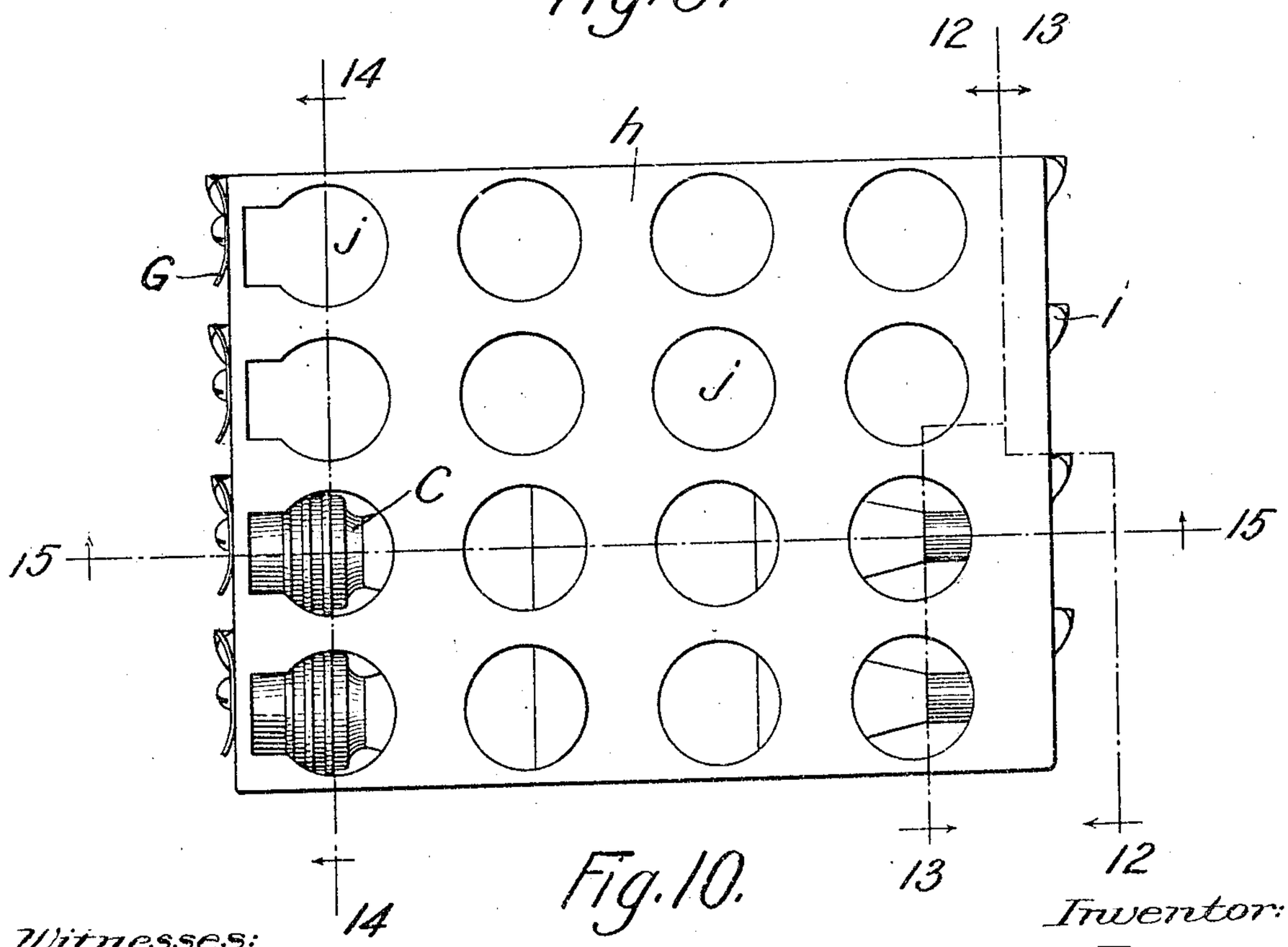


Fig. 10.

Witnesses:
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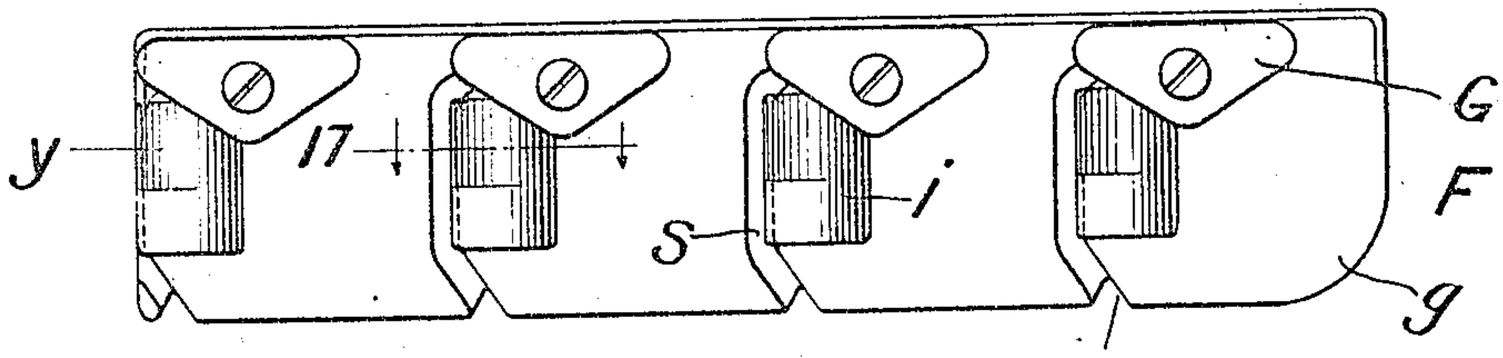


Fig. 11.

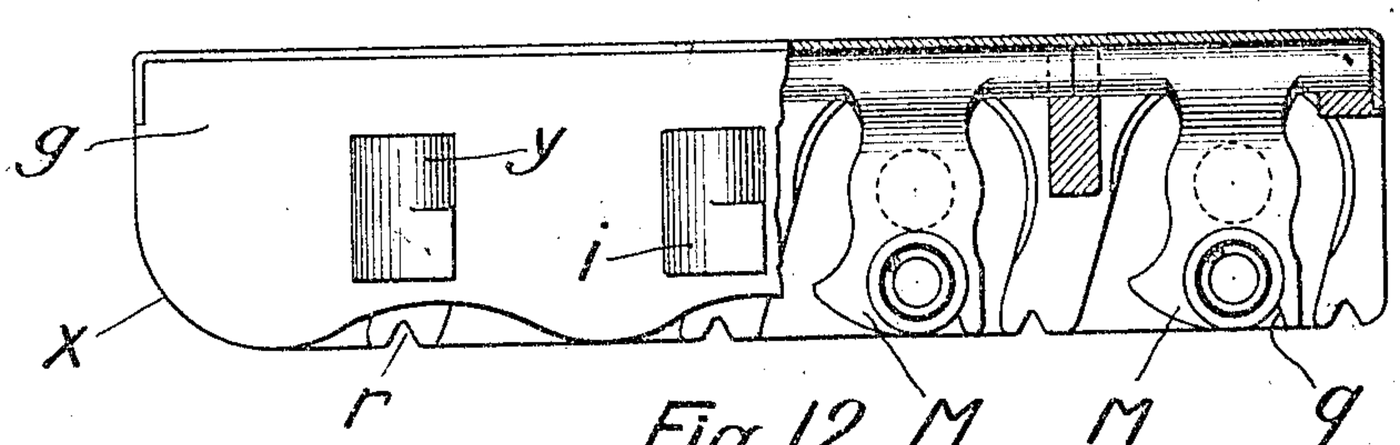


Fig. 12.

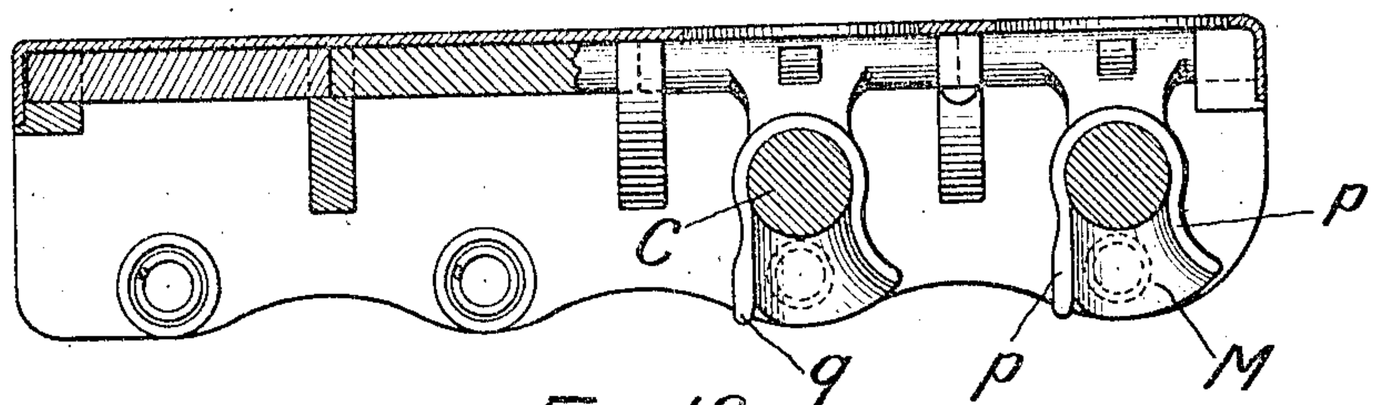


Fig. 13.

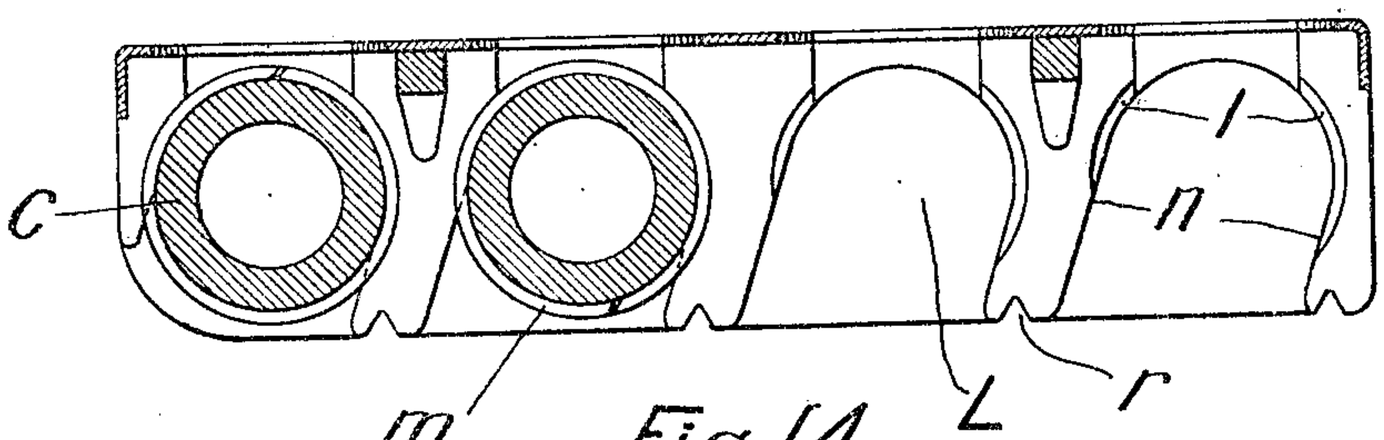


Fig. 14.

Witnesses:
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9 SHEETS—SHEET 9.

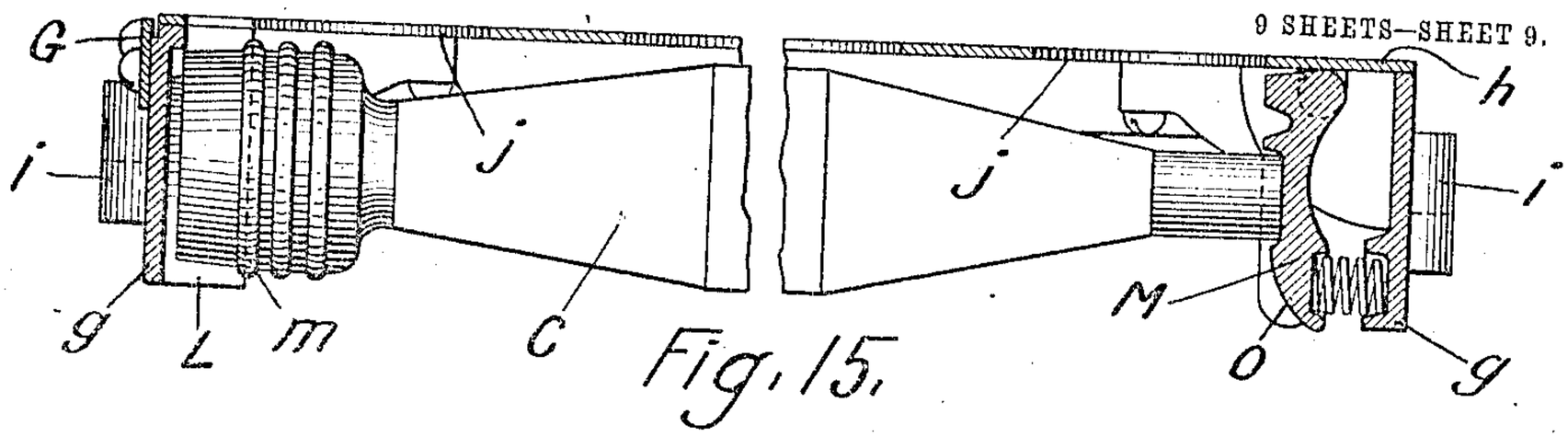


Fig. 15.

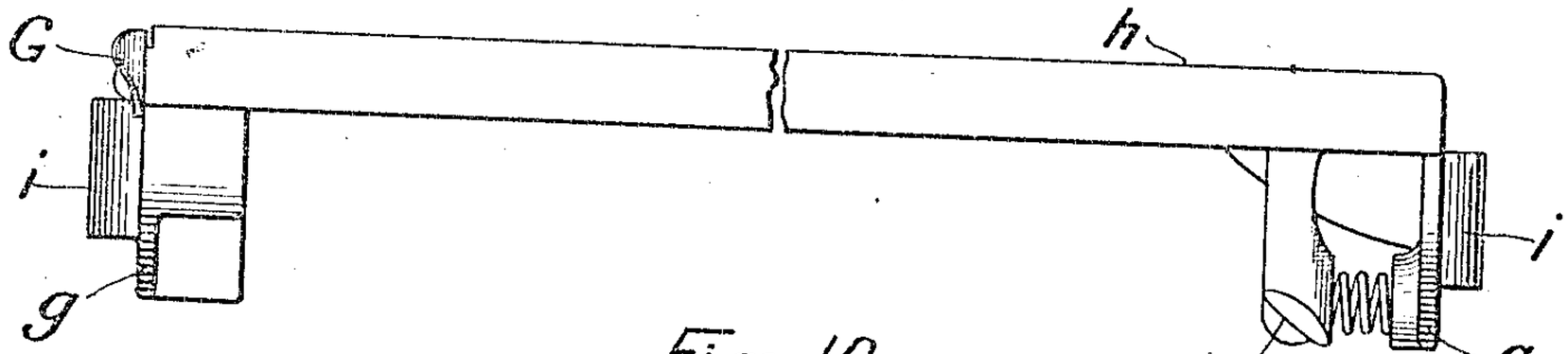


Fig. 16.

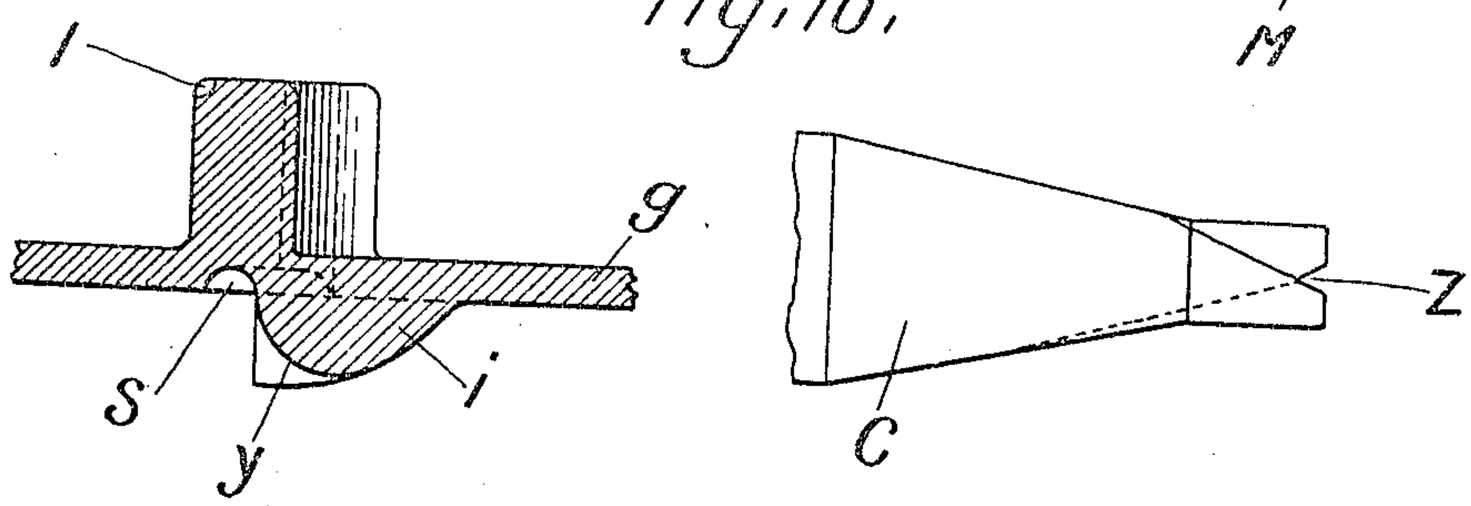


Fig. 17.

Fig. 18.

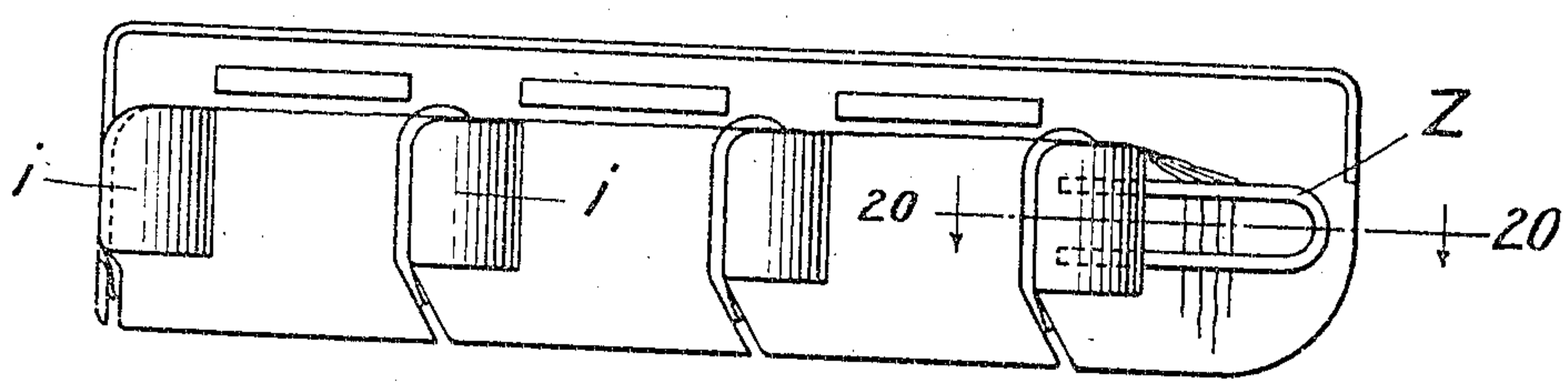


Fig. 19.

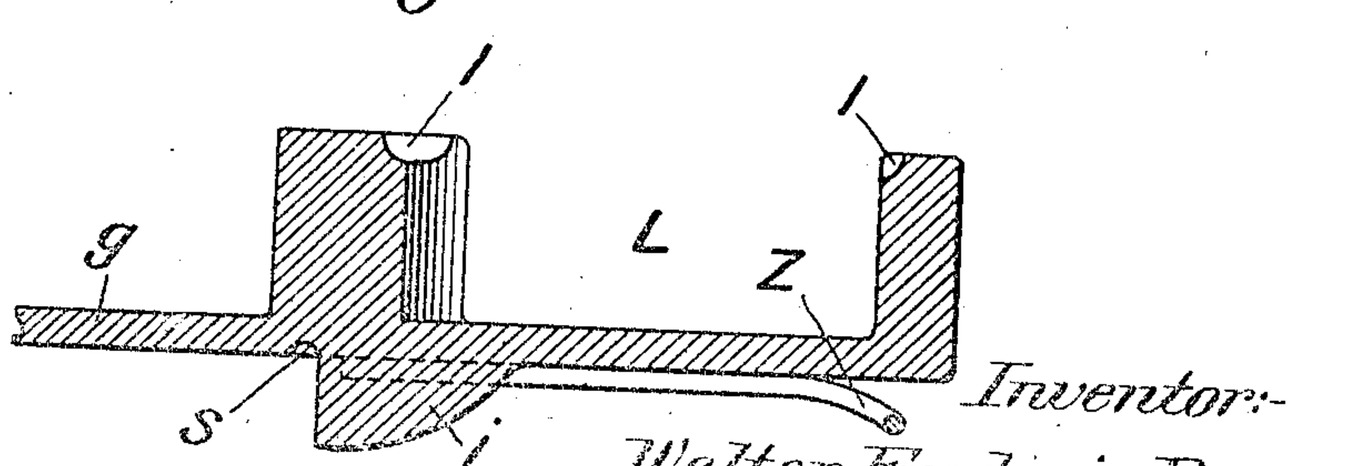


Fig. 20.

Witnesses:
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Inventor:-
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# UNITED STATES PATENT OFFICE.

WALTER FREDERIC ROPER, OF HOPEDALE, MASSACHUSETTS, ASSIGNOR TO DRAPER COMPANY, OF HOPEDALE, MASSACHUSETTS, A CORPORATION OF MAINE.

## WEFT-REPLENISHING LOOM.

No. 843,107 Specification of Letters Patent. Patented Feb. 5, 1907.

Application filed October 16, 1905. Serial No. 282,950.

*To all whom it may concern:*

Be it known that I, WALTER FREDERIC ROPER, a citizen of the United States, residing at Hopedale, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Weft-Replenishing Looms, of which the following is a specification.

The object of the present invention is to substantially relieve the weaver from all attention to the weft-supply of a loom, thus placing the management of the weft in the same category with that of the warp.

In accordance with the present invention the bobbins, cops, or other weft-carriers are suitably placed in appropriate "cages" at any convenient place in the mill, and the end of the weft-thread of each weft-carrier is secured to a weft-end holder with which the cage is equipped. The loom is provided with a suitable magazine of sufficient capacity to hold enough of the weft-carriers to serve the loom for an entire day. In accordance with this invention the loom can be supplied with weft-carriers either after the mill has shut down for the evening or before it starts in the morning, so that the work of the weaver in connection with the loom will be in no wise affected or disturbed by the supplying of weft-carriers to the magazine. The loom is equipped with appropriate mechanism, such as is now well known in the art, whereby a weft-carrier is automatically placed in weaving position in the loom whenever the condition of the running weft demands. After each transfer of a weft-carrier into weaving position has been effected the active cage is then fed forward so as to bring a second weft-carrier automatically into operation, and after all of the weft-carriers of each cage have been exhausted a full cage is brought automatically into action. The emptied cages are discharged automatically into a suitable receiver, as are the spent weft-carriers after use in the loom. The weft ends are so secured to the cages as to avoid any entangling of the various threads in the magazine to avoid breakage of thread and when the corresponding weft-carrier is transferred to the loom to minimize the amount of thread wasted.

One embodiment of the present improvements is illustrated in the accompanying drawings, in which—

Figure 1 is a side view of so much of a loom equipped with the present improvements as is necessary for an understanding of the same. This figure looks toward the weft-supply side of the loom. Fig. 2 is a plan view. Fig. 3 is a vertical section in the irregular plane indicated by the line 3 3 in Fig. 1. Fig. 4 is a horizontal section in the irregular plane indicated by the line 4 4 in Fig. 1. Fig. 5 is a detail vertical section in the plane indicated by the line 5 in Fig. 1. Fig. 6 is a vertical section in the plane indicated by the line 6 in Fig. 2. Fig. 7 is a vertical section in the plane indicated by the line 7 7 in Fig. 2. Fig. 8 is a vertical section similar to Fig. 7, showing the transferrer in the act of transferring a weft-carrier into weaving position in the loom. Fig. 9 is an under side view of one of the cages partly equipped with weft-carriers. Fig. 10 is a top view of one of the cages partly equipped with weft-carriers. Fig. 11 is a view of the inner side of one of the cages, showing the weft-end holders. Fig. 12 is a view of the outer side of the cage, partly in the vertical section indicated by the line 12 12 in Fig. 10. Fig. 13 is a vertical section of one of the cages in the plane indicated by the line 13 13 in Fig. 10. Fig. 14 is a vertical section of one of the cages in the plane indicated by the line 14 14 in Fig. 10. Fig. 15 is a section of one of the cages in the plane indicated by the line 15 15 in Fig. 10. Fig. 16 is a front view of one of the cages. Fig. 17 is a detail section in the plane indicated by the line 17 in Fig. 11. Fig. 18 is a detail figure of the top end of a weft-carrier, showing a permissible way of carrying the end of the thread to the weft-end holder. Fig. 19 is a side view of the cage looking at the weft-end-holder side and illustrating a modified form of weft-end holder. Fig. 20 is a detail horizontal section in the plane indicated by line 20 20 in Fig. 19.

The drawings illustrate only a few of the usual features of an automatic weft-replenishing loom.

In Fig. 1 the usual cam or low shaft A of the loom is shown, and also there is shown

a reciprocating transferrer B, which is pivoted at *a* and is held normally uplifted by a spring *b*. (See Figs. 1 and 2.) This transferrer is of a type now well known in automatic weft-replenishing looms, being similar in general characteristics to that set forth in the United States patent of Northrop, No. 529,940, November 27, 1894. It remains normally uplifted; but on the occurrence of a contingency requiring the automatic replenishment of weft in the loom it descends and automatically transfers a fresh weft-carrier into weaving position in the loom. As is customary in connection with the automatic transfer of a weft-carrier, such as a bobbin C, the transferrer has two fingers *c d*, (see Fig. 3,) which act, respectively, upon the weft-carrier near its butt and tip, respectively. Fig. 8 illustrates the transferrer in the act of transferring a fresh weft-carrier C into a shuttle D in position within the contiguous shuttle-box on the lay E, the spent weft-carrier being ejected at the same time and falling through an opening in the lay into a suitable receiving-chamber *e* below, as indicated in Fig. 3. In these respects the operation of the loom is similar to that of the present well-known Northrop weft-replenishing loom.

In accordance with the present invention the spare weft-carriers are initially placed in suitable holders, which are here called "cages." One of these cages F is illustrated in detail in Figs. 9 to 17, inclusive. Each cage is adapted to receive and hold a plurality of weft-carriers, as shown being capable of holding four weft-carriers.

The cage is equipped with appropriate devices to receive and hold the weft-carriers, and these devices will be hereinafter particularly described. At the time the weft-carriers are placed in the cages the weft end of each weft-carrier is secured to a weft-end holder G, with which the cage is equipped, and preferably there is a separate weft-end holder for each weft-carrier, as illustrated in Figs. 9, 10, and 17. These cages thus filled with weft-carriers are stacked within a suitable fixed vertical magazine H, which is mounted on a fixed support I on a stationary part of the framework of the loom, such as one end of the breast-beam, as illustrated in Figs. 1 and 2. This magazine can be of any height for holding any desired number of the cages, and this is indicated in Fig. 1 by breaking off the top of the magazine. Conveniently and desirably the magazine is made of such height as to receive a stack of cages in sufficient number to furnish enough weft-carriers to certainly supply the loom for an entire day. Figs. 1, 7, and 8 illustrate two of the weft-carriers located within the reservoir-chamber of the magazine, the upper cage resting by gravity upon the lower one, and inspection of these figures indicates how any desired number of the cages can be stacked upon one another within the magazine.

The magazine-chamber is open at its bottom and there communicates with a horizontal guideway for the forward feed of the cages. As shown in Fig. 4, this guideway has horizontal guides J J, on which the lowermost and active cage rests and by virtue of which the active cage supports the superimposed stack of cages located within the magazine. The guideway thus constituted extends forward beneath the front wall of the magazine a sufficient distance to support the active cage until all of the weft-carriers held by it have been transferred in succession to the loom. The feeding mechanism is so arranged that the active cage is fed forward automatically the distance between two successive weft-carriers held by it after each transfer of a weft-carrier from the cage to the loom. When the last weft-carrier in the active cage is thus fed into registering position below the transferrer and is ready to be acted upon by the transferrer when next called into operation by the condition of the running weft, the active cage is removed from beneath the superimposed stack of cages in the magazine, whereupon they drop down by gravity, the then lowermost of the stack of cages taking its position on the guides J J under the control of the feeding mechanism. This feeding mechanism will be hereinafter described in detail. The spent cage exhausted of its weft-carriers is fed step by step forward by the action of the feeding mechanism until it comes entirely over a fixed delivery-chute K, (see Fig. 3,) whereupon the spent cage slides down by gravity into a suitable receiving-chamber *f* beneath.

It will be noted that during the descent of the several cages within the magazine and during the forward feed of the active cage under the control of the automatic step-by-step feeding mechanism each weft-carrier maintains a definite position relatively to its weft-end holder, so that there is no danger of the weft-threads becoming entangled with each other or of the individual weft-threads becoming detached or catching on any part of the loom. Another important feature of the weft-end holders is that they are located at the inner side of the magazine—that is to say, at the side of the magazine nearest to the selvage of the cloth—with the result that each weft-end holder is between its weft-carrier and the cloth selvage. Hence when a weft-carrier is inserted into weaving position in the loom there is a minimum length of weft-thread left between the weft-end holder and the selvage of the cloth to be cut off and wasted. This is of importance in the case of expensive thread.

In describing the details of the improve-

ments the construction of the weft-cages will first be considered, then the construction and mode of operation of the feeding mechanism, then the discharge of the spent weft-cages, and finally illustrated modifications will be considered.

Each cage is composed of two malleable-iron castings *g g*, (see Fig. 9,) connected together by a sheet-steel top plate *h*, (see Fig. 10,) the top plate and side castings being suitably riveted together. There is thus formed a strong substantial but light cage capable of being readily handled without injury. At its two opposite sides and at the exterior it is provided with oppositely-projecting lugs *i i*, integral with the side castings, which coöperate with the feeding mechanism. The top plate *h* is made in skeleton form, as by forming therein holes *j*, which reduce its weight, and at the same time the holes near the sides afford passage for the fingers *c d* of the transferrer. The cage is suitably formed beneath the top plate to receive and securely hold the weft-carriers, while at the same time permitting their ready removal under the action of the transferrer. Each weft-carrier is held both at butt and tip. The inner side casting *g* is provided with suitable sockets L L, (see Fig. 14,) one for each butt of the weft-carriers which the cage is adapted to hold. Preferably each cage is capable of holding a plurality of weft-carriers, as illustrated holding four weft-carriers. Each of these butt-holding sockets L has an open mouth at the lower end to permit the downward discharge of its weft-carrier, and it is of appropriate shape to receive and hold the butt of the weft-carrier, as further illustrated in Figs. 15 and 17. In addition each socket has recesses *l*, into which the end ring *m* of a weft-carrier fits when in place. These recesses *l l* are at opposite sides of the socket, and the distance between their lower corners *n n* is less than the major diameter of the ring *m*. Consequently the butt of the weft-carrier cannot be displaced downwardly except by a slight but sufficient endwise movement of the weft-carrier to clear the ring *m* from the recesses *l l*. This effectually prevents any accidental discharge or displacement of the weft-carriers in the cage. Nevertheless under the force applied by the transferrer the weft-carrier is readily displaced endwise, so as to become freed from these retaining-recesses, the manner in which the weft-carrier tip is held permitting this endwise movement. Each weft-carrier is held by its tip in the cage by a pivoted spring-pressed latch M. (Best shown in Figs. 12, 13, and 15.) As here shown, each latch M is pivotally connected near its upper end to the cage, and at its lower end it is pressed inwardly by a spring. On its inner face each latch has a circular recess to receive the tip of the weft-carrier, as clearly shown in Fig. 15. The inner face of the lower end of the latch M is beveled or rounded at *o* in Fig. 15, so as to facilitate the placing of the weft-carriers in place in the cage. The weft-carriers are readily placed in position in the cage. Conveniently a weft-carrier butt is first placed in one of the sockets L, and the tip is then brought against the beveled end *o* of the latch, thereby pressing the latch back against the tension of its spring, so that the tip of the weft-carrier seats in the recess intended for it. Thereupon the spring restores the latch to its holding position. As shown in Fig. 13, the latch has side flanges *p*, which aid in guiding and directing the weft-carrier tip into place. When the transferrer acts, the latch M yields, thus permitting slight endwise movement of the weft-carrier to free its ring *m* from the socket-recesses *l l*, and the weft-carrier is then thrust downwardly by the transferrer into the shuttle beneath, as illustrated in Fig. 8.

The weft-carrier illustrated is one of well-known construction used in the Northrop loom, having the projecting rings *m* at its butt, which enable it to be grasped and held by bobbin-holding jaws in the shuttle, as set forth in the patent of Northrop, No. 454,807, June 23, 1891.

The shuttle employed is one of the automatic-threading type—such as is set forth, for example, in the Northrop patent, No. 454,807—and in connection with such a shuttle the weft-carriers are so placed in the magazine that their butt-ends are toward the selvage of the cloth—that is to say, when the cages are in place in the magazine, as illustrated in Fig. 2, the weft-carrier butts are at the inner side of the magazine and are hence presented toward the adjacent selvage of the cloth. These considerations determine the location of the weft-end holders G on the cages. Each cage has preferably as many weft-end holders as it holds weft-carriers, as illustrated in Fig. 11. The end of the thread of each weft-carrier is first led toward the weft-carrier tip and thence through an open thread-guide *q* in the latch M, (best shown in Figs. 12 and 13,) and the thread is thence led alongside the weft-carrier (see Fig. 9) to the inner side of the cage. The thread then passes through a notched thread-guide *r* on the edge of the inner side *g* (see Figs. 9 and 11) and thence upwardly through a depressed thread-guiding recess *s* in the outer face of the inner side *g* (see Figs. 11 and 7) to the weft-end holder G. This holder, as shown, consists of a strip of sheet metal with its ends outwardly bent and secured by a screw to the outer wall of the inner side, as best shown in Figs. 9, 10, and 11. The end of the thread is secured to the holder between it and the outer wall of the cage side. The purpose of the recessed thread-guides *r s* is

to enable the thread to be kept away from the edge and wall of the cage, so as to avoid any chafing of the thread during the occupancy of the magazine by the cage or during its feed. The thread is thus fully protected at all times. The circumstance that the thread is led first toward the tip of the weft-carrier, thence around a thread-guide, such as *q*, and thence along the weft-carrier to a holder located between the butt of the weft-carrier and the selvage of the cloth is a matter of importance. During the transfer of the weft-carrier to the shuttle the initial movement of the weft-carrier frees the thread from the thread-guide *q* near the weft-carrier tip, thus leaving slack the thread extending from said thread-guide *q* to the thread-holder G. This amount of slack thread is sufficient to enable the weft-carrier to be deposited into the shuttle on the lay without involving any strain on the thread, hence avoiding thread breakage during the transfer. At the same time, owing to the location of the weft-end holder between the butt of the weft-carrier and the selvage of the cloth, there is only a short length of thread which is wasted. During the entire occupancy of the cage by the weft-carrier the weft-end holder goes with the weft-carrier and always occupies the same relation thereto until the transfer to the loom is made. There is nothing to chafe the thread or to cause it to loosen or become slack, so that there is no entangling of the threads of the different weft-carriers and no damage occurs to the threads. At the same time when all of the weft-carriers have been transferred from the cage to the loom and the spent cage is discharged into its receiver all of the short ends of weft left attached to the cage are carried into the receiver, so that there are no loose ends of thread left flying about with the possibility of being caught in the cloth or by moving parts of the loom. In this connection it will be understood that the loom is equipped, as customarily, with a thread-cutter for cutting the weft between the adjacent selvage of the cloth and the weft-end holder after each weft-carrier has been inserted into weaving position in the loom. These cages are conveniently supplied with weft-carriers, and the weft ends are readily and conveniently secured. This work can be done rapidly by helpers at any convenient place in the mill away from the looms and at small expense.

Each cage is detachable from the loom, and its retaining devices grasp and firmly hold the contained weft-carriers, so that the cages can be handled freely and in any position without danger of accidentally displacing the weft-carriers.

At any convenient time the loaded cages are carried to the looms and stacked up in the loom-magazines. Each magazine is open at its top and also at its outer side, as illustrated in Fig. 2. As illustrated, the magazine is composed of sheet metal bent into appropriate shape to receive and retain the cages lying horizontally. The cages can be inserted either through the open top or through the open outer side. This open outer side has marginal columns N O to prevent the outward displacement of the cages.

The lowermost cage when resting on the horizontal guides J J has its feed-lugs *i i* within range of a step-by-step feeding mechanism which feeds the cage forward whenever the transferrer acts. The feeding mechanism comprises two horizontal sliding racks P P at opposite sides of the magazine-support I, as clearly shown in Fig. 4, each sliding rack P being suitably guided in the support I, as shown in Fig. 5. These two racks P P slide in unison through their rack-teeth, (see Figs. 1, 7, and 8,) meeting with pinions *t* at opposite ends of a rotary shaft Q. At its forward end each rack has a spring-controlled pivoted pawl R, which is adapted to engage the feed-lugs *i i* on the cage, as shown in Fig. 4. The inner rack P has pivoted to it an actuating-link S, which at its forward end has a slot *u*, (see Fig. 8,) into which enters a laterally-projecting pin *v* on an upwardly-projecting arm of the transferrer B. Normally the transferrer, actuating-link, and racks occupy the position shown in Figs. 4 and 7. When, however, the transferrer descends to insert a fresh weft-carrier into the loom, the actuating-link S is moved by the pin *u* to the rear, as shown in Fig. 8, thus thrusting both racks P rearwardly. During this rearward movement the spring-controlled feeding-pawls R ride outwardly upon the beveled front faces of the feed-lugs *i i* on the active cage, thus having no effect upon the position of the cage. The rearward movement of the pawls R is sufficient to bring them in register with the lugs of the active cage immediately in the rear of the lugs originally registered. When the transferrer is restored to its normal uplifted position by its actuating-spring *b* after the completion of the transfer operation, the actuating-link S and the pawl-carrying racks P P are not concurrently restored to their original normal position, because the pin *v* on the transferrer moves idly in the slot *u* of the actuating-link S. Consequently the transferrer moves upwardly freely without being interfered with by the active cage. After the transferrer has thus been restored to its normal uplifted position a cam *u* (see Fig. 1) on the cam-shaft A performs its action upon the lower end of a pivoted gravity-restoring lever T, whose upper end swings in the path of the inner rack P. This cam-actuated restorer then acts upon the rearwardly-projected end of the inner rack P and forces it, together with the outer rack and the actuating-link S, into their normal forward position.

During this forward movement of the racks their pawls R R feed the active cage one step forward.

Both the restorer and the actuating-link S at its slot carry appropriate elastic cushions, so as to avoid any shock upon the cage-feeding devices.

The active cage is limited in its forward movement to avoid overrunning and to leave the forward weft-carrier held by it in accurate position beneath the transferrer by a suitable upwardly-projecting fixed stop U, (see Figs. 7 and 8,) against which the butt of the leading weft-carrier comes in contact, as indicated in Fig. 7. This stop is appropriately located, as indicated by dotted lines in Fig. 4, so that the cage itself can slide by it without contact. This registering stop coacts only with the leading weft-carrier held by the cage. The active cage is further held in proper operative position by means of a spring-brake V, (see Fig. 4,) which is secured to the support I above the outer guide J, so as to come in contact with and press against the outer wall of the outer side *q* of the cage and above the feed-lugs *i i*. This spring-brake steadies the active cage throughout the occupancy of its active position. Each cage is thus fed forward step by step until all of its weft-carriers have been transferred to the loom. When the last weft-carrier of the active cage is brought into register with the transferrer, said cage no longer affords a support to the cages above within the magazine, and accordingly they drop down by gravity, thus bringing a fresh weft-cage within reach of the feeding-pawls. On comparing Figs. 4 and 8 it will be seen that the stack of cages drops down entirely back of the feeding-pawls, so that said pawls do not interfere with the descent of the cages.

The empty cage is fed along forwardly by the active cage, as indicated in Figs. 7 and 8, until it is brought wholly over the laterally, outwardly, and downwardly inclining delivery-chute K. Thereupon the spent cage slides by gravity down the chute and into the receiving-chamber *f* below. In order that the spent cage may be held steady until wholly above the discharge-chute, a spring-finger W is shown in Figs. 2, 7, and 8, which engages a series of notches on the lower edge of the inner side of the cage. These notches are conveniently supplied by the lower notched thread-guides *r*, by this time their office as guides for the thread having been completed. The leading edges of the sides of the cage are rounded off, as indicated at *x*, so as to ride over this spring-supporting finger W and also to facilitate the drop of the cage back of the active cage.

The receiver X, located below the discharge-chute J, is provided with two receiving-chambers *e f*, one for the spent weft-carriers and the other for the spent cages. It is provided with an elastic buffer Y, which receives the impact and changes the direction of fall of the cages as they slide off from the delivery-chute, thus causing them to land right side up in the chamber provided for them.

It is important that the cages should be placed the right face down and the right side in, or, in case this should not be done, that the effectiveness of the feeding mechanism should be automatically arrested. One convenient way of necessitating the proper placing of the cages in the magazine is by making the cages and magazine relatively unsymmetrical in a horizontal plane. This is shown in Fig. 2. The forward column N of the outer side of the magazine is made wider than the rear column O, as clearly shown, so that while the magazine is wide enough at its rear to receive the extreme width of the cages, (including the outwardly-projecting feed lugs *i i*,) yet at the front the magazine is of lesser width, so that if the attempt is made to place the cage within the magazine upside down or wrong end to the cages will not fit the magazine. If it should be attempted to turn the cage upside down and wrong side out, then the cage could not be inserted, because one of its thread-holders would come in contact with the larger column N, and hence prevent insertion. By reason, therefore, of this unsymmetrical relation between the cages and the magazine when regarded horizontally it is impossible to place the cages in the magazine except correctly.

As a further precaution the feed-lugs are so constructed that if the cages should be wrongly placed within the magazine, (as might be the case should the front column N become damaged,) yet no damage could result, because the misplaced cage could not be actuated by the feeding mechanism. As illustrated in Figs. 11, 12, and 17, the upper portion of each feed-lug *i* is rounded away both forward and aft, as shown at *y*. Consequently if a cage should be placed upside down in the magazine it could not be fed by the spring feed-pawls R, since they would ride idly over the lugs in both directions. As the result there would be no transfer effected when the misplaced cage became the active cage, and the loom would then automatically stop by means now well known to the art, such as those disclosed in the Northrop patent, No. 529,943, November 27, 1894.

It is not necessary that the thread should be led from the weft-carrier first over a thread-guide on the cage itself. A substitute construction is shown in Fig. 18, wherein the tip end of the weft-carrier itself is shown provided with a notched thread-guide *z*, through which the thread can be led on its way to the front holder G with satisfactory results; nor is it necessary that each cage should have as many thread-holders as there

are weft-carriers. As shown in Figs. 19 and 20, each cage need have but a single thread-holder Z, to which may be secured the threads of all of the weft-carriers mounted in the cage. As here shown, however, each thread is independently guided to the thread-holder by the thread-grooves at the base of each feed-lug *i*, so that each thread is definitely located with respect to its own weft-carrier when the transfer takes place.

It is obvious that many changes may be made in the various features of this invention without departing from its main principles. For example, each cage could be constructed so as to carry any convenient number of the weft-carriers, and although it is important and desirable that each cage should hold a plurality of weft-carriers, yet some of the advantages of the invention would still be present if the cage was so constructed as to hold but a single weft-carrier.

The transferrer may be set in motion by any of the well-known mechanisms now known in the art. Its action may be controlled by the exhaustion of the running weft, by the approaching exhaustion of the running weft, or by a time or pattern mechanism.

I claim as my invention—

1. A weft-replenishing loom having, in combination, a stationary magazine, a horizontal guideway beneath said magazine extending forward thereof, a stack of superimposed cages resting on each other and supported on said guideway within said magazine, each of said cages holding a plurality of weft-carriers, feeding mechanism coöperating with the lowermost and active cage, a transferrer which automatically transfers the forward weft-carrier in the active cage into weaving position in the loom, a fixed stop cooperating with said forward weft-carrier to register it with the transferrer, a connection between said transferrer and feed mechanism to move said feeding mechanism in one direction, and a cam-actuating restorer to move said feeding mechanism and the active cage into the opposite direction.

2. A weft-replenishing loom having, in combination, a stationary magazine, a horizontal guideway beneath said magazine extending forward thereof, a stack of superimposed cages resting on each other and supported on said guideway within said magazine, each of said cages holding a plurality of weft-carriers, feeding mechanism coöperating with the lowermost and active cage, a transferrer which automatically transfers the forward weft-carrier in the active cage into weaving position in the loom, and means for automatically actuating said feeding mechanism each time the transferrer acts.

3. A weft-replenishing loom having, in combination, a magazine, a guideway beneath said magazine extending forward thereof, a stack of superimposed cages resting on each other and supported on said guideway within said magazine, each of said cages holding a plurality of weft-carriers, feeding mechanism coöperating with the lowermost and active cage, a transferrer which automatically transfers the forward weft-carrier in the active cage into weaving position in the loom, and means for automatically actuating said feeding mechanism each time the transferrer acts.

4. A weft-replenishing loom having, in combination, a magazine, a guideway beneath said magazine extending forward thereof, a stack of superimposed cages resting on each other and supported on said guideway within said magazine, each of said cages holding a weft-carrier, feeding mechanism coöperating with the lowermost and active cage, a transferrer which automatically transfers a weft-carrier from the active cage into weaving position in the loom, and means for automatically actuating said feeding mechanism each time the transferrer acts.

5. A weft-replenishing loom having, in combination, a magazine, a plurality of cages within said magazine, each of said cages holding a plurality of weft-carriers, feeding mechanism coöperating with said cages, and a transferrer which automatically transfers the coöperatively-located weft-carrier into weaving position in the loom.

6. A weft-replenishing loom having, in combination, a magazine, a plurality of cages each holding a weft-carrier, feeding mechanism coöperating with said cages, and a transferrer which automatically transfers a weft-carrier from the coöperatively-located cage into weaving position in the loom.

7. A weft-replenishing loom having, in combination, a plurality of independent cages, each having means to removably hold a weft-carrier at both of its ends, and automatic means for removing said weft-carriers from their cages.

8. A weft-replenishing loom having, in combination, a plurality of cages each adapted to hold a plurality of removable weft-carriers, and automatic means for removing said weft-carriers from their cages.

9. A weft-replenishing loom having, in combination, a plurality of cages each adapted to hold a removable weft-carrier, and automatic means for removing said weft-carriers from their cages.

10. A weft-replenishing loom having, in combination, a guideway, a cage holding a plurality of weft-carriers and supported on said guideway, said cage having on each side outwardly-projecting feed-lugs beveled on their forward faces, two horizontally-sliding racks geared together on opposite sides respectively of said cage, a spring-controlled pawl pivoted to each rack and adapted to engage said feed-lugs, said pawls riding idly

over said feed-lugs when moved backwardly and acting on said lugs to feed the cage when moving forwardly, a reciprocating transferrer which ejects the forward weft-carrier in said cage, an actuating-link pivoted to one of said racks, a pin-and-slot connection between said actuating-link and transferrer whereby the transferrer moves the racks backwardly on its weft-carrier-ejecting movement, but has no effect when moving in the other direction, a restorer to move said racks forward, and a rotary cam to move said restorer.

11. A weft-replenishing loom having, in combination, a guideway, a weft-carrier cage supported on said guideway, said cage having on each side outwardly-projecting feed-lugs, two sliding racks moving in unison on opposite sides respectively of said cage, a spring-controlled pawl pivoted to each rack and engaging said feed-lugs, said pawls riding idly over said feed-lugs when moved backwardly and acting on said lugs to feed the cage when moving forwardly, a reciprocating transferrer which ejects the forward weft-carrier in said cage, an actuating-link pivoted to one of said racks, a connection between said actuating-link and transferrer whereby the transferrer moves the racks backwardly on its weft-carrier-ejecting movement, but has no effect when moving in the other direction, a restorer to move said racks forward, and a rotary cam to move said restorer.

12. A weft-replenishing loom having, in combination, a guideway, a weft-carrier cage on said guideway, said cage having outwardly-projecting feed-lugs, a sliding rack, a pawl on said rack engaging said feed-lugs, a transferrer which ejects a weft-carrier in said cage, means for moving the rack backwardly at each action of the transferrer, and a restorer independent of said transferrer to move said rack forward.

13. A weft-replenishing loom having, in combination, a lay, an automatically-threading shuttle, a cage, a support for said cage, a weft-carrier held by said cage with its butt toward the selvage of the cloth, a weft-end holder on the cage between the weft-carrier butt and the cloth selvage, a thread-guide near the weft-carrier tip for the thread on its way from the weft-carrier to said weft-end holder, and a transferrer which automatically transfers said weft-carrier from said cage into the shuttle on the lay.

14. A weft-replenishing loom having, in combination, a lay, an automatically-threading shuttle, a cage, a support for said cage, a weft-carrier held by said cage with its butt toward the selvage of the cloth, a weft-end holder at the inner side of the cage next the cloth selvage, a thread-guide near the weft-carrier tip for the thread on its way from the weft-carrier to said weft-end holder, and a transferrer which automatically transfers said weft-carrier from said cage into the shuttle on the lay.

15. A weft-replenishing loom having, in combination, a lay, an automatically-threading shuttle, a cage, a weft-carrier held by said cage with its butt toward the selvage of the cloth, a weft-end holder at the side of the cage next the cloth selvage, a thread-guide near the weft-carrier tip for the thread on its way from the weft-carrier to said thread-holder, and a transferrer which automatically transfers said weft-carrier from said cage into the shuttle on the lay.

16. A weft-replenishing loom having, in combination, an automatically-threading shuttle, a cage, a weft-carrier held by said cage, a weft-end holder at the side of the cage next the cloth selvage, and a transferrer which automatically transfers said weft-carrier from said cage into the shuttle.

17. A weft-replenishing loom having, in combination, a guideway for weft-carrier cages, each of said cages having a series of notches on the lower edge of its inner side, means for feeding said cages step by step along said guideway, means for ejecting the weft-carriers one by one from said cages, an inclined delivery-chute for receiving and discharging the spent cages, and a spring-finger engaging said notches in succession to steady each cage until wholly over said delivery-chute.

18. A weft-replenishing loom having, in combination, a guideway for weft-carrier cages, means for feeding said cages step by step along said guideway, means for ejecting the weft-carriers one by one from said cages, and an inclined delivery-chute for receiving and discharging the spent cages.

19. A weft-replenishing loom having, in combination, weft-carrier cages, means for feeding said cages step by step, means for automatically ejecting the weft-carriers one by one from said cages, and means for receiving and discharging the spent cages.

20. A weft-replenishing loom having, in combination, weft-carrier cages, means for automatically feeding said cages, means for automatically ejecting the weft-carriers from said cages, and a receiver for the spent cages.

21. A weft-replenishing loom having, in combination, a guideway, a cage on said guideway having feed-lugs, and feed mechanism acting on said lugs, said lugs being uncontrollable by said feeding mechanism if the cage is misplaced on the guideway.

22. A weft-replenishing loom having, in combination, a guideway, a cage moving thereon and a brake acting on said cage.

23. A weft-replenishing loom having a magazine holding weft-carrying cages, said magazine and cages being relatively unsymmetrical to obviate misplacing the cages in the magazine

24. A cage for a weft-replenishing loom adapted to hold and carry a plurality of weft-carriers, said cage having a socket for the butt of each weft-carrier, a yielding latch for the tip of each weft-carrier (each socket having means to prevent displacement of its weft-carrier except by a lengthwise movement thereof, involving the yielding of the corresponding latch,) a weft-end holder on the outer wall of the inner side of the cage for each weft-carrier, a guide on each latch for the thread on its way from the weft-carrier to the proper weft-end holder, and thread-grooves in the inner side of the cage to protect each thread on its way to its weft-end holder.

25. A cage for a weft-replenishing loom adapted to hold and carry a plurality of weft-carriers, said cage having a socket for the butt of each weft-carrier, a yielding latch for the tip of each weft-carrier (each socket having means to prevent displacement of its weft-carrier except by a lengthwise movement thereof, involving the yielding of the corresponding latch,) a weft-end holder on the outer wall of the inner side of the cage for each weft-carrier and a guide on each latch for the thread on its way from the weft-carrier to the proper weft-end holder.

26. A cage for a weft-replenishing loom adapted to hold and carry a plurality of weft-carriers, said cage having a socket for the butt of each weft-carrier, a yielding latch for the tip of each weft-carrier (each socket having means to prevent displacement of its weft-carrier except by a lengthwise movement thereof, involving the yielding of the corresponding latch,) a weft-end holder on the outer wall of the inner side of the cage for each weft-carrier, and a guide at the weft-carrier tip for the thread on its way from the weft-carrier to the proper weft-end holder.

27. A cage for a weft-replenishing loom adapted to hold and carry a plurality of weft-carriers, said cage having a socket for the butt of each weft-carrier, a yielding latch for the tip of each weft-carrier, and a weft-end holder for each weft-carrier.

28. A cage for a weft-replenishing loom adapted to hold and carry a plurality of weft-carriers having a weft-end holder for each weft-carrier.

29. A cage adapted to hold and carry a weft-carrier, said cage having a weft-end holder on the outer wall of one side, and thread-grooves in said side to protect the thread on its way to its weft-end holder.

30. A weft-replenishing loom having, in combination, an automatically-threading shuttle, a plurality of spare weft-carriers, means for feeding said weft-carriers into transferring position, weft-end holders between the weft-carriers and the cloth selvage, said weft-end holders advancing with their respective weft-carriers, and a transferrer which automatically transfers said weft-carriers into weaving position in the loom.

31. A weft-replenishing loom having, in combination, a lay, a plurality of spare weft-carriers, means for feeding said weft-carriers into transferring position, weft-end holders between said weft-carriers and the cloth selvage, said weft-end holders advancing with the respective weft-carriers, thread-guides near the other ends of said weft-carriers for the threads on their way from the weft-carriers to said holders, said guides advancing with their respective weft-carriers, and a transferrer which automatically transfers said weft-carriers into weaving position in the loom.

32. A weft-replenishing loom having, in combination, a plurality of spare weft-carriers, means for feeding said weft-carriers into transferring position, weft-end holders between the weft-carriers and the cloth selvage, said weft-end holders advancing with their respective weft-carriers, and a transferrer which automatically transfers said weft-carriers into weaving position in the loom.

33. A cage adapted to hold and carry a weft-carrier, said cage having a socket for the butt of each weft-carrier, said socket having means to permit displacement of its weft-carrier only by a lengthwise movement thereof, and a yielding latch for the tip of the weft-carrier, said latch in yielding moving in a direction away from the socket.

34. A detachable cage for an automatic weft-replenishing loom having means to removably hold both ends of a weft-carrier.

35. A detachable cage for an automatic weft-replenishing loom having means to grasp and hold a plurality of removable weft-carriers.

36. A detachable cage for an automatic weft-replenishing loom having means to grasp and hold a removable weft-carrier, and having also a weft-end holder.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

WALTER FREDERIC ROPER.

Witnesses:
CLARE H. DRAPER,
J. E. WALKER.