H. W. SMITH.

WEFT REPLENISHING LOOM.

APPLICATION FILED SEPT. 12, 1901.

930,425.

Patented Aug. 10, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

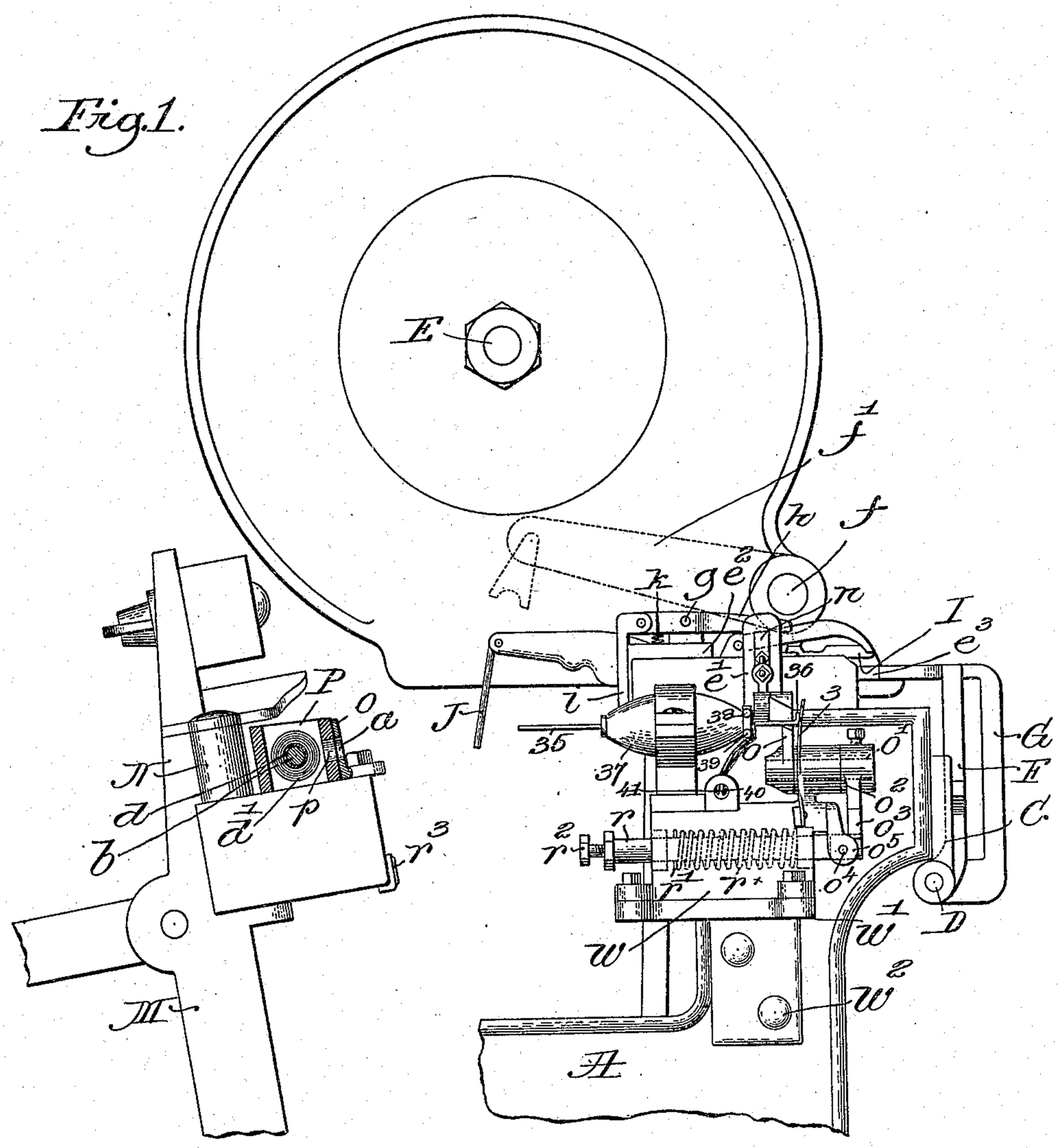


Fig. 2.

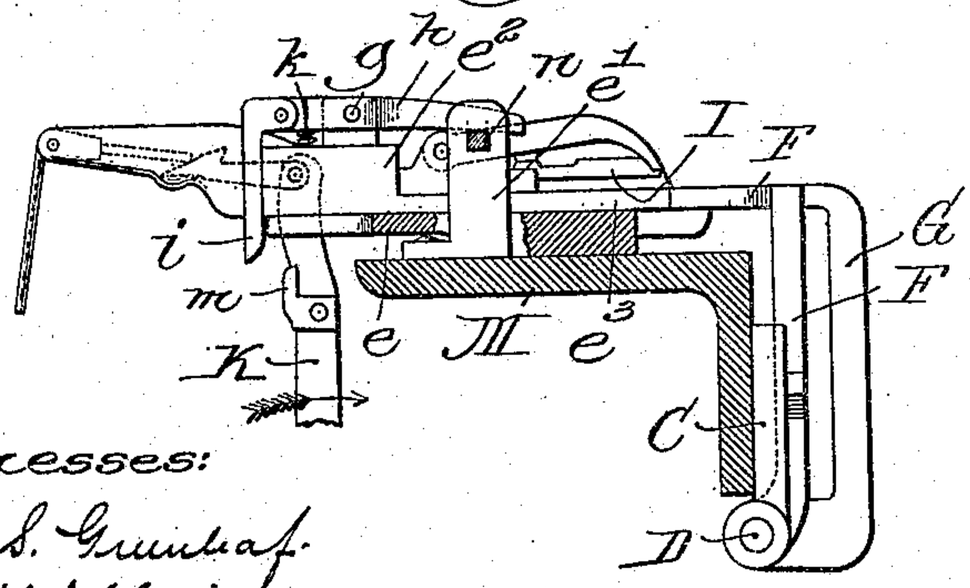
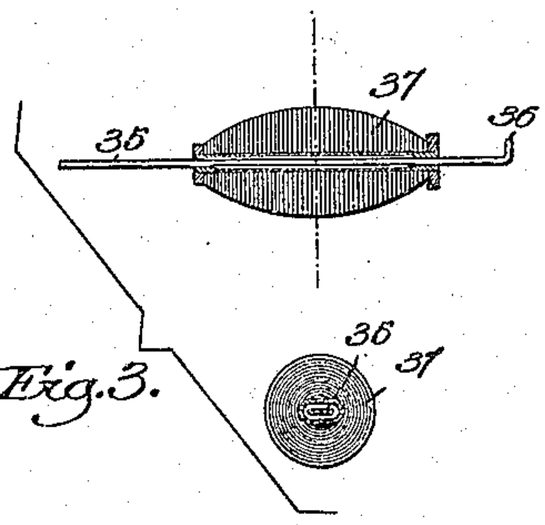


Fig. 3.



Witnesses:
Fred S. Grunbaf.
Adolph L. Kaisen.

Inventor:
Harry W. Smith,
by Crosby & Gregory
Attys.

H. W. SMITH.

WEFT REPLENISHING LOOM.

APPLICATION FILED SEPT. 12, 1901.

930,425.

Patented Aug. 10, 1909.

2 SHEETS—SHEET 2.

Fig. 4.

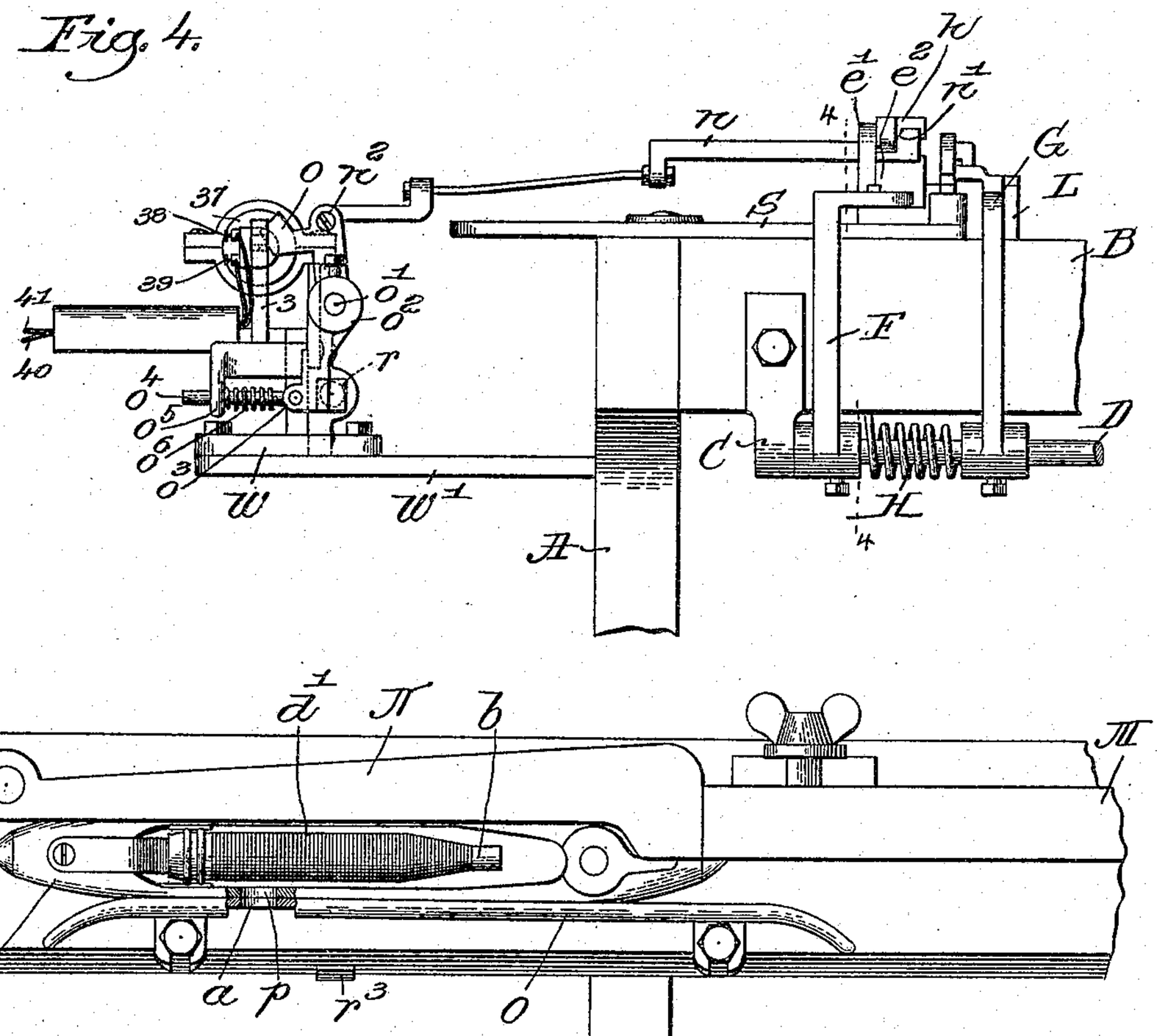
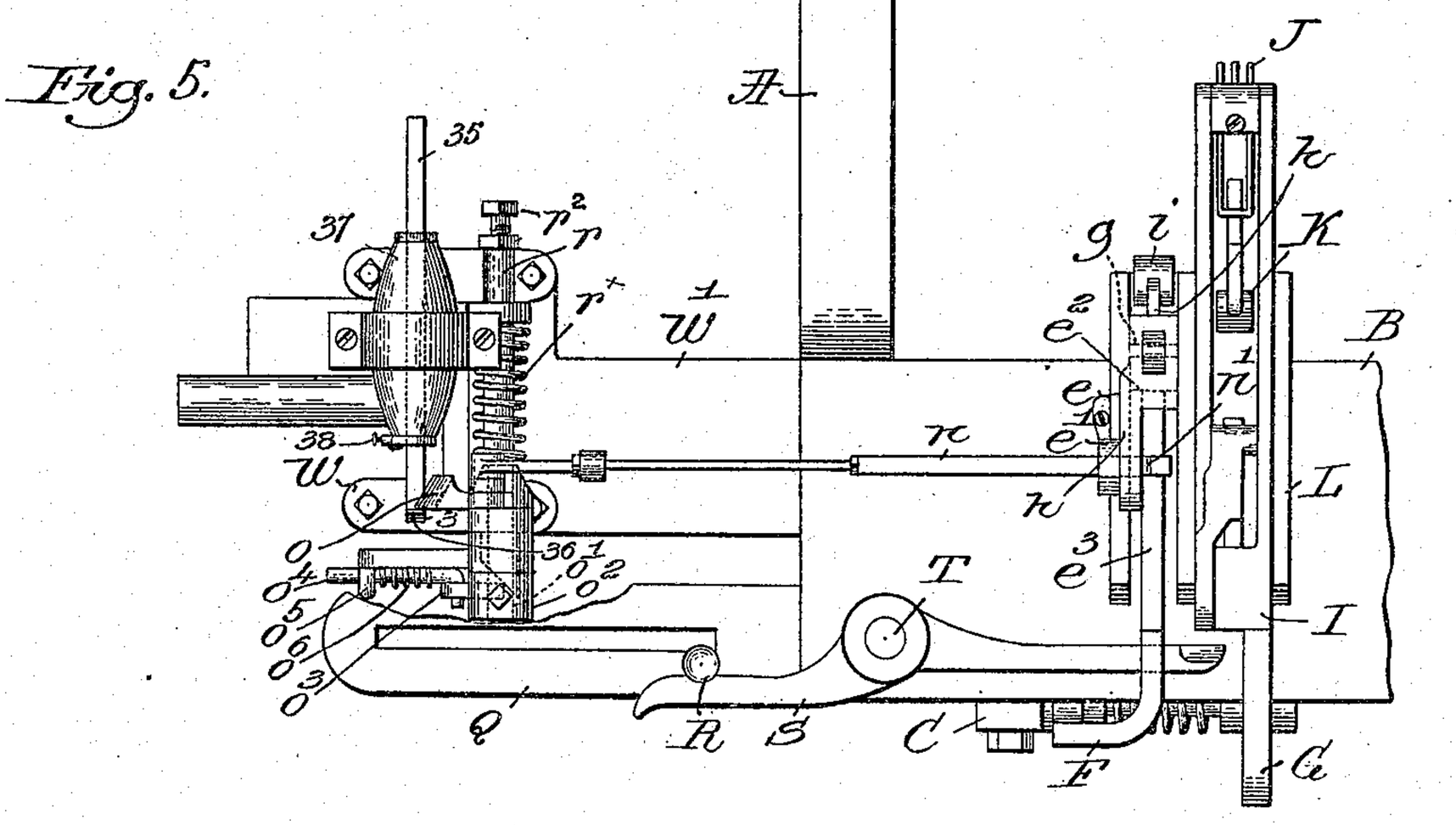


Fig. 5.



Witnesses:
Fred S. Grumbach.
Adolph H. Kain.

Inventor:
Harry W. Smith,
by Lovejoy & Gregory
Attys.

UNITED STATES PATENT OFFICE.

HARRY W. SMITH, OF NORTH GRAFTON, MASSACHUSETTS, ASSIGNOR TO CROMPTON & KNOWLES LOOM WORKS, A CORPORATION OF MASSACHUSETTS.

WEFT-REPLENISHING LOOM.

No. 930,425. Specification of Letters Patent. Patented Aug. 10, 1909.

Application filed September 12, 1901. Serial No. 75,137.

To all whom it may concern:

Be it known that I, HARRY W. SMITH, a citizen of the United States, residing at North Grafton, in the county of Worcester and State of Massachusetts, have invented an Improvement in Weft-Replenishing Looms, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention has for its object to improve that class of weft replenishing apparatus represented in United States Patent No. 665,559, dated Jan. 8, 1901, wherein a feeler represented as a magnet co-acts with a detecting member made as a magnetizable body shown as mounted on the filling carrier and as having a to-and-fro movement transverse the breast beam of the loom, said feeler, however, being coupled with said detecting member and being put thereby in an abnormal position, only when the filling on the filling carrier has been exhausted to a predetermined point.

One feature of this present invention relates to a construction whereby the feeler will not jam or cut the filling or weft, and also whereby the detecting member on the filling carrier and the feeler will not be battered by mutual contact, and also whereby a maximum magnetic field is brought into the most effective relation to the detecting member, the two being, moreover, balanced or regulated to suit the speed of the loom and the grade of filling. In achieving these results I have greatly reduced the weight of the feeler by making the same thin, the width of the feeler being increased in the direction of the length of the bobbin.

A light-weight feeler broadened at its ends will not by contact with fine yarn mar or cut the same, and when the feeler meets the detecting member on the filling carrier, neither the said member nor the feeler will be marred or upset to the great disadvantage of the feeler.

In the patent referred to, the feeler is shown as a cylindrical bar, and in practice I have found that such a form of feeler, if made so as to contact with a large number of threads or length of filling surface is sluggish in action because of its mass, and, on the other hand, if made small and light for easy movement the resulting small point is apt to cut and injure the weft; moreover, these are only two of the difficulties, a further one being that a large mass, although not cutting because of small area of contact, pounds and jams because of its inertia, and so, likewise, from an electrical or magnetic standpoint various considerable difficulties are met with. For example, as the certainty of movement due to the attractive influence of the feeler and its armature depends upon the strength or intensity of the magnetic field at the extreme end or contacting point of the feeler with the armature, there must be sufficient iron to carry the requisite lines of force; and also, while a light or blunt pressure is required for a very fine thread, a more quickly and highly responsive movement of the feeler is required for high speed looms than for slow speed looms. Accordingly I have devised a balanced construction which permits me to secure precisely the movement and effect required for any given conditions, and I have produced a special construction which readily enables me to obtain this balanced condition, the said construction preferably including a flat or narrow feeler or core magnetized by a conoidal, elongated coil whose forward end, because of its reduced or elongated, pointed shape, may be carried forward beyond the breast beam and, in fact, may project forward so as to enter the shuttle box upon the forward movement of the lay.

The form of solenoid in the patent mentioned had a uniform diameter throughout its length, and it was therefore necessary to set it back with relation to the inner face of the breast beam a considerable distance so that it could not be struck by the lay in its movement toward the fell, but by my special construction of solenoid the magnetizing current is permitted to pass around the core much closer to the end of said core or feeler than was before possible, and therefore a more intense magnetic field is produced. This construction of solenoid and feeler also permits me to vary the relative masses of the armature and feeler as required for the proper balancing thereof to suit varying conditions, as by increasing the mass of the armature or decreasing the mass of the feeler the speed of the latter, or responsiveness thereof to the attractive influence of the armature, may be increased; or, in other words, this construction enables me to produce, in the first place, an intense magnetic field at the ex-

treme end of the feeler, and, in the next place, to bring the armature or detecting member opposite the end of said feeler in such position that it will extend throughout the region of maximum intensity of the lines of force from said feeler.

The armature will be of such a size or have such mass, relatively to the feeler and its magnetic field, as to be capable of receiving approximately all of the lines of force at said polar region of greatest intensity. It will be seen, therefore that this feature of my invention enables me to have the sensitiveness or responsiveness and the entire action of the magnetic device under definite control; so that I may balance it according to any special conditions of speed, filling and loom desired.

Figure 1 in elevation shows a sufficient portion of a loom with my improvements added to enable the same to be understood, the front wall of the shuttle box, the shuttle, and the filling or weft carrier being shown in section. Fig. 2 is a section in the line 4—4, Fig. 4; Fig. 3 shows the coil in longitudinal and cross section and the feeler within the same. Fig. 4 is an elevation looking at the parts at the left hand end of the loom from the right in Fig. 1, and Fig. 5 is a plan view of the left hand end of the loom, Fig. 1.

In the drawing, A represents part of a loom side, B part of a breast beam, C one of a pair of stands in which is mounted a rock shaft D instrumental in actuating a transferrer represented by dotted lines at *f'* and carried by a rock shaft *f*, said transferrer when moved acting upon one of a series of filling carriers mounted in a rotary hopper contained on a stud E, as provided in so-called Northrop looms, a type of which is represented in United States Patent No. 648,986.

The rock shaft D has connected with it near its left-hand end two arms F, G, a spring H surrounding said rock-shaft acting normally to keep said arms pressed toward the breast beam.

The upper end of the arm G engages the end of a weft-fork slide I, sustaining a pivoted weft-fork J which, whenever the weft is absent in front of the usual reed carried by the lay M, is moved toward the front of the loom by the upper end of a catch carried by a weft hammer K common to said United States Patent No. 648,986, the hammer moving said slide longitudinally in a guide L fixed on the top of the breast beam, and turning the shaft D to actuate the filling changer to supply new filling in the shuttle to take the place of a filling carrier in which the filling has parted. Should the filling, however, not be supplied, the slide I will have imparted to it further movement toward the front of the loom, and will strike the lever S, turn it, and release the shipper handle R and stop the loom in well known manner.

The lay M has as herein shown at its left hand end a shuttle box of usual construction provided with a binder N and a front wall O having an opening *a*. The shuttle P, shown in Figs. 1 and 4, is provided with a filling carrier *b* provided with a detecting member *d* of magnetizable material, said detecting member being herein shown only in Fig. 1 by full lines in the form of a band, the filling *d'* covering the detecting member and being uncovered only just before the filling is exhausted.

That the filling carrier may be changed automatically, the bottom of the shuttle and the shuttle box below the shuttle is open, the filling being changed at that end of the lay which is immediately under the usual hopper containing the supply of filling carriers.

The feeler 35 shown, instead of being cylindrical as in Patent No. 665,559, referred to, is composed of a piece of flat metal of sufficient thickness that when struck by the filling and moved longitudinally in the wire coil 37, the feeler will not be bent and therefore bind in the solenoid. The feeler constitutes the core of the coil or solenoid.

The light-weight feeler is a leading feature of my present invention, and by its use the yarn is not marred as it strikes the feeler and moves it in the coil, and the feeler having a thin end of considerable width, when struck by the detecting member is not upset, nor is the detecting member marred.

The wire coil surrounding the feeler, in Patent No. 665,559, is uniformly cylindrical throughout its length, and the ends of the coil are as large as the median line thereof, and the coil has therefore to be so set that its inner end will occupy a position beyond the point reached by the lay in its movement toward the fell.

To gain the best results in a loom I have found by experiment that the size and length of the wire in the coil 37 must be such and so distributed as to make of the feeler the strongest possible magnet, and to effect this the wire in the coil should be brought as close as possible to the end of the feeler when in its normal position of rest, and I have derived important results by so shaping the coil that its inner end will lie close to the detecting member when the latter is exposed to engage the magnetized feeler. To accomplish this I have wound the wire coil 37 thicker at its median line than at its inner end next the lay, and as the lay is moved toward the fell the hole *a* in the shuttle box will pass over the end of the coil 37. To prevent the feeler from being withdrawn from the coil by the pull of the detecting member *d*, I have bent upwardly the inner end of the thin feeler at 36. The binding posts 38 and

39 receive wires 40, 41 of any suitable electric circuit, deriving current from any source of electric energy, as, for instance, a dynamo, the current traversing the solenoid in usual manner.

The breast beam sustains a guideway e having a slotted guiding ear e'. The guideway receives a slide block e^2 free to be moved therein, the projecting end e^3 of which when in its normal position terminates substantially in contact with the upper end of the arm F connected with the rock shaft D.

The block e^2 has rising from it an ear on which is pivoted at g a lever h provided at its inner end with a dog i, a spring k, Fig. 2, acting against said lever and normally keeping the dog i out of the range of movement of a projection m fast upon the usual weft hammer K which is moved forwardly in usual manner at every other movement of the lay.

Prior to the exhaustion of the filling to a predetermined point, the dog i is maintained in its normal position shown in Fig. 2, but whenever the filling is exhausted to a predetermined point, the lever h is moved to depress the dog into its abnormal position, so that the projection m of the weft hammer K will engage the dog as the hammer moves in the direction of the arrow Fig. 2, and move the slide e^2 outwardly causing it, acting against the arm F, to turn the rock shaft D and cause the filling changing mechanism to be moved to supply new filling to the shuttle, the incoming filling meeting the filling carrier which is to be ejected and forcing the same from the shuttle through the shutle box of the lay.

The dog and slide form part of the actuating mechanism for the transferrer f', and other parts of said mechanism in the form in which I have chosen herein to illustrate the same is a rod n having at or near one end an incline n', see Fig. 4, and joined by a set screw n^2 to a lever o, the rod being made preferably of a plurality of parts that the length thereof may be adjusted to suit the requirements of the loom. The lever o is mounted upon one end of a rock shaft o' free to be turned in a suitable bearing o^2 of a frame W mounted on a stand W′ extended from the loom frame, said frame being connected with said stand by suitable bolts. The rock shaft o' has also connected to it a second arm o^3 to which is jointed a rod o^4 extended through a guide or bracket o^5. The rod o^4 is surronded by a suitable spring o^6 which acts normally to keep the acting upper end of the lever o pressed toward the feeler or magnet 35, said lever contacting with said feeler only when the latter occupies its normal position. The lever o constitutes an auxiliary feeler co-acting with the feeler 35, and is moved away from the feeler 35 at each forward movement of the lay toward the fell to beat in the filling, said auxiliary feeler being arrested by said feeler 35 only as the lay is moving backwardly, said feeler 35 then occupying its normal position.

The coil 37 is secured in such position that whenever the lay M is moved toward the breast beam or fell to beat in the filling, the hole in the front wall of the shuttle box will pass over the inner end of the feeler, and at every other forward beat of the lay said feeler will be embraced by the hole made in the front wall of the shuttle and the filling then on the filling carrier will contact with the feeler and push the same backwardly against the spring 3, and so long as the detecting member d of the filling carrier is not permitted, by the exhaustion of the filling to the desired extent, to be attracted to the feeler or magnetic core 35 the feeler or magnet will stop in the position shown in Figs. 1 and 5, while the lay moves backwardly or away from the breast beam. Should the feeler or magnet and the magnetically responsive mass or detecting member be coupled together due to the exhaustion of the filling to a predetermined extent, then as the lay is moved backwardly, the feeler is attracted by the detecting member and moved with it into its abnormal position.

By the term "abnormal position of the feeler" I mean any position in which the feeler is drawn backwardly with the lay by magnetic action due to the responsive presence of the armature or detecting member moving with the lay in the magnetic field of the feeler or solenoid core, and in such position only the lever o will not be arrested by the feeler. If the lever or auxiliary feeler c is not arrested by the feeler 35, then said lever is moved by the spring o^6 abnormally to the left, which insures such a movement of the rod n as will cause the dog i to be lowered that it may be engaged by the usual weft-hammer and actuate the filling changing means.

A suitable spring 3 is made to just contact with the outer end of the feeler 35 when the solenoid is adjusted as described, and the lay is moved forward far enough to put the magnetizable body d of the filling carrier in contact with the inner end of the feeler or magnet 35.

Suitable means has been provided to move the lever o from contact with the feeler or magnet 35 when the latter is being moved by the filling on the filling carrier, and while said feeler is being moved back into its normal position. Said means as herein shown includes a rod r free to slide in suitable ears of the frame W and having a cam-shaped inner end, see Figs. 1 and 5. The cam part of said rod acts against the lower end of the arm o^3 as the rod r is moved outwardly with

the lay as the latter is moved forwardly toward the fell.

The rod r is surrounded by a spring r^x, one end of which rests against an ear of the frame, and the other against a suitable projection as r' of said rod, so that said spring normally acts to retain the rod in its inward position. The inner end of the rod r has an adjustable contact r^2 which may be adjusted to increase or decrease the effective length of the rod and determine the exact times of starting the longitudinal movement of the rod r with relation to the time of starting the feeler as the lay is moved toward the breast beam.

It is preferred to move the rod r a little in advance of the movement of the feeler 35 as the lay is moved toward the breast beam. The rod r is moved by or through the action of a bunter r^3 carried by the lay meeting the contact piece r^2 of the rod. Whenever the lay is, therefore, moved toward the breast beam the rod r is moved so that its cam-shaped end acts against the arm o^3 and moves the lever o away from the feeler or magnet 35 as or a little before the filling acts against the inner end of the feeler to move the latter outwardly against the pressure of the spring 3, and said lever is prevented from coming in contact with said feeler or magnet until the latter arrives again in its normal position, and consequently said feeler or magnet is not worn and it may be moved easily. Whenever, however, the feeler or magnet is drawn into its abnormal position by the attraction of its armature moved with the lay and shown as on the filling carrier, the feeler fails to arrest said lever, and the latter is moved by the spring o^6, drawing the cam bar n to the left, Figs. 4 and 5, causing the incline n' thereof to lift the lever h and depress the dog i into its abnormal position, so that the said dog is caught by the projection m of the weft hammer which moves the slide e^2, as before described, and turns the rock shaft D, causing the filling changer to act.

The less the weight of the feeler the lighter the blow required by the filling to move the feeler as the lay approaches the fell, and consequently the yarn is not injured, but yet the feeler must have sufficient mass, as already explained, to produce enough lines of magnetic force to magnetize quickly the magnetizable detecting member d, the degree of quickness required depending upon the speed of the loom and other conditions already explained; and for the best results, as also already explained, the armature and feeler must be so related in size or mass that the armature will cut or receive a maximum number of the lines of force at the end of the feeler, this being the polar region of greatest density or intensity of magnetic force.

I have found it of great advantage to thus balance, as I term it, the magnetic strength of the feeler with the band or detecting member on the filling carrier according to the weight of yarn and the speed of the loom. As for instance, a thin band at a slow speed of the lay may attract and draw a comparatively heavy feeler, whereas if the loom is speeded up, said band would fail to attract and move the feeler.

I believe that I am the first to proportion the fixed and movable magnetic bodies to the work to be done.

Having described my invention what I claim as new and desire to secure by Letters Patent, is:—

1. In a weft replenishing loom, a filling carrier provided with a detecting-member, and a magnetized feeler composed of a metallic bar having its end flattened in the direction of the length of the filling carrier to obviate jamming or cutting the filling.

2. In a weft replenishing loom, a weft carrier provided with an armature detecting-member, a solenoid, and a feeler composed of a thin flattened metallic bar guided in said solenoid and prevented from rotating therein, said feeler contacting with the filling.

3. In a weft replenishing loom, a weft carrier provided with an armature detecting-member, a solenoid, and a magnetized feeler composed of a thin, flattened metallic bar guided in said solenoid and prevented from rotating therein, said feeler contacting with the filling, and means to prevent the escape of said feeler from said coil.

4. In a weft replenishing loom, a filling carrier, a magnetizable detecting-member and feeler, said feeler being composed of a thin, light-weight metallic bar the widest part of which is located in the direction of the length of the filling carrier to obviate jamming or cutting the filling, a lay having a shuttle box provided with an opening, and a solenoid surrounding said feeler, the end of the solenoid being embraced by a part of the shuttle box when the lay arrives at the end of its stroke toward the fell.

5. In a weft replenishing loom, a filling carrier provided with a detecting-member, and a magnetized feeler composed of a metallic bar widened at its end in the direction of the length of the filling carrier to obviate jamming or cutting the filling, a solenoid wound tapering at its inner end and surrounding said feeler, and a shuttle box having an opening opposite said solenoid whereby the smaller inner end of the coil may project toward the lay without interference with the usual forward movement of the lay toward the fell.

6. In a weft replenishing loom, a filling carrier provided with an armature detecting-member, a solenoid and its core, the latter constituting a feeler for coöperating

with said armature, said solenoid being wound in a thin elongated layer at its forward end adjacent the filling carrier.

7. In a loom, a feeler consisting of a solenoid core, combined with an armature on the filling carrier, said armature opposite the end of the feeler extending throughout the region of maximum intensity of the lines of force from said feeler, and having a mass capable of receiving approximately all of the said lines of force in the polar region of maximum magnetic intensity.

8. In a loom, a shuttle having a filling carrier provided with a detecting member, and a magnetic feeler having an end enlarged in one direction to enable substantially the entire end of the feeler to contact with said detecting member.

9. In a weft replenishing loom, a filling carrier provided with an armature detecting-member, a solenoid and its core, the latter constituting a feeler for coöperating with said armature, said feeler being rendered quickly responsive by being relatively light and having its magnetic field brought to maximum intensity at the innermost end of the feeler, the strength of said field being sufficient to magnetize the armature when exposed, and the armature having a mass capable of receiving approximately all of the lines of magnetic force at the end of said feeler.

10. In a weft replenishing loom, a filling carrier, a feeler adapted to feel for the filling on the carrier and be moved thereby on the beat up movement, an auxiliary feeler normally contacting with the first named feeler and means for relieving the said first named feeler from such contact to permit free movement thereof.

11. In a weft replenishing loom, a filling carrier, a feeler adapted to feel for the filling on the carrier and be moved thereby, an auxiliary feeler normally contacting with the first named feeler, and means for moving the auxiliary feeler transversely of the first named feeler.

12. In a weft replenishing loom, a filling carrier provided with a detecting member, a magnetized feeler adapted to feel for the filling on the carrier and be moved thereby on the beating up movement when there is a supply of filling on the carrier, an auxiliary feeler and means for moving the auxiliary feeler transversely of the path of movement of the first named feeler.

13. In a weft replenishing loom, a lay, a filling carrier provided with a detecting member, a magnetized feeler adapted to feel for the filling on the carrier and to be moved backward thereby on the beating up movement when there is a supply of filling on the carrier, and to follow the detecting member on the reverse movement of the lay when the filling on the carrier is practically exhausted, an auxiliary feeler adapted to contact with the magnetized feeler when the latter is in normal position, and means for moving the auxiliary feeler out of such contact to permit free movement of the magnetized feeler.

14. In a weft replenishing loom, a filling carrier, a magnetized feeler to feel for the filling on the carrier, said feeler being sustained yieldingly in a magnetized field and adapted to be moved by the filling on the carrier on the beating up movement, and an auxiliary feeler normally contacting with the sustained magnetized feeler, and means for moving the auxiliary feeler out of contact with the magnetized feeler to permit free movement of the magnetized feeler.

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

HARRY W. SMITH.

Witnesses:
GEO. W. GREGORY,
GEO. H. MAXWELL.