C. A. LITTLEFIELD.

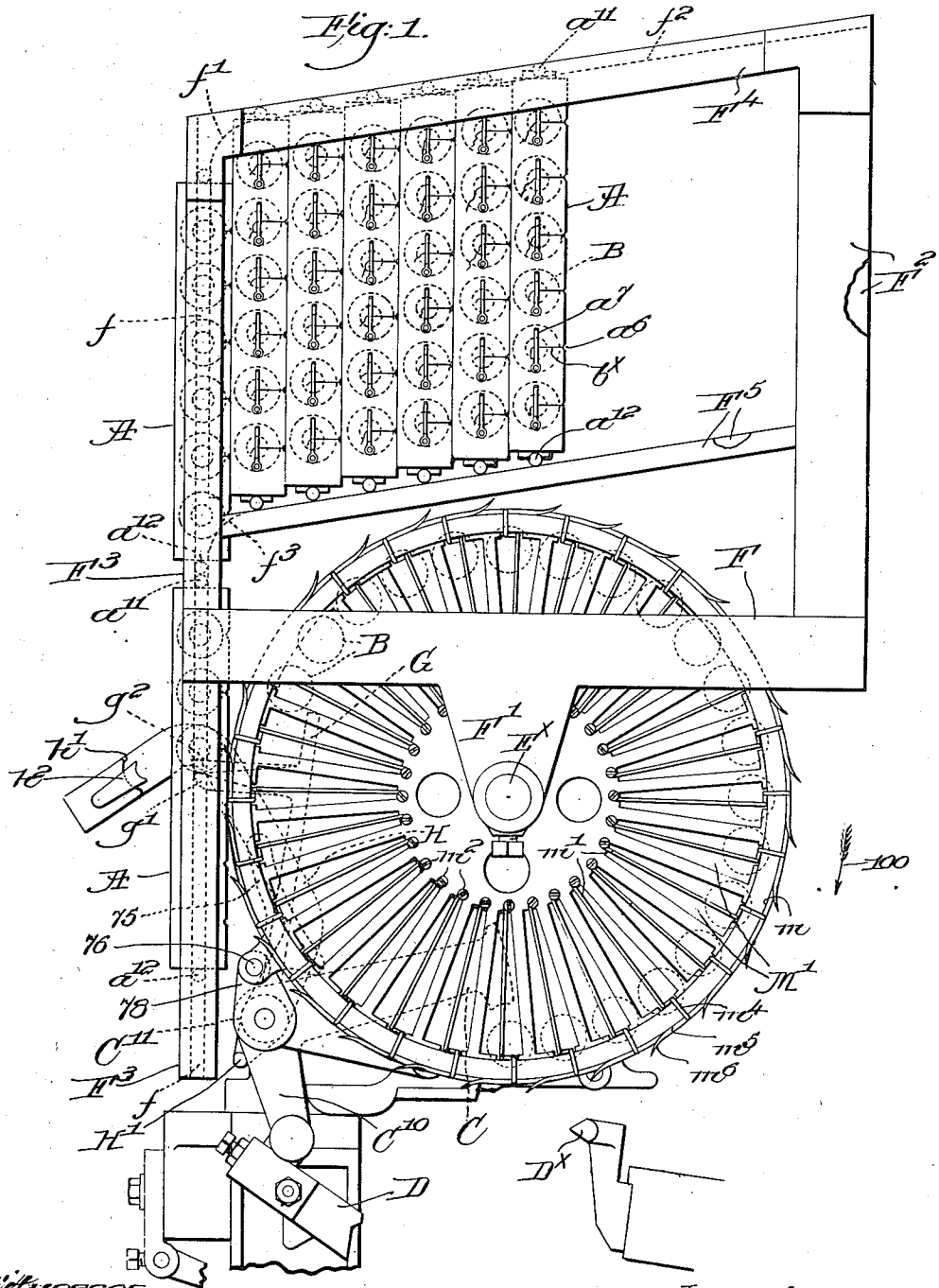
FILLING SUPPLYING MECHANISM FOR AUTOMATIC FILLING REPLENISHING LOOMS.

APPLICATION FILED MAR. 26, 1910.

972,881. **Patented Oct. 18, 1910.**

4 SHEETS—SHEET 1.

Fig. 1.



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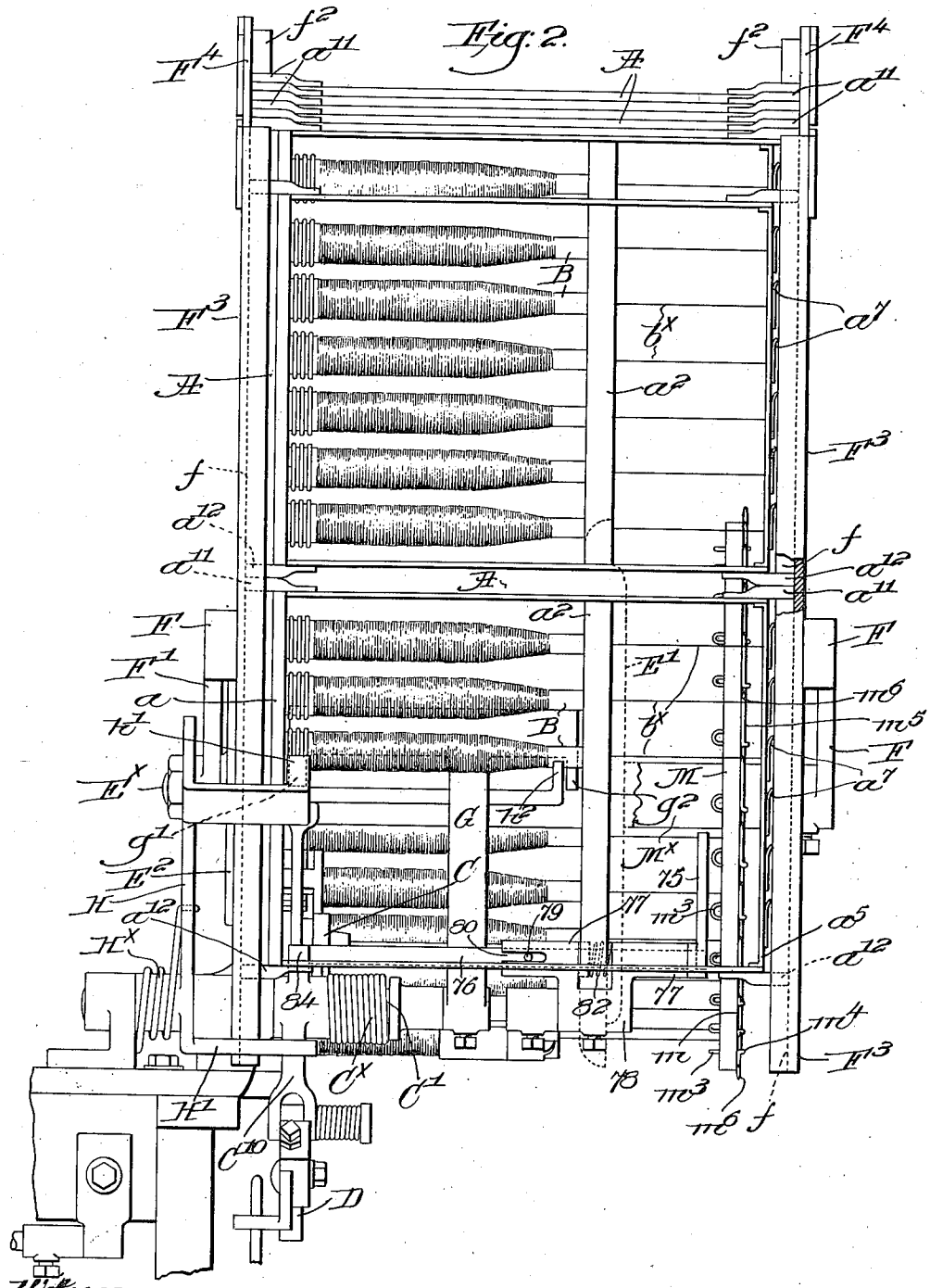
4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

Fig: 3.

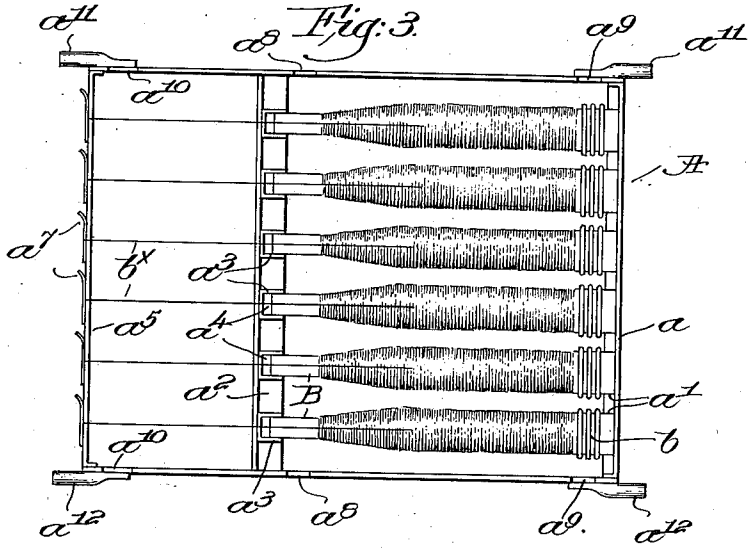


Fig: 4.

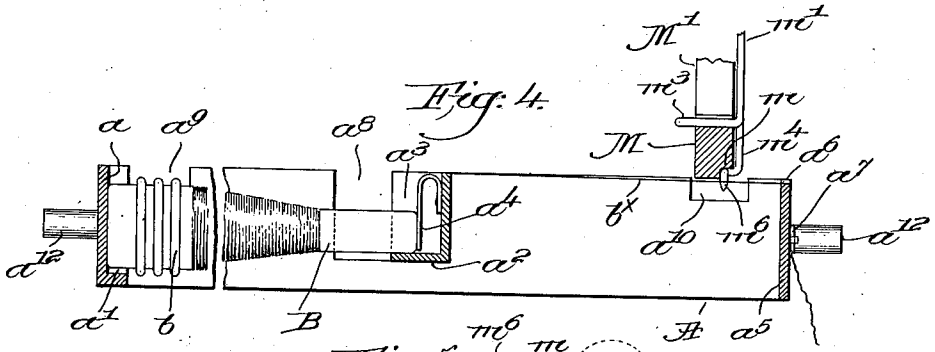
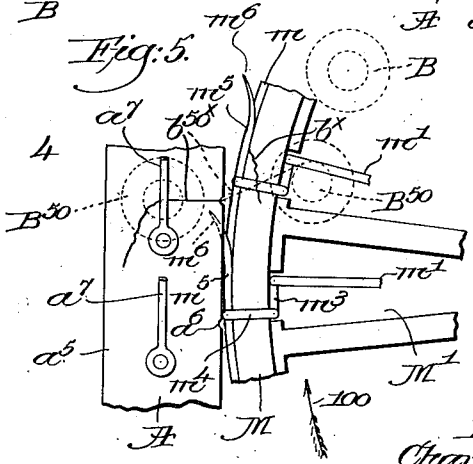


Fig: 5.



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4 SHEETS—SHEET 4.

Fig: 6.

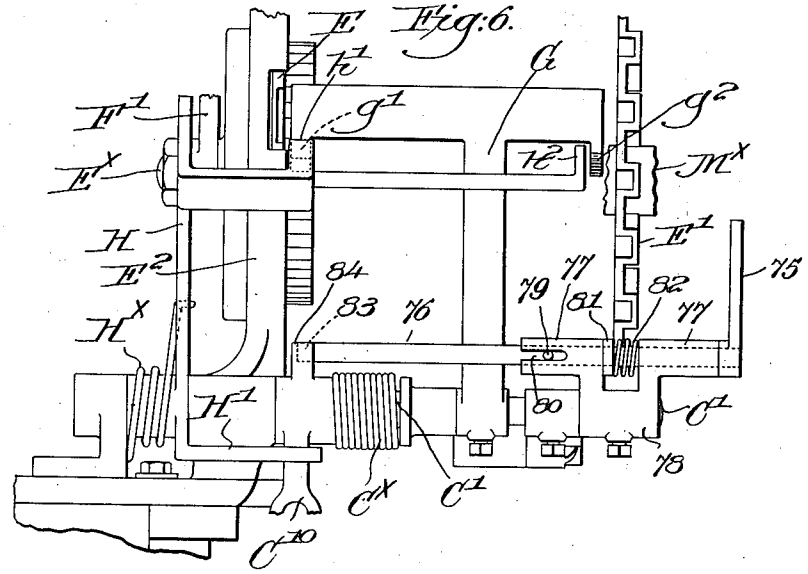


Fig: 7.

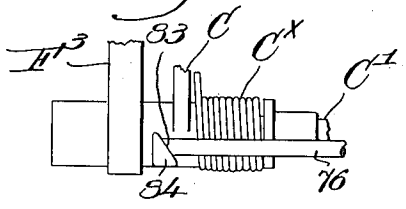
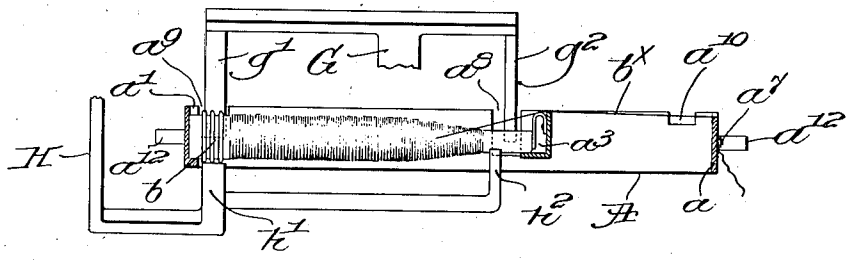


Fig: 8.



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UNITED STATES PATENT OFFICE.

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FILLING-SUPPLYING MECHANISM FOR AUTOMATIC FILLING-REPLENISHING LOOMS.

972,881. Specification of Letters Patent. Patented Oct. 18, 1910.

Application filed March 26, 1910. Serial No. 551,618.

To all whom it may concern:

Be it known that I, CHARLES A. LITTLEFIELD, a citizen of the United States, and resident of Lowell, county of Middlesex, State of Massachusetts, have invented an Improvement in Filling-Supplying Mechanism for Automatic Filling-Replenishing Looms, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention has for its object the production of novel and improved mechanism for supplying filling in an automatic filling-replenishing loom, providing for a large supply of spare filling-carriers and relieving the weaver to a very great extent from labor connected with the supply of filling.

In its essential features my present invention comprehends a magazine arranged to sustain groups of filling-carriers; a rotary feeder to receive filling-carriers from such groups as the groups are directed from the magazine into discharging position; automatic mechanism to insert the carriers of a group in the feeder; a transferrer to transfer the filling-carriers one by one from the feeder to the shuttle, and means on the feeder to assume control automatically of the filling-end of each carrier as it is inserted in the feeder and to retain such control until transfer of such carrier to the working shuttle. Heretofore a magazine has been devised to hold a large number of filling-carriers and to conduct the carriers into position to be inserted automatically in a rotary feeder, to be transferred therefrom to the shuttle, each filling-end being secured to an end holder detachably mounted on the carrier, as in United States Patent No. 921,909 granted to M. L. Stone, May 18, 1909, the structure therein set forth having a device to detach the filling-end holders from the carriers as they are inserted in the feeder, and the holders are then sustained by means connected with the feeder until their respective carriers are transferred to the shuttle. The use of such end holders is necessary in the patented structure, inasmuch as the filling-carriers in the magazine are loosely held and are supported one upon another in upright compartments thereof, from which they travel individually into position to be inserted in the feeder.

It has also been proposed to mount groups of filling-carriers in cages, each cage preferably holding several removable carriers, and being provided with a filling-end holder for each carrier, the cages being fed automatically step by step, and mechanism is provided for transferring the carriers one by one from a cage into weaving position in the loom, as in United States Patent No. 843,107 granted to W. F. Roper, February 5, 1907. The cages are superposed one upon the other in a suitable magazine, from which they are fed into position for the transfer of the carriers held therein, and each filling-end is retained by its holder on the cage until the corresponding carrier has been inserted in the working shuttle. Thus there is no occasion for any change in the control of the filling-ends from the time the filling-carriers, such as bobbins or cops, are inserted in the cages until the carriers are transferred automatically to the shuttle, whereas in the Stone patent, supra, there must be a change in the control of the filling-ends, due to the structure of the apparatus in general.

There are advantages attendant upon the use of cages each to receive a plurality of filling-carriers, as the carriers are held firmly and separately until discharged from the cage, and the filling-end holders on a cage are desirable, the cages being loaded by unskilled labor in any convenient part of the mill. There are also advantages in the use of a rotary feeder for the carriers, supplied automatically with filling-carriers from a reserve supply in a magazine, as in the Stone patented apparatus, but the removal of the filling-end holders from the filling-carriers, and subsequent care of the said holders, is in practice objectionable in some respects.

In my present invention I make use of cages each holding a group of filling-carriers and having holders for the filling-ends thereof, and these cages are sustained in a novel and convenient manner in a magazine, from which they are fed into discharging position. When a cage is so positioned the carriers are removed therefrom one by one automatically and inserted in a rotary feeder similar to that shown in the Stone patent, but I have provided the feeder with devices which catch the filling-ends and disengage them from the holders on the cage

as the carriers are removed therefrom. These devices retain control of the filling-ends so caught and disengaged until the corresponding filling-carriers have been transferred from the feeder to the working shuttle. Thus I am enabled to utilize in one structure the advantageous features found in both the Stone and Roper structures, while eliminating certain features which in practice are more or less objectionable.

The various novel features of my invention will be fully described in the subjoined specification and particularly pointed out in the following claims.

Figure 1 is a right hand side elevation of a portion of an automatic filling-replenishing loom of well known type, with one embodiment of my present invention applied thereto, one of the cages being shown in discharging position; Fig. 2 is a front elevation of the apparatus shown in Fig. 1, a portion of the guideway leading from the magazine being broken out; Fig. 3 is a rear elevation of one of the cages, with a plurality of filling-carriers held removably therein, and showing the filling-end holders on the outer end of the cage; Fig. 4 is an enlarged transverse section of a cage, broken out between its ends, and taken on the line 4—4, Fig. 5, showing also one of the end-holders movable with the rotary feeder; Fig. 5 is an enlarged detail in side elevation of a portion of a cage in discharging position, and two of the end-holders movable with the feeder, one of the latter being in readiness to catch and disengage a filling-end from its holder on the cage; Fig. 6 is a detail in front elevation of the means for retaining a cage in discharging position, with the device for discharging the filling-carriers from the cage and inserting them in the rotary feeder, only a portion of the latter being shown, and the transferrer is omitted altogether to avoid confusion; Fig. 7 is a detail in top plan view of a part of the mechanism shown in Fig. 6, to be referred to; Fig. 8 is a detail in plan view of the cage positioning means, showing its co-operation with the filling-carrier next to be discharged from the cage, the latter being shown in transverse section, and the discharging device is shown in plan ready to remove the filling-carrier from the cage and insert it in the rotary feeder.

The spare filling-carriers are initially placed in suitable holding devices termed "cages", one of which is shown separately in Fig. 3, at A. Each cage is conveniently made as a skeleton or open, rectangular frame of plate metal, of greater length than height, one end, as a, having at its inner face a series of seats a' for the butts of a plurality of filling-carriers B, shown as bobbins having rings b around their butts, and of well known construction, and a cross-bar a^2 extended from the top to the bottom of the cage has seats a^3 for the tips of the carriers.

In each seat a^3 is mounted a yielding latch, conveniently made as a bent spring a^4, Fig. 4, secured at one end to the closed end of the seat and arranged to press firmly against the tip of the carrier and hold it securely yet removably in the cage.

The filling-ends $b^\times$ are led from the carriers over the seats a^3 to the end a^5 of the cage, notched slightly at a^6, Fig. 5, to receive the filling-ends, which latter are drawn under and held by light spring clips or holders a^7, one for each filling-end, and mounted on the outer face of the cage end a^5. These filling-ends holders are clearly shown in Figs. 3, 4 and 5 and they need only be strong enough to retain their grip on the ends under ordinary circumstances.

The top and bottom of each cage have deep notches a^8 therein opposite each other, Fig. 3, at the back of the cage, and adjacent the cross-bar a^2, said notches being alined with the tip portions of the filling-carriers, for a purpose to be described hereinafter. A second pair of deep notches a^9 is made in the top and bottom of the cage substantially in alinement with the butts of the filling-carriers B, as best shown in Fig. 3, and near the end a^5 a third but shallower pair of notches a^{10} are provided.

The cages are sustained in upright position in the magazine, and when in discharging position, a filled cage when viewed from the rear of the loom appearing as shown in Fig. 3. Preferably round projections a^{11}, a^{12} extend from the opposite ends of each cage at top and bottom thereof, and as shown in Fig. 1 the projections are midway between the front and rear edges of the frame constituting the cage. Supposing the cages to have been filled or loaded, they are then placed in the magazine, presently to be described.

In the Northrop loom, an example of which is found in United States Patent No. 529,940, November 27, 1894, a starting shaft is provided, which shaft is rocked to effect the operation of filling-replenishing mechanism whenever replenishment of filling in the running shuttle is necessary, due to the exhaustion, breakage, or substantial exhaustion of the filling in use. Such movement of the starting shaft causes a transferrer to transfer a fresh filling-carrier from the rotary feeder into the shuttle, at the same time ejecting therefrom the spent carrier, all in a manner familiar to those skilled in the art.

In Figs. 1 and 2 the transferrer C and notched dog D of such mechanism are shown, the transferrer rocking on the fixed stud C′ and being retracted or lifted by a spring $C^\times$, and it is moved downward to transfer a filling-carrier from the feeder to the shuttle when the dog D is engaged and

moved by the bunter D^x, Fig. 1, on the lay, all as in the Northrop type of loom.

The usual rotary filling-feeder of the Northrop loom is used herein, comprising essentially connected disks E, E′, shown in part in Fig. 6, and it is constructed and operated in the usual manner, the disks rotating on a horizontal arm E^x rigidly attached to the feeder stand E^2 mounted on the breast-beam of the loom, as usual.

The magazine.—In the present embodiment of my invention the magazine is made in skeleton form, and comprises upright parallel and like sides, each side having a horizontal bottom member F, provided with a depending bracket F′ having a hub to embrace the horizontal arm E^x at its inner and outer ends, respectively, Fig. 1, upright standards F^2 being rigidly secured to the rear ends of the members F, Fig. 1. The bracket hubs are fixedly secured to said arm E^x, the inner bracket F′ being located close to the inner face of the feeder stand E^2.

At the front ends of the bottom members F are rigidly attached upright standards F^3, which extend above and depend below the members F, and the opposite inner faces thereof are longitudinally grooved or channeled, as at *f*, from top to bottom, to constitute a guideway as well as form the front of the magazine.

Each groove is widened at its upper end and its rear wall curved, as at *f*′, see dotted lines Fig. 1, to coincide with the upper surfaces of opposite ledges f^2 extending from the inner faces of plates F^4 connecting the upper ends of the front and rear standards F^3, said ledges being inclined downward and frontward and constituting supports for the upper ends of the cages A when inserted in the magazine. The plates F^4 project above the ledges or supports f^2, as shown in Figs. 1 and 2, to form side guards therefor. A second pair of inclined supports F^5, Fig. 1, are located below the pair f^2, and in parallelism therewith, at such a distance therefrom that when a cage A is placed in the magazine from its open back the projections a^{11} will rest upon the upper supports f^2, suspending the cage in upright position, and the lower projections a^{12} will just touch the lower supports F^5.

The rear walls of the grooves *f* are cut away just above the front ends of the supports F^5, and the tops of the latter are curved, at f^3, Fig. 1, to meet the rear walls of the groove below said supports, to enable the projections a^{12} of a cage to travel from said supports into the upright guideway, the projections a^{11} of the cage traveling in similar manner from the upper pair of supports f^2 over the curved part *f*′ into the upper end of the guideway formed by the opposite grooves *f*.

The filled cages are placed in the magazine one after another and slide forward along the supports, the leading or front cage passing into the guideway and descending therein by gravity into discharging position, and after one cage completely clears the magazine the next one will enter the guideway, as shown in Fig. 1. At such time the upper projections a^{11} of the lower cage engage the lower projections a^{12} of the cage next above and support such cage, in an obvious manner, the remaining cages being held in the magazine by the cage in the upper part of the guideway.

The magazine can be made large enough to contain a sufficient number of cages for one day's supply of filling for the loom, or for any other quantity desired, it being designed that the magazines will be filled each day when work begins, by employees other than the weavers.

As shown in Fig. 1 the lower portion of the guideway is adjacent the front of the rotary feeder and substantially tangent thereto, so that when a cage descends in such guideway the open seats for the filling-carriers therein face the feeder.

Positioning means.—The cage must be positioned for the discharge of the filling-carriers one by one, and after a carrier is discharged the cage must be permitted to descend in the guideway far enough to bring the next remaining carrier into discharging position.

Referring to Figs. 1, 2, 6 and 8, the stud C′ has fixed thereon an upturned and rearwardly inclined T-shaped arm G, located between the feeder plates E, E′ and provided with rigid, frontwardly extended fingers *g*′, g^2 which project into the guideway in the path of the butts and tips, respectively, of the filling-carriers contained in a cage. The finger *g*′ clears the top and bottom of the cage by virtue of the notches a^9, previously referred to, and similarly the finger g^2 traverses the notches a^8, so that there is no engagement between the fingers and a cage at any time. When a cage descends in the guideway the lowermost carrier B held therein is engaged and stopped by the fingers *g*′, g^2 in position to be discharged from the cage and inserted in the feeder, and during such movement the rings *b* of the carrier travel rearward along the upper edge of finger *g*′ while the tip of the carrier travels along the upper edge of finger g^2. As the feeder rotates in the direction of arrow 100, Fig. 1, each carrier inserted in the feeder is carried upward and away from the positioning members as the feeder rotates, and when the inserting device is retracted the cage drops to bring the next carrier therein into engagement with and to be stopped by the positioning members or fingers *g*′, g^2, and in like manner the cage descends intermittingly until the carriers have

all been discharged, whereupon the empty cage drops from the bottom of the guideway.

The inserting mechanism is herein shown as an arm H rocking on the inner end of stud C′ adjacent the feeder stand E^2, see Fig. 6, and retracted by a spring H^x, said arm being equipped with appropriate parts h', h^2 which act respectively upon the butt and tip of the filling-carrier during its discharge from the cage and insertion in the feeder.

The operation of such parts is very similar to the operation of corresponding parts of the usual Northrop transferrer, as will be apparent from an inspection of Fig. 8. A lateral extension H′ from the foot of the inserter H is located in front of the depending arm C^{10} on the transferrer hub, and when the transferrer C is operated to transfer a filling-carrier from the feeder to the working shuttle the inserter is operated to discharge a carrier from the cage and insert it in the feeder. This supplying of the feeder with a filling-carrier each time a carrier is transferred therefrom to the shuttle is effected in the Stone apparatus before referred to, and as therein provided for the elongated upper edge of the part h' of the inserting device engages the next filling-carrier above it until said device returns to normal position. Herein upon such return the cage drops one step to bring such previously engaged carrier into discharging position, resting upon and stopped by the positioning members g', g^2.

Means for controlling the filling-ends.— As the filling-ends are primarily held by the holders on the cages it is necessary to assume control of such filling-ends when the carriers are inserted in the feeder. To this end the tip-supporting plate E′ of the feeder has suitably connected with it the elongated hub M^x of a disk M, located at some distance beyond the outer face of the disk E′, as shown in Fig. 1, the hub M^x turning on the arm or fixed shaft E^x.

The disk M is radially slotted at M′, Figs. 1 and 5, the slots corresponding in number with the total number of supporting devices for filling-carriers on the feeder, and a peripheral groove m is formed in the outer face of said disk, Figs. 4 and 5. A series of filling-end holders are mounted on the disk, each holder being conveniently made of relatively stiff spring wire. Each holder comprises a straight shank m' secured at its inner end to the disk at m^2, Fig. 1, and extended radially along the middle of a slot M′ to the outer end thereof, whereat it is bent laterally into a substantially U-shaped portion m^3 projecting beyond the inner face of disk M, Figs. 2 and 4, and then the holder is again bent to extend radially across the outer face of the peripheral part of the disk, as at m^4. The extremity of the holder is now bent to normally rest in the groove m, as at m^5, and the tip is turned outward and preferably sharpened, as shown at m^6, Figs. 1, 4 and 5. These tips constitute catchers for the filling-ends, and as the feeder and disk M rotate the out-turned tips or catchers m^6 travel in a circular path which intersects the path occupied by a filling-end b^x when its carrier in a cage A is in position to be discharged, the notches a^{10} in the top and bottom of a cage providing a clearance for the catchers, as indicated in Fig. 4.

Referring to Fig. 5 the dotted circle B indicates the last filling-carrier which has been discharged from cage A and inserted in the feeder, the latter having advanced one step after such insertion, and the cage A has dropped one step to bring the next carrier B^{50} into discharging position. It will be seen that the filling-end b^{50x} of that carrier is now just above the lower one of the two catchers m^6, and when carrier B^{50} is inserted in the feeder its filling-end will occupy substantially the position shown by the dotted line leading to the smaller of the two dotted circles B^{50}. After such insertion the discharging device H and its parts is retracted and the feeder advances one step in the direction of arrow 100, thereby causing the lower one of the two catchers m^6 shown in Fig. 5 to catch or engage the filling-end b^{50x} and draw it down into the groove m, where it is firmly held by the part m^5 of the holder, and at the same time the filling-end will be disengaged from or pulled out of the holder a^7 on the cage, such holders being made of less holding power than the holders on the disk M. Thus the insertion of each filling-carrier into the rotary feeder from the cage places its filling-end in position to be caught by the holder movable with the feeder, and the subsequent advance of the latter causes the proper holder on the feeder to assume control of the filling-end of the carrier last inserted and to disengage it from the holder on the cage. The holders on the feeder maintain control of the filling-ends until their respective carriers are transferred from the feeder to the shuttle by the usual transferrer C, and it will be understood that the length of filling from the disk M to the cloth will be severed by any usual thread-cutting devices commonly employed in connection with Northrop looms. Such severed ends hang down from the holders on disk M until they pass beyond the transferring point, after which the holders are caused to release the threads by an automatic device comprising a segmental plate 75 located adjacent the inner face of the disk M and normally just clearing the bends m^3, Fig. 2, the plate being mounted on a rod 76 mounted to slide longitudinally in separated bearings 77, Fig.

6, on a bracket 78 fixedly mounted on the outer end of the transferrer stud C'. A pin 79 on the rod moves in a slot 80 in one of the bearings, to prevent turning of said rod, the latter having fast upon it a collar 81 acted upon by a spring 82 between the bearings, the spring serving to laterally position the segmental plate and rod as shown in Figs. 2 and 6. The inner end of rod 76 is beveled at 83 to coöperate with a cam lug 84 on the hub of the transferrer C, as shown in Figs. 6 and 7.

At each operation of the transferrer, at which time the feeder is at rest, the cam lug 84 wipes over the beveled end 83 and moves the rod 76 to the right, Figs. 2 and 6, thereby moving plate 75 against two or more of the bends m^3 and pushing them outward. The shanks m' of the holders are thus flexed, and the ends m^5 are temporarily lifted out of the groove m in the disk M, thus releasing the ends of filling and permitting them to drop to the floor. When the transferrer resumes its normal position the spring 82 retracts plate 75 and the bends m^3 return to normal position, restoring the holders to active condition, the holders being rendered inoperative successively as the feeder rotates.

By making the plate 75 long enough to act upon several of the bends m^3 at each transferring operation it will be manifest that each holder is opened or rendered inoperative a plurality of times, so that there is no possibility of the ends of filling being retained unduly by the holders.

In Figs. 1 and 2 I have not shown the filling-ends held by the several holders movable with the feeder, as the illustration of the mechanism would be confused thereby, the showing in the larger detail view, Fig. 5, being deemed sufficient for a proper understanding of this feature.

As the operation of the apparatus has been explained from time to time throughout the preceding description no further explanation is believed necessary to enable the operation of the various instrumentalities to be fully and clearly understood.

Various changes or modifications in details of construction and arrangement may be made by those skilled in the art without departing from the spirit and scope of my invention as set forth in the claims annexed hereto.

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

1. An automatic filling-replenishing loom having a rotary feeder, an automatic transferrer coöperating therewith, a magazine having means to engage the upper ends of and suspend a series of cages independently of each other and sustain them slidably in upright position, each cage adapted to hold a plurality of filling-carriers, means to direct the cages singly from the magazine into discharging position relatively to the feeder, a device to discharge automatically the carriers one by one from the positioned cage and place them in the feeder, and means projecting between the sides of the cage and coöperating with the next carrier to be discharged to maintain in position the cage holding such carrier.

2. An automatic filling-replenishing loom having a rotary feeder, a magazine having inclined supports, a series of cages each adapted to hold a plurality of removable filling-carriers and provided with projections to rest upon and slide along the supports, a guideway to coöperate with the projections and direct the cages into discharging position, an inserter to engage and discharge the carriers one by one and insert them in the feeder, and a transferrer to remove the carriers singly and automatically from said feeder.

3. An automatic filling-replenishing loom having a rotary feeder, a magazine having inclined supports, a series of cages each adapted to hold a plurality of removable filling-carriers and provided with projections to rest upon and slide along the supports, a guideway to coöperate with the projections and direct the cages into discharging position, an inserter to engage and discharge the carriers one by one and insert them in the feeder, and a transferrer to remove the carriers singly and automatically from said feeder, combined with means to coöperate with the leading carrier of the discharging cage and position such carrier for coöperation with the inserter.

4. An automatic filling-replenishing loom having a rotary feeder, a magazine having inclined supports, a series of cages having lateral projections to rest upon and slide along the supports while the cages are maintained in upright position, each cage adapted to hold a plurality of removable filling-carriers, a guideway to direct the cages by gravity into discharging position, an automatic inserter to remove the carriers singly from a positioned cage and insert them in the feeder, fixedly mounted means projecting between the sides of the cage and coöperating successively with the carriers therein to govern the feed movement of such cage as its carriers are removed, and a transferrer to remove the carriers automatically from the feeder.

5. An automatic filling-replenishing loom having a rotary feeder, a magazine having inclined supports, a series of cages each adapted to hold a plurality of removable filling-carriers and provided with lateral projections to rest upon and slide along the supports, a guideway to coöperate with said projections and direct the cages one by one into discharging position, means to govern

the feed of a cage during discharge of its carriers, and an instrumentality to coöperate automatically with the carriers in the cage and insert them one by one in the feeder.

6. An automatic filling-replenishing loom having, in combination, a rotary feeder for holding filling-carriers and from which said carriers are transferred to the shuttle, a cage adapted to hold a plurality of removable filling-carriers and having a filling-end holder for each carrier, automatic mechanism to remove the carriers from the cage and insert them in the feeder, and means on the latter to withdraw the filling-ends from the holders and retain control thereof until the corresponding carriers are transferred from the feeder.

7. An automatic filling-replenishing loom having, in combination, a rotary feeder for holding filling-carriers and from which said carriers are transferred to the shuttle, means to present a group of filling-carriers to the feeder and to hold the filling-ends of such carriers, mechanism to insert, one by one, the filling-carriers of a group in the feeder, and a series of catchers movable with the feeder to catch and hold automatically the filling-ends of the carriers as they are inserted in the feeder.

8. An automatic filling-replenishing loom having, in combination, a rotary feeder for holding filling-carriers and from which said carriers are transferred to the shuttle, a cage adapted to hold a plurality of removable filling-carriers and having spring-holders for the filling-ends, automatic mechanism to remove the carriers from the cage and insert them in the feeder, and a circularly-arranged series of catchers movable with the feeder, each withdrawing a filling-end from the spring-holder as its carrier is removed from the cage and retaining control of such filling-end until the corresponding carrier is transferred from the feeder.

9. An automatic filling-replenishing loom having, in combination, a rotary feeder for holding filling-carriers and from which said carriers are transferred to the shuttle, means to present groups of filling-carriers to the feeder and having a holder for the filling-end of each carrier, mechanism to insert automatically the carriers of a group singly in the feeder, means movable with the latter to disengage the filling-ends from such holders and to retain control of the filling-ends until removal of the corresponding carriers from the feeder, and an instrumentality to thereafter act upon said disengaging and holding means and cause release of the filling-ends.

10. An automatic filling-replenishing loom having, in combination, a rotary feeder for holding filling-carriers and from which said carriers are transferred to the shuttle, an upright guideway adjacent and substantially tangent to said feeder, a cage adapted to hold a plurality of removable filling-carriers and having a filling-end holder for each carrier, said cage being movable in the guideway into discharging position, automatic mechanism to discharge the carriers therefrom singly and insert them in the feeder, a device to coöperate with the lowermost carrier in the cage and position such carrier for discharge, and means movable with the feeder to disengage the filling-ends from the holders as their carriers are discharged and to retain control of the filling-ends until transfer of the corresponding carriers from the feeder.

11. An automatic filling-replenishing loom having, in combination, a rotary feeder for holding filling-carriers and from which said carriers are transferred to the shuttle, a disk at the outer end of the feeder and rotatable therewith, a series of filling-end catchers mounted on said disk, each catcher having its outer end extended beyond the periphery of the disk and in the direction of rotation of the feeder, means to present groups of filling-carriers for insertion in the feeder, such means including devices to hold separately the filling-ends of the carriers of a group, and mechanism to insert the filling-carriers of a group one by one into the feeder, the outer end of a catcher passing under and assuming control automatically of the filling-end of a carrier as it is inserted in the feeder.

12. An automatic filling-replenishing loom having, in combination, a rotary feeder for holding filling-carriers and from which said carriers are transferred to the shuttle, automatic mechanism for inserting filling-carriers in the feeder, means to hold the filling-end of each carrier prior to its insertion in the feeder, and devices on the latter to grasp and disengage automatically the filling-ends from such holding means as the corresponding carriers are inserted in the feeder.

13. An automatic filling-replenishing loom having, in combination, a rotary feeder for holding filling-carriers and from which said carriers are transferred to the shuttle, automatic mechanism for inserting filling-carriers in the feeder, means to hold the filling-end of each carrier prior to its insertion in the feeder, and spring-acting devices carried by the feeder to grasp and disengage automatically the filling-ends from such holding means as the corresponding carriers are inserted in the feeder and maintain control of such filling-ends until after transfer of their carriers from the feeder.

14. An open, rectangular cage for filling-replenishing looms, provided with means to sustain the butts and tips of a plurality of filling-carriers, a filling-end holder for each carrier, on the end of the cage nearer the

tip-sustaining means, and projections extended from opposite ends of the cage at its top.

15. A cage for filling-replenishing looms, provided with means to hold a plurality of removable filling-carriers disposed one above another between the top and bottom of the cage, filling-end holders on one end of the cage, and projections extended from opposite ends of the cage at its top and bottom, respectively.

16. A detachable cage for a filling-replenishing loom, having means to grasp and hold a plurality of filling-carriers arranged one above another between its top and bottom, and having also a filling-end holder for each carrier, the top and bottom of the cage being deeply notched opposite the butts and tips of the carriers.

17. In a filling-replenishing loom, a skeleton magazine having upper and lower pairs of parallel and inclined supports, an upright guideway communicating with the lower ends thereof, removable cages each adapted to hold a plurality of removable filling-carriers arranged one above another between the top and bottom of the cage, projections extended from the opposite ends of each cage at top and bottom thereof, to rest upon and slide along the inclined supports and maintain the cages upright in the magazine, said cages moving one by one into the guideway and descending therein by gravity, means to govern the feed of the cages down the guideway, a rotary feeder adjacent and substantially tangent to the guideway, and automatic mechanism to transfer the filling-carriers one by one from the lowermost cage to the feeder.

18. An automatic filling-replenishing loom having, in combination, a rotary feeder, a magazine for a series of cages each adapted to hold a plurality of removable filling-carriers and having holders for the filling-ends of the carriers therein, means to present the cages into discharging position, automatic mechanism to transfer the filling-carriers singly from a cage so positioned to the feeder, and a series of filling-end holders movable with the latter, each of such holders having a device to catch the filling-end of a carrier and disengage it from its holder on the cage when the carrier is transferred to the feeder, whereby the filling-end of a carrier is first retained by a holder on the cage and thereafter by a holder movable with the feeder.

19. An automatic filling-replenishing loom having, in combination, a rotary feeder, a cage to hold a removable filling-carrier and having a holder for the filling-end thereof, automatic mechanism to transfer a filling-carrier from its cage to the feeder, and a series of filling-end holders movable with the latter, each of such holders automatically assuming control of and disengaging the filling-end of a carrier from its holder on the cage when the carrier is transferred to the feeder, whereby the filling-end of a carrier is first retained by the holder on a cage and thereafter by a holder movable with the feeder.

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

CHARLES A. LITTLEFIELD.

Witnesses:
FRANK J. DUTCHER,
F. A. MACDONALD.