J. NORTHROP.

WEFT FEELER FOR LOOMS.

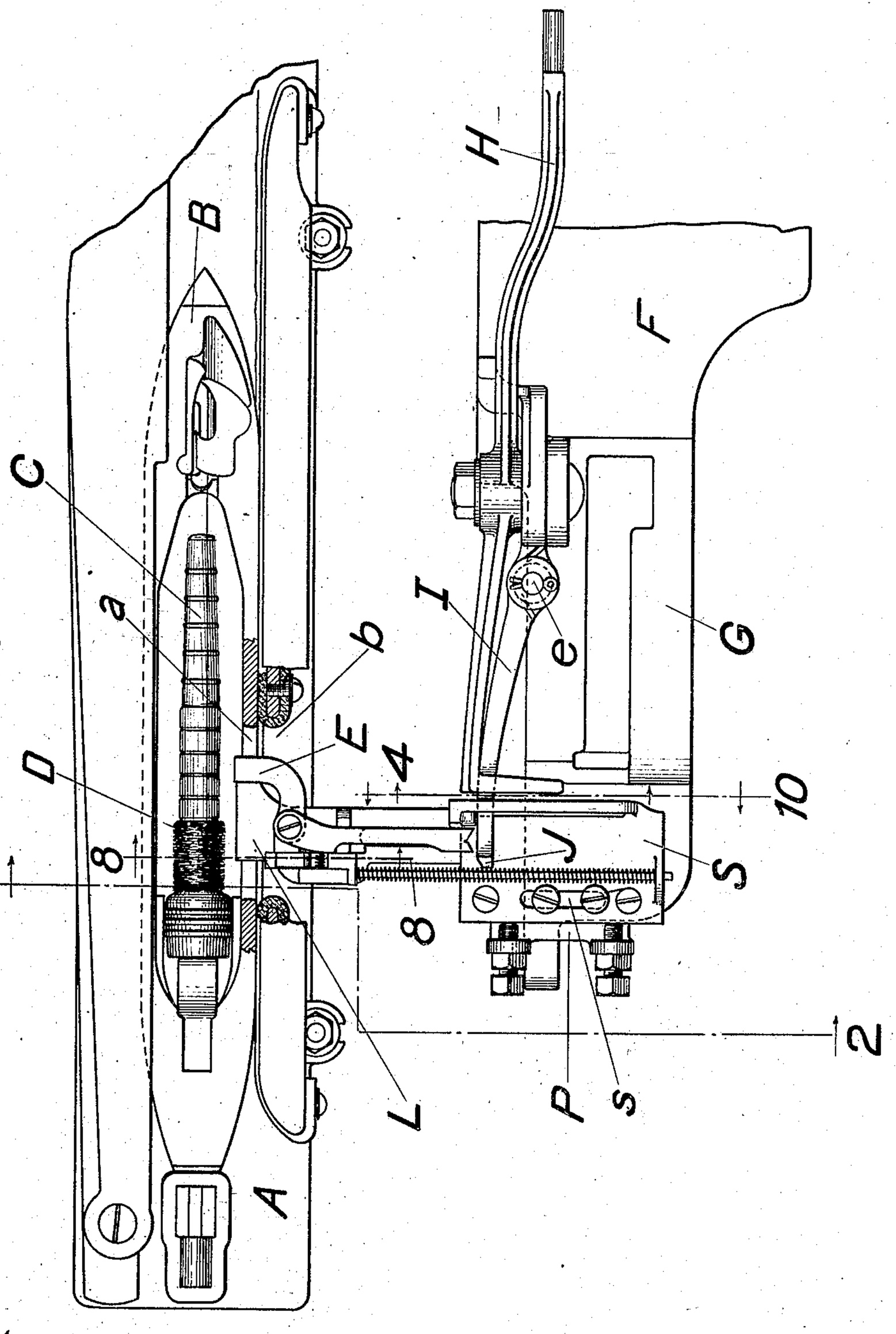
APPLICATION FILED FEB. 15, 1906.

911,672.

Patented Feb. 9, 1909.

6 SHEETS—SHEET 1.

FIG. 1.



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6 SHEETS—SHEET 2.

FIG. 4.

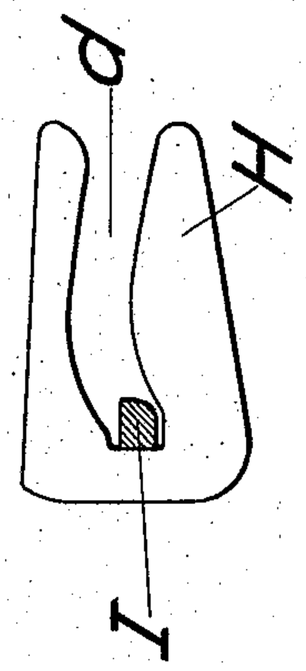


FIG. 2.

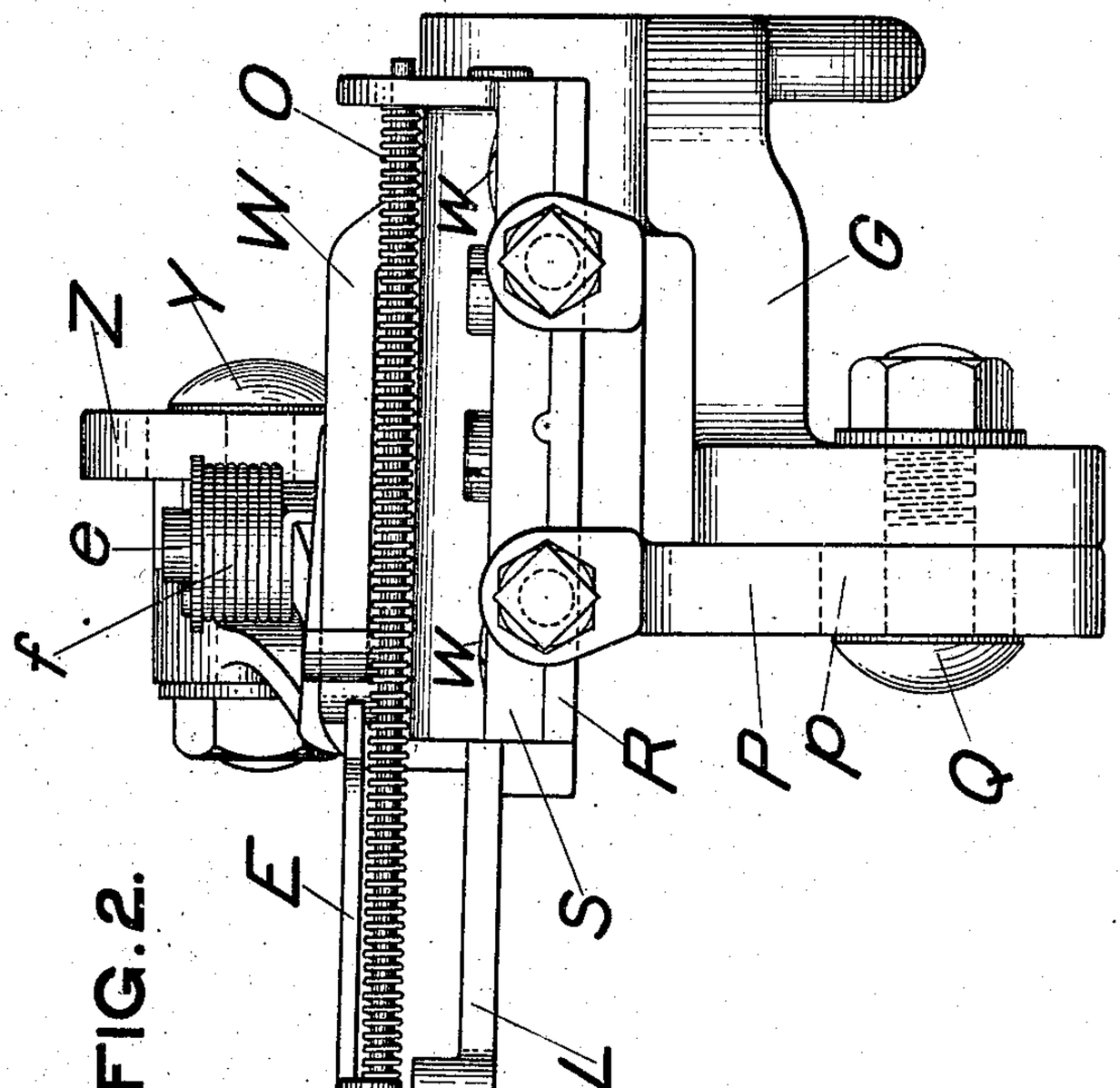
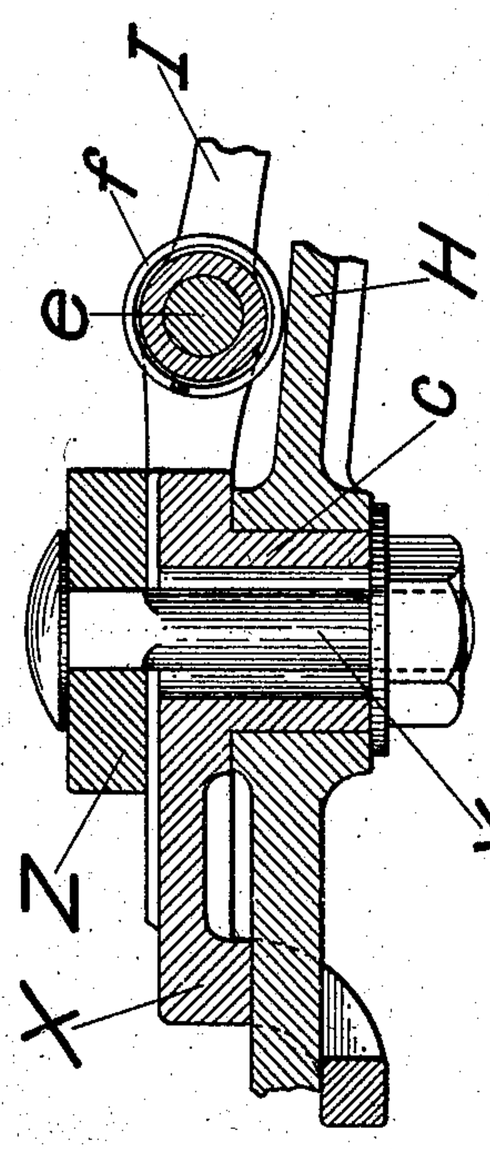
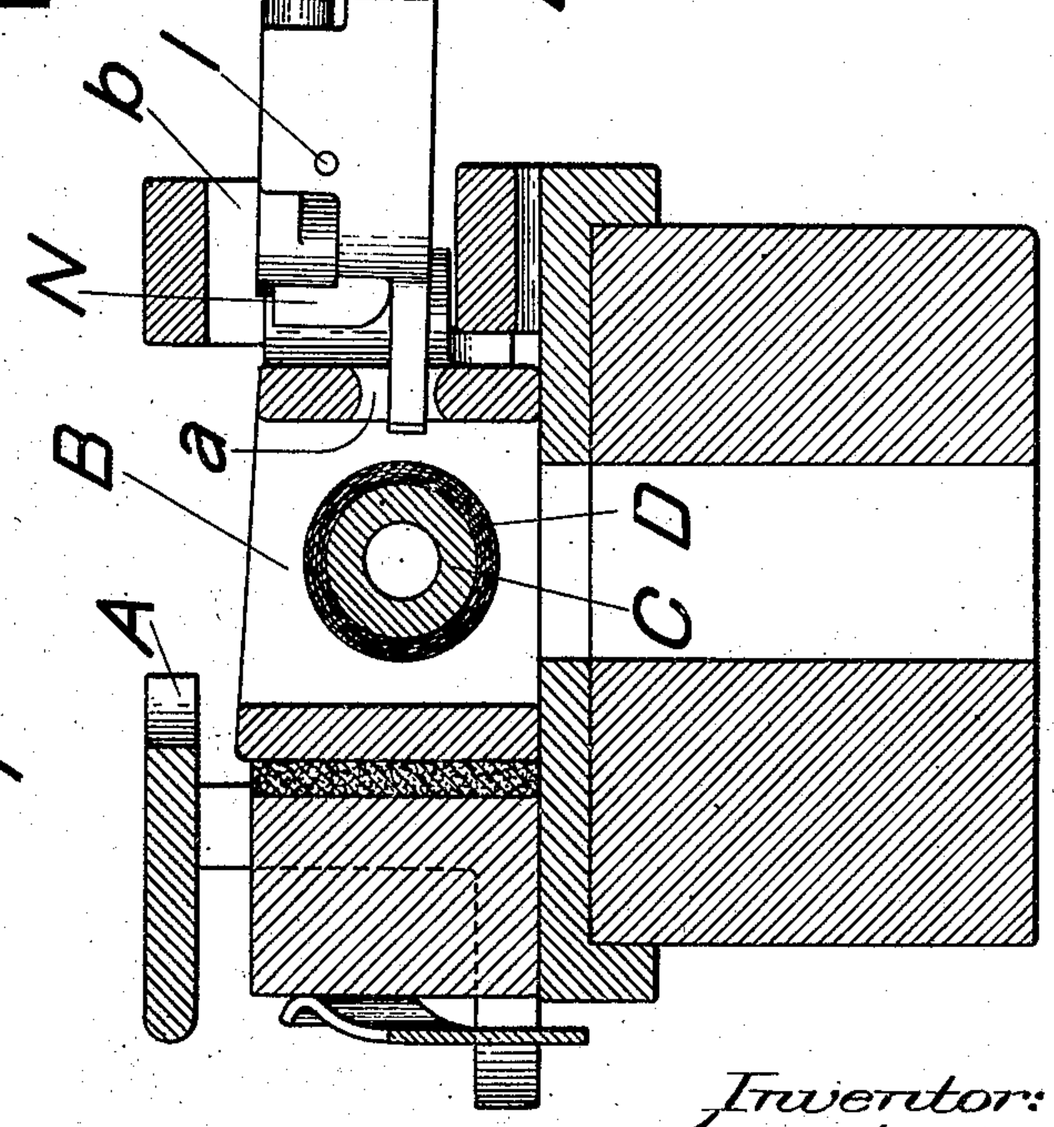


FIG. 3.





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6 SHEETS—SHEET 3.

FIG. 5.

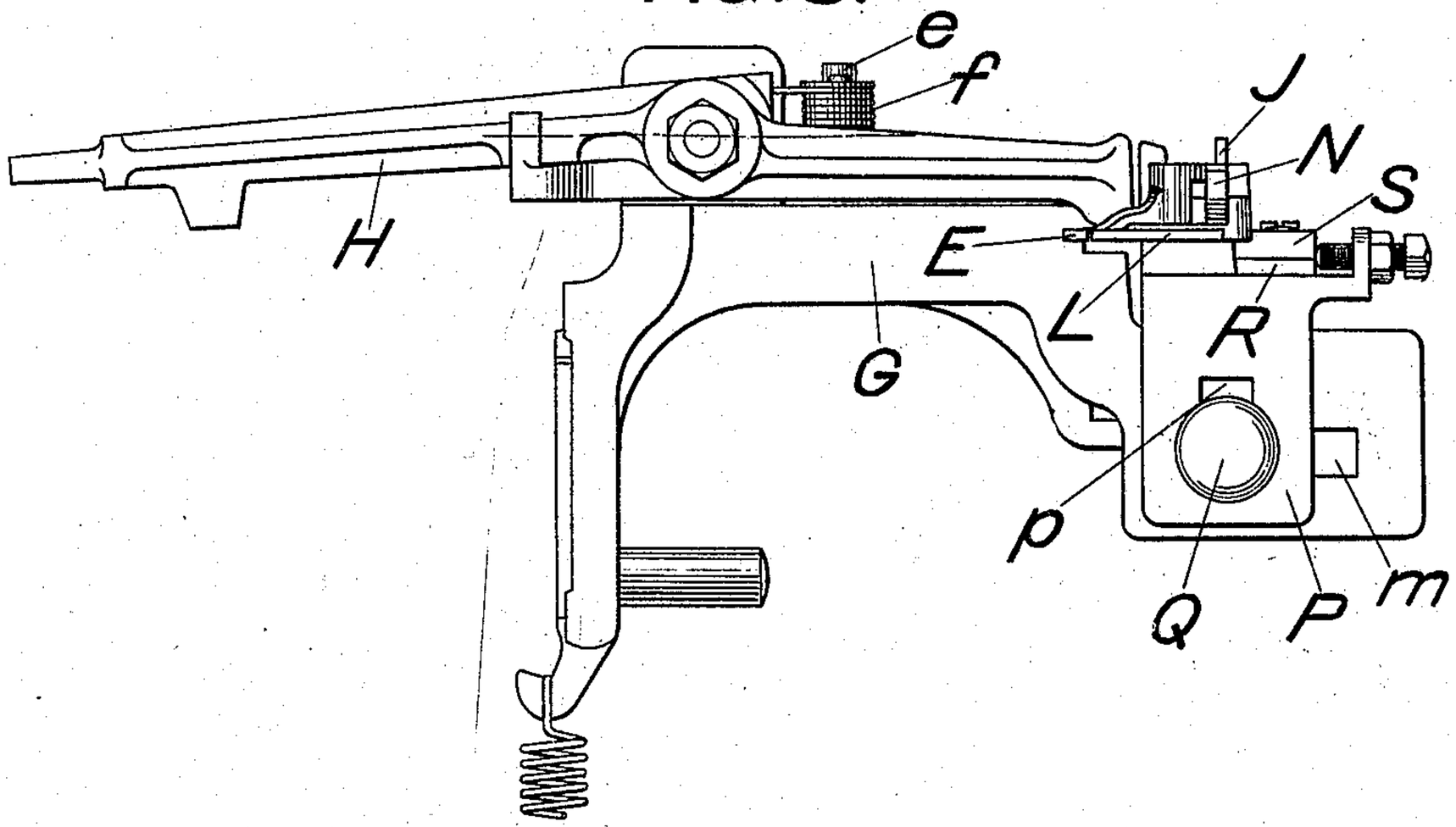
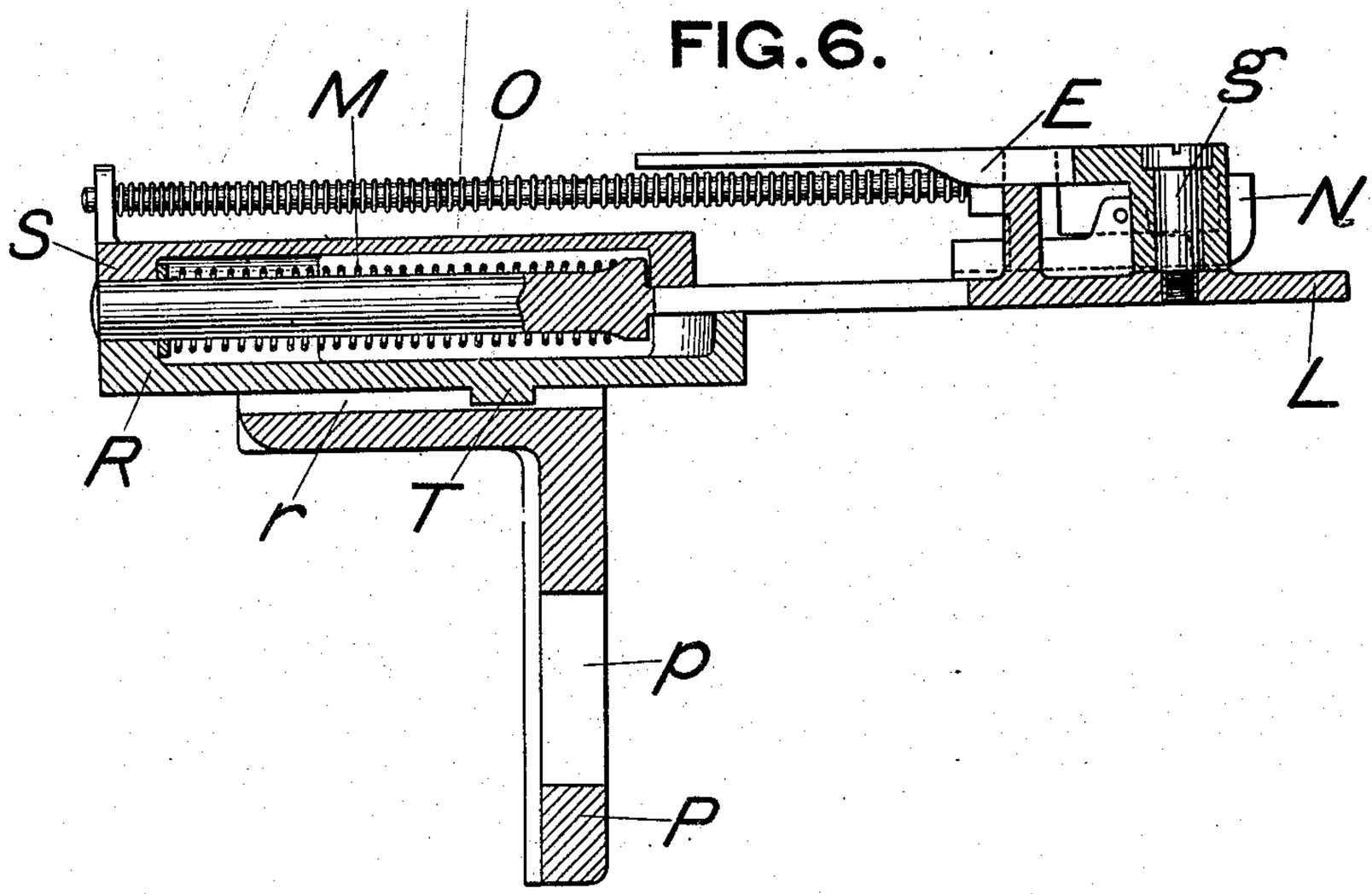


FIG. 6.



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6 SHEETS—SHEET 4.

FIG. 7.

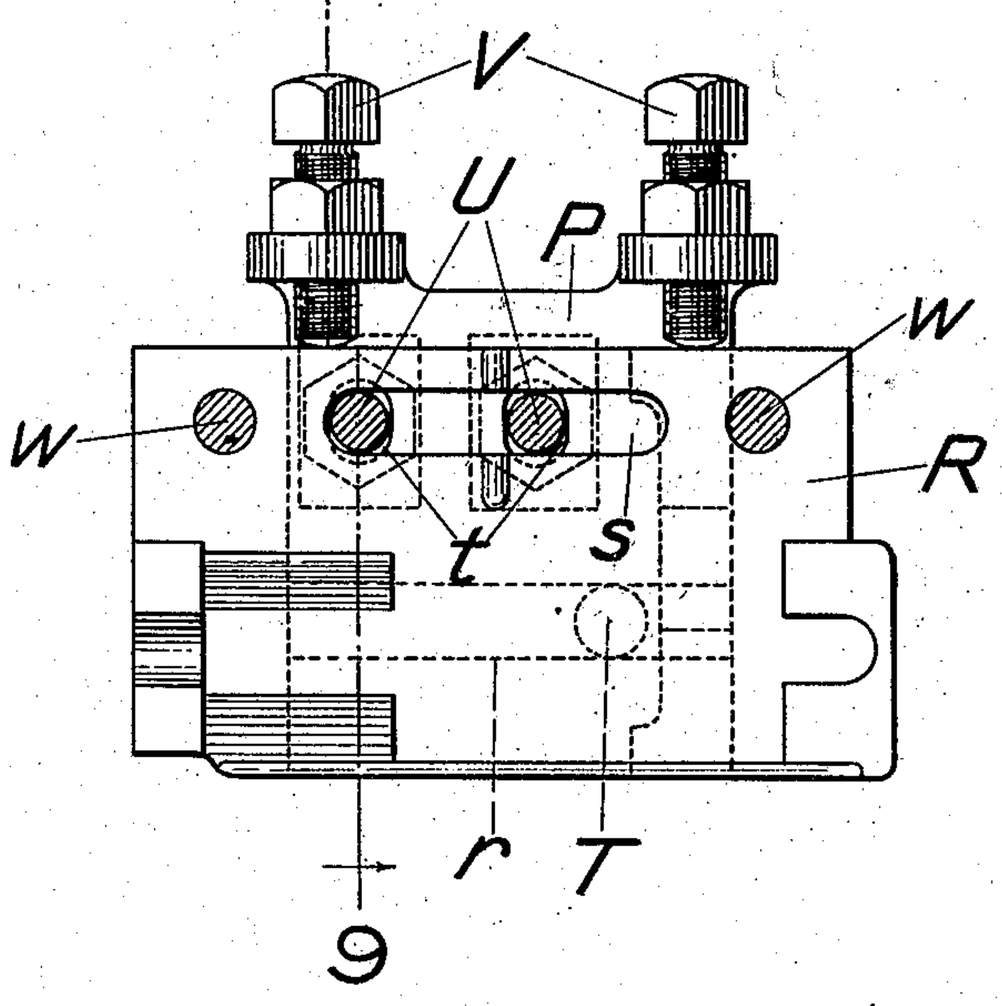
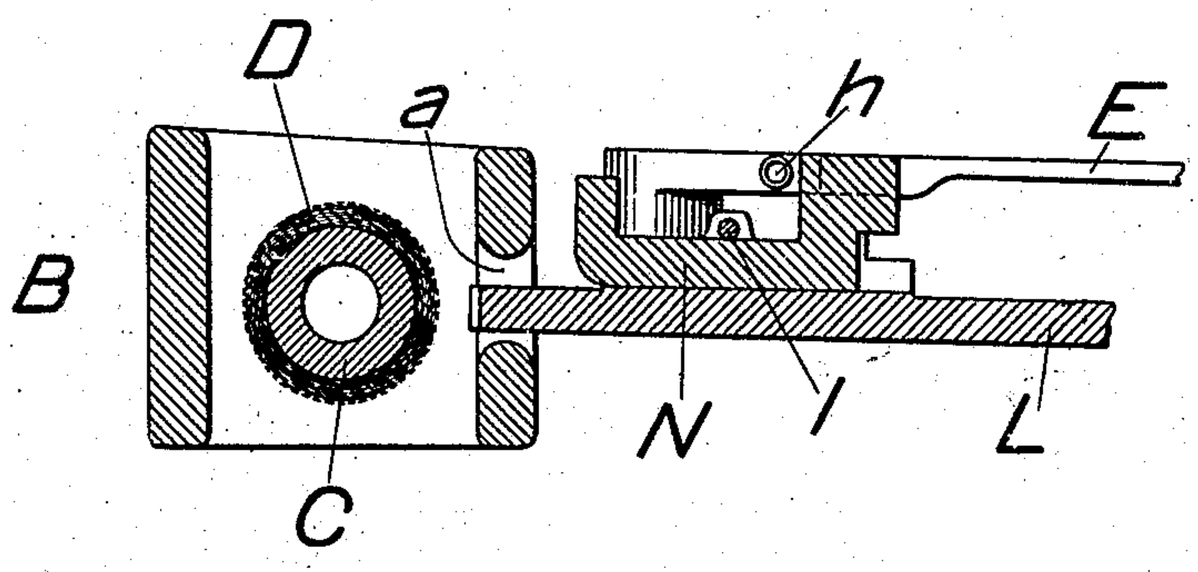


FIG. 8.



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6 SHEETS—SHEET 5.

FIG. 9.

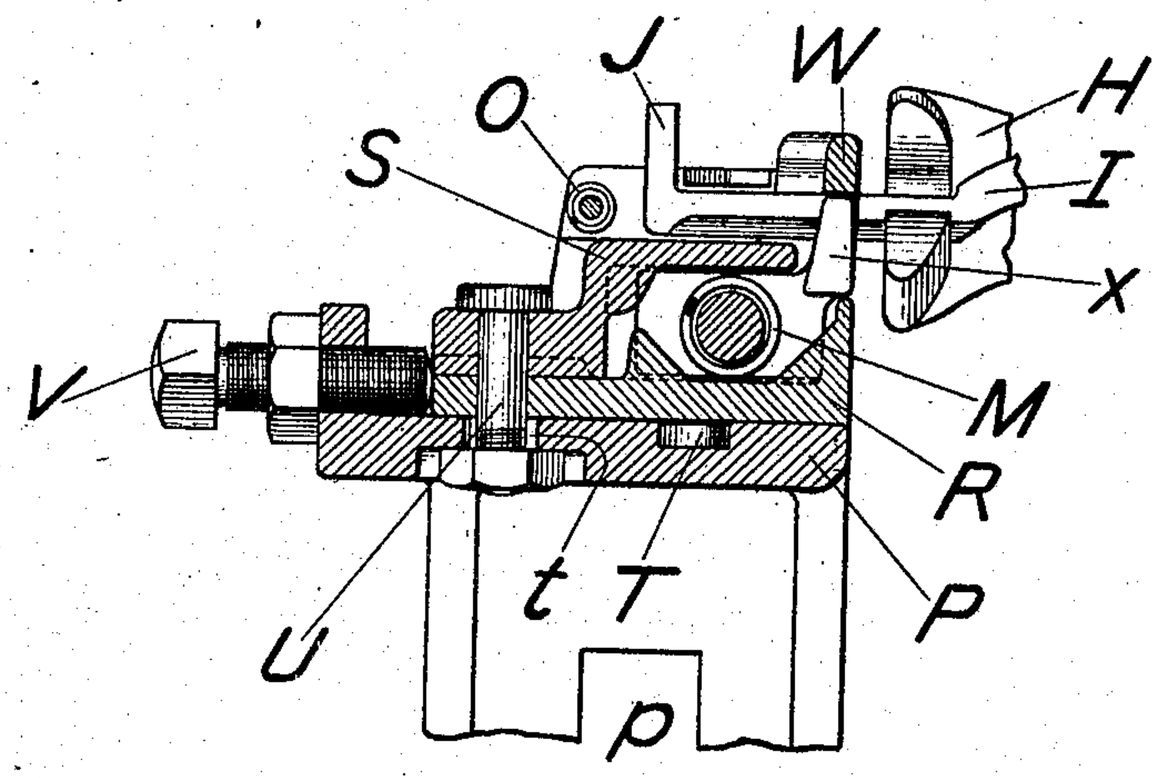
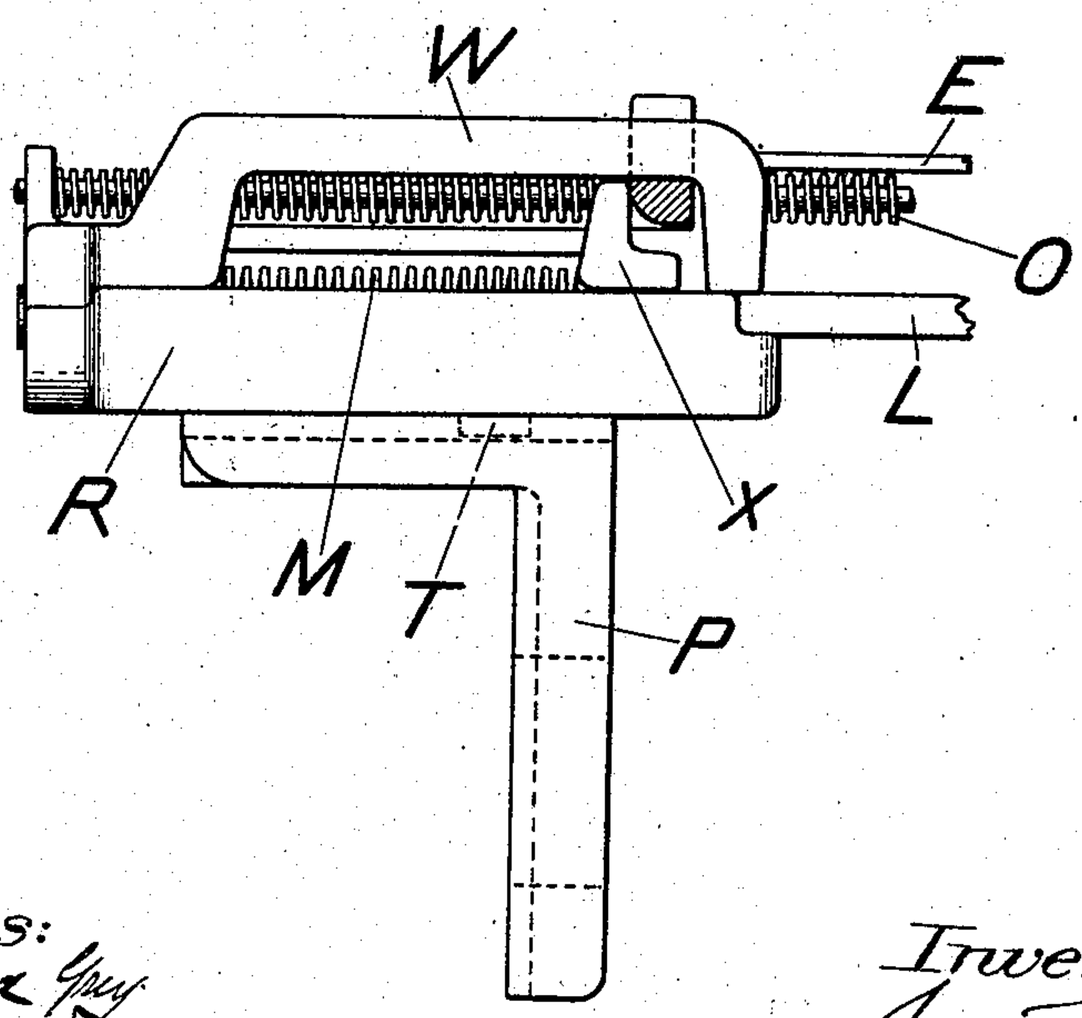


FIG. 10.



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WEFT FEELER FOR LOOMS.

APPLICATION FILED FEB. 15, 1906.

911,672.

Patented Feb. 9, 1909.

6 SHEETS—SHEET 6.

FIG. 11.

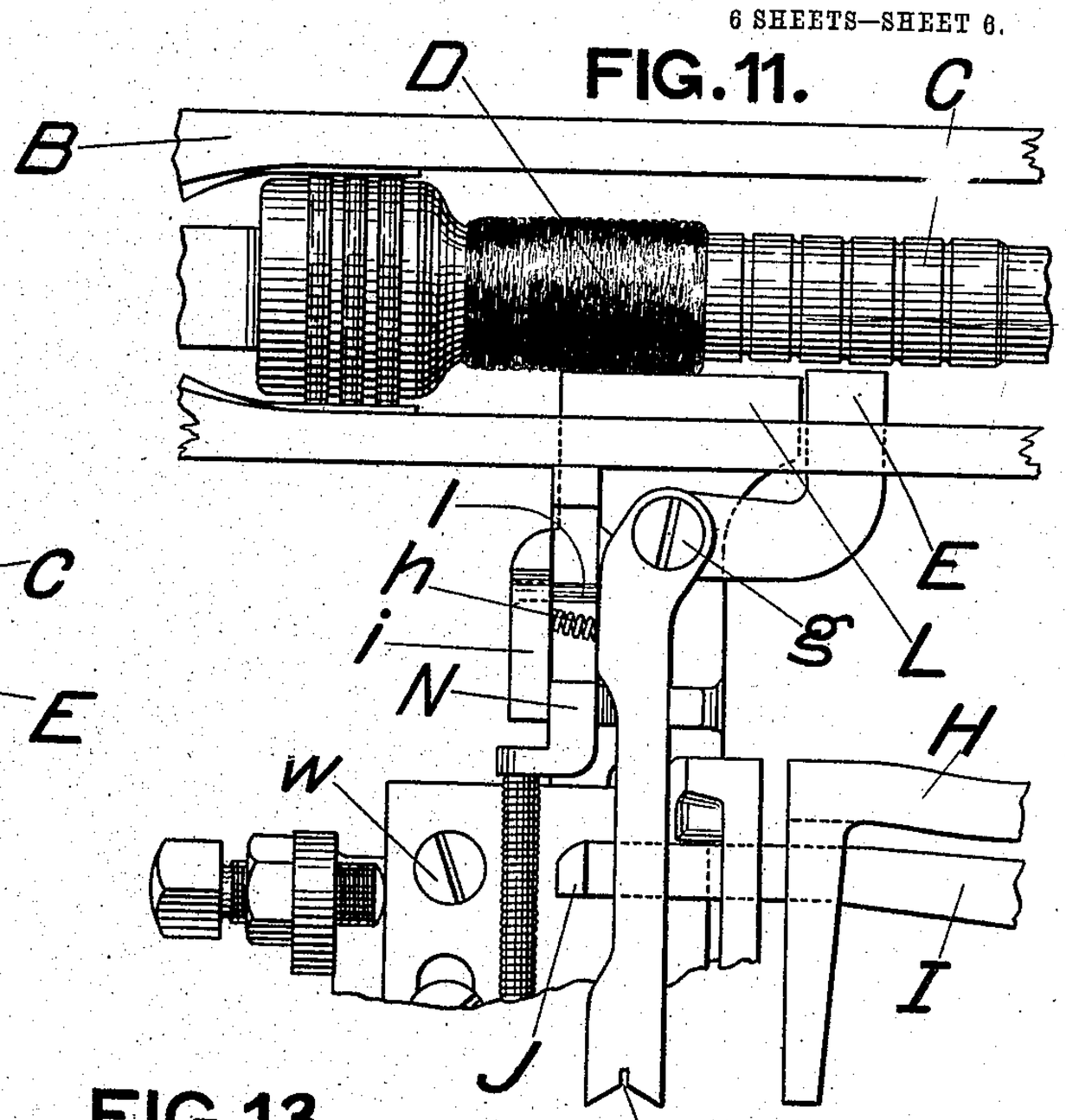


FIG. 12.

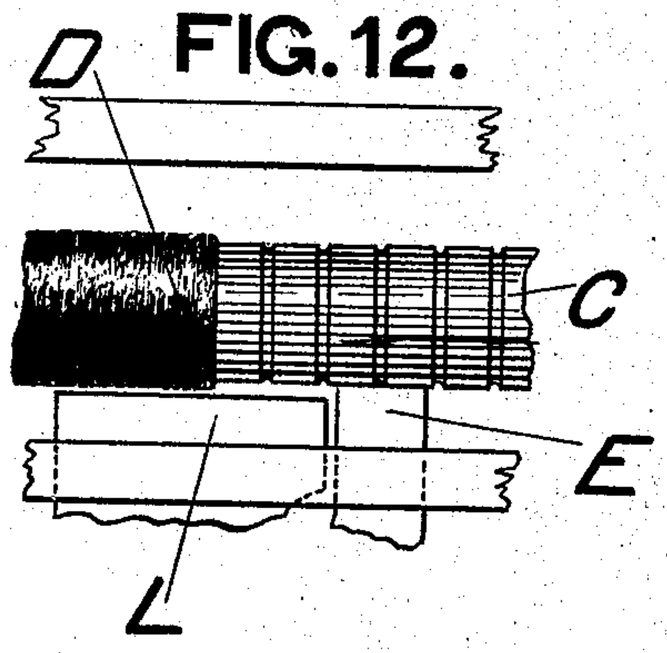
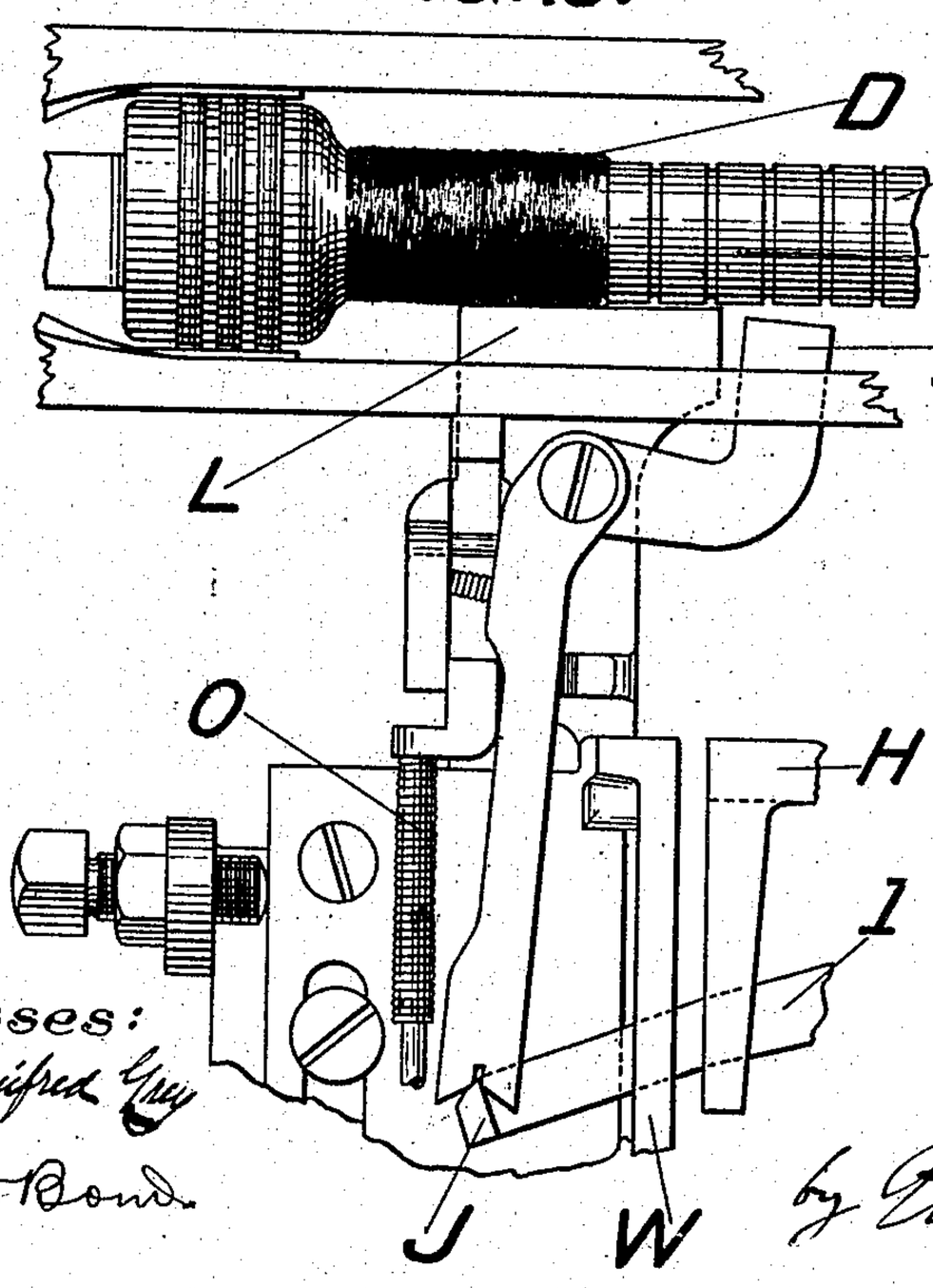


FIG. 13.



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UNITED STATES PATENT OFFICE.

JONAS NORTHROP OF HOPEDALE, MASSACHUSETTS, ASSIGNOR TO DRAPER COMPANY, OF PORTLAND, MAINE, A CORPORATION OF MAINE.

WEFT-FEELER FOR LOOMS.

No. 911,672. Specification of Letters Patent. Patented Feb. 9, 1909.

Application filed February 15, 1906. Serial No. 301,262.

To all whom it may concern:

Be it known that I, JONAS NORTHROP, of Hopedale, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Weft-Feelers for Looms, of which the following is a specification.

The present invention has particular utility in that class of automatic weft-replenishing looms wherein the weft is replenished prior to the complete exhaustion of the working weft so that no blank picks occur, and there are no short length picks woven into the cloth. Automatic looms of this type are now commonly known as "feeler" looms, because ordinarily equipped with a movable device or "feeler" (operatively connected with the weft-replenishing mechanism) which periodically comes in contact with or "feels" the weft in the working shuttle, and, when the volume of weft has been sufficiently reduced, the movement of the feeler thereby ensuing brings the weft-replenishing mechanism into action. In the practical use of such feeler mechanisms there are numerous variable factors requiring consideration. The bobbin or other weft-carrier is not rigidly held in the working shuttle, and as it receives the blow of the feeler it may yield slightly. Bobbins may not be exactly the same size, and different shuttles may not hold the bobbins in exactly the same position. There is necessarily some lost motion in the parts which actuate the lay, so that it may not always beat up to exactly the same position, and the lost motion in adjacent looms may be variable. These are among the variable factors to be considered. While these variations are minute, they become important when it is borne in mind that the variation in the amount of thread in the working shuttle is in the condition which is to bring the weft-replenishing mechanism into action. If, as the result of one or more variable factors, the weft is exhausted before the feeler sets the weft-replenishing mechanism into action, the purpose of the feeler is defeated. In such contingency the looms are ordinarily designed to stop automatically, requiring the presence of the weaver to remedy what would otherwise be a defect in the cloth, and to restart the loom. To avoid this the feeler must be so set as to obviate the probability of such stoppage. As a result of this, the feeler may bring the replenishing mechanism into action while a material amount of thread still remains in the working shuttle, in which event a considerable quantity of thread is wasted, and this waste, in the case of high priced fabrics, may largely counterbalance the advantage of automatic weft-replenishment.

The main object of the present improvements is to produce a feeler the action of which is independent of the usual disturbing variable factors, and which accordingly can be rendered so sensitive as to reduce to a substantially negligible minimum the waste of thread without impeding the automatic weft-replenishment.

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

Figure 1, is a plan view of a shuttle-box at one end of the lay of a loom and also a plan view of one end of the stationary breast-beam and of an extension thereof which supports the feeler mechanism; the front plate of the shuttle-box and the front wall of the shuttle shown in the shuttle-box being partly broken away. Fig. 2, is a vertical section in the plane indicated by the line 2—2 in Fig. 1. Fig. 3, is a detail horizontal section of the "transmitter" and its adjustable support. Fig. 4, is a detail section in the plane indicated by the line 4—10 in Fig. 1, and looking inwardly toward the breast-beam and the outer end of the transmitter. Fig. 5, is an elevation of the breast-beam extension and parts carried thereby, looking at the same from the lay. Fig. 6, is a vertical section through the feeler, its governor, and support. Fig. 7, is a plan view of one part of the feeler governor support showing certain bolts in horizontal section, and illustrating certain features of adjustment. Fig. 8, is a vertical section through a shuttle, its weft-carrier, and a portion of the feeler mechanism, being in the plane indicated by the line 8—8 in Fig. 1. Fig. 9, is a vertical section in the plane indicated by the line 9—9 in Fig. 7, other coöperating features not illustrated in Fig. 7, being shown in Fig. 9. Fig. 10, is a vertical section in the plane indicated by the line 4—10 in Fig. 1, and looking outwardly, that is to say, toward the feeler support. Figs. 11, 12, and 13, are diagrams illustrating the action of the feeler.

A, is a shuttle-box at one end of the lay

shown as containing a suitable shuttle B, equipped with a removable weft-carrier C, having weft thereon, illustrated at D, as approaching exhaustion. The front wall of the shuttle has a slot *a*, and the front plate of the shuttle-box a registering aperture *b*, (Fig. 1) through which the feeler E, may enter as the lay beats forward toward the breast-beam F, so as to contact with the weft. The breast-beam has an extension consisting of a firmly bolted bracket G, which carries the feeler E. This bracket also carries the "transmitter" H, through which the action of the feeler is transmitted to the automatic weft-replenishing mechanism. The mechanism brought into action by this transmitter is not illustrated because its details constitute no part of the present improvements. This mechanism may conveniently be that set forth in United States Letters Patent No. 789,471, dated May 9, 1905, wherein is shown at 36, 37, Fig. 1, a transmitter similar in its action to the transmitter H, now illustrated. This transmitter H is representative of the succeeding train of weft-replenishing mechanism. The illustrated transmitter H, is pivoted near its middle to swing on a horizontal stud *c*, (Fig. 3) and it has a cam-slot *d*, (Fig. 4) at its outer end, through which extends a controller I, pivoted at its inner end to a vertical stud *e*, (Figs. 1, 3, and 5). The outer end of the controller is normally maintained in its rearward position, as shown in Fig. 1, by a coiled spring *f*, (Figs. 2, 3, and 5). When the outer end of the controller is moved forward (as is the case when the feeler detects the approaching exhaustion of weft) the controller acts upon the cam-slot *d*, to swing the transmitter on its stud *c*, whereby the automatic replenishment of weft is accomplished by means such as those set forth in said Patent No. 789,471. This mode of operation and relation between controller and transmitter is substantially as set forth in said Patent No. 789,471. In accordance with the present improvements the outer or free end of the controller has an upwardly extending beveled finger J (Figs. 1, and 13) which coöperates with a beveled notch K, (Figs. 11, and 13) in the forward end of the long arm of the feeler.

The feeler is a lever pivoted to swing horizontally on a vertical stud *g* (Figs. 6, and 11) secured to the feeler-governor L. Normally the feeler and controller finger J, are out of register, as shown in Fig. 1, but, when the feeler swings on its pivot stud *g*, its notch K, registers with said finger J, as shown in Fig. 13, with the result that the controller is moved forwardly to start the weft-replenishment, as will presently appear. The feeler is restored to its normal position by a spring *h*, (Fig. 11).

The feeler-governor L, is mounted on a suitable guide so as to be capable of moving back and forward, and, as herein shown, it constitutes a carrier for the feeler as well as the governor of the critical or functional action of the feeler. It is moved backwardly by a spring M (Figs. 6, 9, and 10) and forwardly by the action of the weft on the feeler as the lay beats up. The rear end of the feeler-governor registers with the slots *a*, and *b*, (Figs. 1, and 2) so as to enter the shuttle; and, when the lay beats forward, the weft on the weft-carrier (except when approaching exhaustion) encounters the feeler, and forces it together with the feeler-governor forwardly against the stress of the spring M, this constituting the usual and normal action. The feeler and feeler-governor touch the weft at different places lengthwise of the weft-carrier; and the feeler touches the weft nearer the free tip of the weft-carrier than does the feeler-governor.

The feeler is normally prevented from swinging on its pivot *g*, by means of a feeler lock N (Fig. 11) which is mounted to slide forward and back on the feeler-governor between the heel of the feeler and an abutment *i*, fixed to the feeler-governor. This lock is normally held in its rear position on the feeler-governor, as shown in Fig. 1, by a spring O (Figs. 2, 6, 10, and 13) in which position it locks the feeler, holding it from swinging on its pivot, and hence keeping the feeler out of engagement with the controller I. The lock is held down in place on the feeler-governor by a fixed guide pin *l*, (Figs. 2, 8, and 11). The aperture *b*, in the front wall of the shuttle box is sufficiently high (Fig. 2) to receive the lock N, as the lay swings forward, but the lock extends upwardly above the slot *a*, in the shuttle so that the lock can never enter the slot *a*.

The mode of operation will now be understood. As shown in the drawings, the feeler E, extends rearwardly toward the weft-carrier farther than the feeler-governor L, or the feeler lock N. This is true when neither feeler nor feeler-governor is within the shuttle, and when neither is in contact with the weft; and in fact is always true, except when the feeler is swung on its pivot. Normally, while there is ample weft in the shuttle, the weft encounters the feeler as the lay beats forward, and the feeler, feeler-governor and feeler lock are moved forward with the lay, and, on the lay's retreat, are moved backwards by the springs M, O. During this normal action the feeler is prevented from swinging on its pivot by the lock. This action continues until the weft has been so far depleted that it does not encounter the feeler. This condition is illustrated in Fig. 11. As here shown the weft D is so far depleted that the weft-carrier C, is bare opposite the feeler, and the weft now abnormally contacts directly with the rear end of the feeler-gov-

ernor L. The amount of weft is, however, sufficient to prevent the feeler and the denuded body of the weft-carrier coming into contact. Hence, the feeler-governor and its adjuncts are moved forward, but without the feeler swinging on its pivot. Fig. 11, also shows the weft so far depleted as to permit the shuttle-body to come into contact with the rear face of the feeler-lock. As here shown, when the lay beats forward, the shuttle-body first hits the feeler-lock so as to move it sufficiently forward to unlock the feeler; and, the weft then encounters the feeler-governor, thereby moving it and its adjuncts forward, but the feeler is then idle because encountering nothing and does not swing on its pivot though free to do so. This action continues until the weft by its further depletion permits the feeler to encounter the previously weft-covered but now denuded body of the weft-carrier C, as indicated in Fig. 12, this now occurring in advance of the weft D, striking the feeler-governor. Since the lock N, has been first moved out of the way by the blow of the shuttle-body, the action now is, first to swing the feeler on its pivot so as to bring its notched end K, behind the finger J, of the controller I; and, then to move the feeler-governor and feeler forward, thereby causing the feeler to encounter the controller finger and move it forward (as shown in Fig. 13), with the result that the controller acting in the cam slot *d*, swings the transmitter H, and hence effects the replenishment of weft.

The "feeling" action which brings about the replenishing operation is between the last windings of thread on the weft-carrier and the surface of the weft-carrier which has been left bare by the denudation of its thread previously covering it. This not only permits great delicacy of action but is also not subject to disturbance by variable factors which affect previous feelers. The effective action of the feeler is simply dependent upon the difference in level between the residue of weft on the weft-carrier and the adjacent denuded body of the weft-carrier, and this may by adjustment of the feeler and feeler-governor be so far reduced as to eliminate any substantial waste of thread. The delicacy and sensitiveness of the feeler is due in part to the circumstance that the feeler is a pivoted lever, the long arm of which engages the controller finger, and, also, to the notched end of the feeler; and to the fact that momentum rather than positive swing of the feeler may be utilized to bring about the operative connection with the controller. When the denuded weft-carrier strikes it, the feeler swings by momentum far enough for one corner of its notch to engage the beveled edge of the controller finger, which is all that is necessary to insure control since, engagement being thus initiated, the advance of the feeler-governor completes the engagement. This not only adds to the sensitiveness of the feeler but also admits ample clearance between the feeler and controller during normal action, thus avoiding accidental weft-replenishment. Also, momentum is instrumental in unlocking the feeler, since, when struck by the shuttle, the feeler-lock flies forward to clear the feeler. In this connection, it is to be noted, that the feeler-lock spring O, is light as compared with the feeler-governor spring M. The action of the feeler is first to contact with the weft on the working weft-carrier; then to be held idle so as to have contact with neither weft nor weft-carrier; and finally to contact with the denuded body of the weft-carrier. During the first period of this action (while the feeler is encountering the weft) the feeler and feeler-governor move together in the same direction and equally, the feeler being locked from movement relatively to the feeler-governor by the feeler-lock. During this first period the feeler-governor has no effective or functional contact with the weft or weft-carrier. It may, perhaps, from time to time touch the weft, but, whether or not, is a matter of indifference, since, in any event, the feeler lock at this time prevents any relative movement of the feeler and feeler-governor, because the lock moves equally with the governor and feeler. The second period of action arrives when the weft in the path of the weft-carrier toward the feeler has been so far depleted as to permit the feeler-governor to abnormally touch the weft while the feeler itself is thereby prevented from contacting either with the weft or with the denuded body of the weft-carrier. This idle movement and its duration are governed by the feeler-governor. At the beginning of this second period the lock still acts to prevent movement of the feeler relatively to the feeler-governor; but, toward the close of this period, the depletion of the weft lying between the weft-carrier and the feeler-governor permits the body of the shuttle to encounter the lock thereby moving the lock relatively to the feeler-governor and feeler and hence unlocking the feeler. Finally, in the further depletion of the weft between the weft-carrier and the feeler-governor, the feeler again becomes active encountering the denuded body of the weft-carrier; and, being now unlocked, it executes its movement relatively to that of the feeler-governor and in a direction different from that in which the feeler-governor moves, and thus encounters the controller and hence causes the action of the weft-replenishing mechanism. This occurs while there is still enough weft on the working weft-carrier to carry on the weaving until the replenishment has been effected so that no blank picks occur. As a rule, the first contact between the feeler and the body of the

weft-carrier swings the feeler so as to engage the controller and effect the weft-replenishment.

The feeler-lock is an important feature of the invention. The weft-carrier may be irregularly supplied with thread so that when it is still full of thread, it may present such surfaces to the feeler-governor and feeler respectively as would cause the functional movement of the feeler relatively to the feeler-governor, if the lock were not present. This premature action of the feeler is prevented by the lock which does not unlock the feeler until the weft is nearly exhausted. The lock is preferably so located and related that several picks take place after the feeler is unlocked and before the functional movement of the feeler occurs. This insures the quiescence of the feeler and its proper location on the governor at the time it encounters the denuded weft-carrier.

The feeler acts and sets the initiating devices of the replenishing mechanism into action while there is still enough thread on the weft-carrier to enable the thread to last until the denuded weft-carrier is discharged from the shuttle. By adjusting devices (to be described) this amount of thread can be regulated so as to cover the usual exigencies such as those growing out of delay in the replenishment due to the displacement of the shuttle at the supply side of the loom.

The rearward projection of the feeler farther than the feeler-governor is exaggerated in the drawings in order that it may be noted, and to facilitate understanding of the operation. In practice the difference is much smaller than is shown, and only great enough to secure the desired differential action between the feeler and governor.

A number of important structural and adjusting features are used in connection with the feeler mechanism. The bracket G, immediately carries the base P, of the feeler-support. The bracket G, has a horizontal slot *m* (Fig. 5), and the base P, has a vertical slot *p* (Figs. 2, 5, and 6) through which slots extends a fastening bolt Q. These two slots permit the vertical and horizontal adjustment of the feeler and governor so as to bring it into proper register with the slots in the shuttle and shuttle-box front.

Intermediate between the base P, and the feeler-governor L, is the adjustable feeler-support for the feeler-governor which is composed of a bottom R, and cap S (Figs. 6, and 9), which also serve to guide the stem of the feeler-governor and house the spring N. This support is adjustable back and forth, and also has a rocking or angular adjustment on the base P. The base P, has a fore and aft groove *r* (Figs. 6 and 7), in its upper face in which enters and slides a pivot boss T, on the underside of the bottom R. The bottom R, likewise has a slot *s* (Fig. 7), parallel with slot *r*, and the cap S, has a similar slot *s* (Fig. 1), through which pass two fastening bolts U, U (Figs. 7 and 9), whereby the support is fastened to the base. By loosening the bolts, the support R, S, can be adjusted forward and back so that the duration of contact between the feeler and running weft can be regulated. Each of these bolts U, U, also passes through a slot *i* (Fig. 7), in the base P, which extends at right angles to the slots *r*, and *s*. These slots permit the angular adjustment of the support R, S, around its pivot T, relatively to the length of the working shuttle and to the length of its contained weft-carrier. This admits a very nice adjustment of the feeler E, so as to determine just when it shall touch the denuded body of the weft-carrier relatively to the depletion of the thread. With this adjustment it is not necessary that the rear faces of the feeler and feeler-governor should be at different levels or out of line with each other since the time of the effective or functional action of the feeler can be wholly regulated by the angular adjustment. The feeler-guide is held in its position of angular adjustment by the bolts V, V, (Figs. 7 and 9) which are carried by the base P, and bear against the support R, S.

The cap S, is secured to the bottom R, by the tap-bolts *w*, *w*, shown in Figs. 2, 7, and 11. The cap is upwardly arched as shown at W, in Fig. 10, to form a guideway for the controller I. This arched guide also serves to limit the swing of the controller in both directions. This is of especial importance to prevent displacement of the controller when executing its outward or operative movement under the thrust of the feeler. The feeler-governor has a projection *x* (Fig. 10), also sliding in this arched guide which aids in maintaining the feeler-governor in proper position. The controller is back of this projection, and, in consequence, the spring M, aids the spring *f*, in restoring the controller to its normal position and maintaining it there.

The stud *c*, (Fig. 3) on which the transmitter H, swings is on a bracket X, to which the controller is pivoted. This stud has a horizontal opening larger in diameter than a bolt Y, which fastens bracket X, to a projection Z, of the bracket G. This permits the adjustment of the controller relatively to the feeler, so that the relation between the feeler-notch K, and controller-finger J, can be regulated.

It is obvious that numerous changes can be made in the structure and details of the mechansim without departing from the principles of the invention. It is further obvious that the improvements are applicable to

looms having different weft-replenishing devices, and to fancy, multiple-harness, and drop box looms.

While the present improvements have special utility when employed in connection with automatic weft-replenishing mechanism, they can be advantageously employed in connection with mechanism designed to stop the loom before the complete exhaustion of the working weft.

I claim:—

1. A loom having a feeler-governor and a feeler movable relatively thereto, both of which enter the shuttle to coöperate with the weft therein, in combination with a feeler-lock which normally locks the feeler, but, when the weft demands replenishment, releases the feeler and thereby permits the functional movement of the feeler.

2. A loom having, in combination, a feeler-governor and a feeler both of which enter the working shuttle and touch the weft, the feeler extending farther toward the weft-carrier than the feeler-governor when neither feeler nor feeler-governor is touching the weft, whereby said feeler may touch the denuded weft-carrier while weft may still be left between the weft-carrier and the feeler-governor.

3. A loom having, in combination, a feeler entering the shuttle, and a feeler-lock which normally locks the feeler, but before the weft demands replenishment, releases and thereby permits the functional movement of the feeler.

4. A loom having, in combination, a feeler entering the shuttle, and a feeler-lock which prevents the feeler from performing its function until that part of the weft-carrier registering with the feeler is denuded of filling.

5. A loom having, in combination, a feeler-governor and a feeler movable first equally with said feeler-governor and thereafter relatively thereto, both feeler-governor and feeler entering the working shuttle to contact with the weft therein, and the feeler to the exclusion of the feeler-governor also contacting with the denuded weft-carrier to produce its movement relatively to the feeler-governor.

6. A loom having, in combination, a feeler-governor and a feeler connected therewith, both of which enter the shuttle to coöperate with the weft therein, and a loom controller coöperating solely with said feeler.

7. A loom having, in combination, a feeler-governor and a feeler pivoted thereto, both of which enter the shuttle to coöperate with the weft therein, and a loom controller coöperating solely with said feeler.

8. A loom having, in combination, a feeler, a controller struck thereby and a guide for said controller which limits its outward operative movement under the thrust of the feeler.

9. An automatic weft-replenishing loom having, in combination, a movable feeler-governor; a feeler pivoted to said feeler-governor, the feeling end of which extends toward the weft-carrier farther than does the feeling end of the feeler-governor, whereby the feeler-governor is normally held from effective contact with the weft; a feeler-lock movable with and on the feeler-governor which normally locks the feeler and prevents its swinging on the feeler-governor, said lock extending into the plane of the path of a portion of the shuttle-body, and being normally held out of contact with the shuttle-body by the contact between the weft and feeler; a shuttle having an aperture for the entrance of both said feeler-governor and said feeler; weft-replenishing mechanism; and a controller for said mechanism which is set in action when the feeler swings.

10. A loom having a feeler which first touches the weft on the working weft-carrier and thereafter touches the denuded weft-carrier, and means for rendering said feeler idle in the interim so as to touch neither weft nor weft-carrier.

11. An automatic weft-replenishing loom having, in combination, a shuttle having a weft-carrier and constructed to allow contact with said weft-carrier and its weft; a movable feeler-governor adapted to enter said shuttle and abnormally touch the weft; a feeler adapted to enter said shuttle and normally touch the weft at a different place lengthwise of the weft-carrier than where said feeler-governor touches, said feeler having the same movement as the feeler-governor and in addition a different movement, and the touching end of said feeler extending towards the weft-carrier farther than does the touching end of said feeler-governor; and a controller for the weft-replenishing mechanism which is set in action by engagement with said feeler only, and when said feeler moves in the direction which the feeler-governor never moves in.

12. An automatic weft-replenishing loom having, in combination, a shuttle having a weft-carrier and constructed to allow contact with said weft-carrier and its weft; a feeler-governor having a reciprocating movement only, and adapted to enter said shuttle and abnormally touch the weft; a feeler adapted to enter said shuttle and normally touch the weft at a different place lengthwise of the weft-carrier than where the feeler-governor touches, said feeler having a normal reciprocating movement and an abnormal swinging movement, and the touching end of said feeler extending towards the weft-carrier farther than does the touching end of the said feeler-governor; and a controller for the weft-replenishing mechanism which is set in action by engagement with said feeler only, and when said feeler swings.

13. An automatic weft-replenishing loom having, in combination, a shuttle having a weft-carrier and constructed to allow contact with said weft-carrier and its weft; a feeler-governor adapted to enter said shuttle and abnormally touch the weft; a feeler adapted to enter said shuttle and normally touch the weft at a different place lengthwise of the weft-carrier than where said feeler-governor touches, the touching end of said feeler extending towards the weft-carrier farther than does the touching end of said feeler-governor when neither feeler nor feeler-governor is within the shuttle; and a controller for the weft-replenishing mechanism which is set in action by said feeler.

14. An automatic weft-replenishing loom having, in combination, a shuttle having a weft-carrier and constructed to allow contact with said weft-carrier and its weft; a feeler-governor having a reciprocating movement only, and adapted to enter said shuttle and touch the weft; a feeler adapted to enter said shuttle and touch the weft, said feeler having a normal reciprocating movement and an abnormal swinging movement; and a controller for the weft-replenishing mechanism which is set in action by engagement with said feeler only, and when said feeler swings.

15. An automatic weft-replenishing loom having, in combination, a shuttle having a weft-carrier and constructed to allow contact with said weft-carrier and its weft; a feeler-governor adapted to enter said shuttle and abnormally touch the weft; a feeler adapted to enter said shuttle and normally touch the weft, the touching end of said feeler extending towards the weft-carrier farther than does the touching end of said feeler-governor when neither the feeler nor the feeler-governor is within the shuttle; and a controller for the weft-replenishing mechanism which is set in action by said feeler.

16. An automatic weft-replenishing loom having, in combination, a shuttle having a weft-carrier and constructed to allow contact with said weft-carrier and its weft; a feeler-governor adapted to enter said shuttle and abnormally touch the weft; a feeler adapted to enter said shuttle and normally touch the weft at a different place lengthwise of the weft-carrier than where the feeler-governor touches, said feeler having an abnormal swinging movement, and the touching end of said feeler extending towards the weft-carrier farther than does the touching end of the said feeler-governor when neither the feeler nor the feeler-governor is within the shuttle; and a controller for the weft-replenishing mechanism which is set in action only by said feeler and when said feeler swings.

17. An automatic weft-replenishing loom having, in combination, a shuttle having a weft-carrier and constructed to allow contact with said weft-carrier and its weft; a movable feeler-governor adapted to enter said shuttle and abnormally touch the weft; a feeler adapted to enter said shuttle and normally touch the weft, said feeler having the same movement as the feeler-governor and in addition a movement in a different direction; and a controller for the weft-replenishing mechanism which is set in action by contact with said feeler only, and when said feeler moves in the direction which the feeler-governor never moves in.

18. An automatic weft-replenishing loom having, in combination, a shuttle having a weft-carrier and constructed to allow contact with said weft-carrier and its weft; a feeler-governor having a reciprocating movement only, and adapted to enter said shuttle and abnormally touch the weft; a feeler adapted to enter said shuttle and normally touch the weft, said feeler having a normal reciprocating movement and an abnormal swinging movement; and a controller for the weft-replenishing mechanism which is set in action by contact with said feeler only, and when said feeler swings.

19. An automatic weft-replenishing loom having, in combination, a shuttle having a weft-carrier and constructed to allow contact with said weft-carrier and its weft; a feeler-governor adapted to enter said shuttle and abnormally touch the weft; a feeler adapted to enter said shuttle and normally touch the weft at a different place lengthwise of the weft-carrier than where said feeler-governor touches; and a controller for the weft-replenishing mechanism which is set in action by contact with said feeler only.

20. An automatic weft-replenishing loom having, in combination, a shuttle having a weft-carrier and constructed to allow contact with said weft-carrier and its weft; a feeler-governor adapted to enter said shuttle and touch the weft; a feeler adapted to enter said shuttle and touch the weft at a different place lengthwise of the weft-carrier than where said feeler-governor touches, the touching end of said feeler extending towards the weft-carrier farther than does the touching end of said feeler-governor when neither feeler nor feeler-governor is within the shuttle; and a controller for the weft-replenishing mechanism which is set in action by said feeler.

21. An automatic weft-replenishing loom having, in combination, a shuttle having a weft-carrier and constructed to allow contact with said weft-carrier and its weft; a feeler-governor adapted to enter said shuttle and touch the weft; a feeler adapted to enter said shuttle and touch the weft, the touching end of said feeler extending towards the weft-carrier farther than does the touching end of

the said feeler-governor when neither feeler nor feeler-governor is within the shuttle; and a controller for the weft-replenishing mechanism which is set in action by said feeler.

22. An automatic weft-replenishing loom having, in combination, a shuttle having a weft-carrier and constructed to allow contact with said weft-carrier and its weft; a movable feeler-governor adapted to enter said shuttle and touch the weft; a feeler adapted to enter said shuttle and touch the weft, said feeler having the same direction of movement as the feeler-governor and in addition a movement in a different direction; and a controller for the weft-replenishing mechanism which is set in action by said feeler when said feeler moves in the direction which the feeler-governor never moves in.

23. An automatic weft-replenishing loom having, in combination, a shuttle having a weft-carrier and constructed to allow contact with said weft-carrier and its weft; a feeler-governor adapted to enter said shuttle and abnormally touch the weft; a feeler adapted to enter said shuttle and normally touch the weft nearer the free tip of the weft-carrier than does the feeler-governor; and a controller for the weft-replenishing mechanism which is set in action by contact with said feeler only.

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

JONAS NORTHROP.

Witnesses:
GEORGE OTIS DRAPER,
ERNEST W. WOOD.