To all whom it may concern:

Be it known that I, EUGENE H. BALLOU, a citizen of the United States, residing at Pawtucket, in the State of Rhode Island, have invented a new and useful Improvement in Leno-Looms, of which the following is a specification.

Heretofore in leno-weaving the warp-threads to be crossed have been made to pass through a single dent in the reed and the crossing effected by means of doup and standard harnesses located back of the reed; but in carrying out my invention the warp-threads to be crossed are passed through several of the dents of the reed, and the crossing of the threads is effected by means of doup and standard harnesses located in front of the reed; and my invention consists in the employment of a doup and standard harness in front of an independent reed which is detachable from the lay, also in means for preventing the stopping of the loom by the action of the weft-fork when the loom is making the plain weave.

In the accompanying drawings, Figure 1 represents the front elevation of a loom provided with my improvement. Fig. 2 represents an end view of the same. Fig. 3 represents a vertical section taken in the line 3 3 of Fig. 1. Fig. 4 represents an enlarged detail view showing a front view of the doup when the loom is making the plain weave. Fig. 5 represents a section taken in the line 5 5 of Fig. 4, showing an edge view of the doup. Fig. 6 represents a detail view showing the protector-arm for preventing the stoppage of the loom when making the required blank picks. Fig. 7 represents a side view of the standard harness. Fig. 8 represents a transverse section of the drop-box of the loom. Fig. 9 represents an axial section taken in the line 9 9 of Fig. 1 to show the construction of the pulleys for operating the doup and standard harnesses. Fig. 10 represents a detail front view showing the doup when they are drawn up for making the required turn of the leno warp-threads. Fig. 11 represents a detail front view showing the doup when the turn of the warp-threads has been made. Fig. 12 represents a section taken in the line 12 12 of Fig. 10 showing the reed-beam in locked engagement with the lay-beam. Fig. 13 represents a section taken in the line 13 13 of Fig. 11, showing the reed-beam unlocked from the lay-beam. Fig. 14 represents an enlarged view of metallic loops which form the bight of the doup. Fig. 15 represents an enlarged view of the eye portion of one of the heddles of the standard harness and the bight of the soft portion. Fig. 16 represents a section showing the reed and the connected standard and doup harnesses when disengaged from the lay-beam. Fig. 17 represents the warp-thread crossing of the leno fabric.

In the drawings, A represents the frame of the loom; B, the lay; C, the shuttle-race; D, a single shuttle-box at one end of the loom; E, a drop shuttle-box of four box members at the opposite end of the loom; F, the reed; G, the crank-shaft; H, the pitman connecting the crank-shaft with the lay; I, the standard harness; J, the doup-harness, and K the weaving-harnesses, which latter are operated, as usual, from the dobby L. The reed F is made separable from the lay and supported for operation by means of the swords O O, which are pivoted upon the pivot-rod N of the lay, the said swords being actuated backwardly from contact with the lay-beam by means of the torsion-springs b b, held upon the pivot-rod, the backward movement of the said swords being checked by means of the flat buffer-springs c c, attached to the tie-beam d d of the frame A. The reed F is held between the reed-beam M and the top rail M', and in front of the reed-beam and moving in suitable guideways e e, formed at the inner sides of the swords O O, is placed the standard harness I, and in front of the standard harness is placed the doup-harness J, also moving in the guideways e e, formed in the said swords. The doup and standard harnesses are held at their elevated positions, as shown in Figs. 4 and 16, by means of the spiral springs a a, to which are attached the cords a a a a, passing over the sheaves a a a a, which are held by the brackets f f, attached to the inner sides of the said swords O O, the said cords then passing downward to their points of attachment to the rods g g g g', which rods serve to support the doup and standard.
harnesses by contact with the lower edges of
the harness-frames, the said rods being held
and guided by means of suitable perforations
made in the ears v v of the bracket f, through
which the said rods pass and serve to impart
upward movement to the said harnesses. The
required downward movement of the doup
and standard harnesses is imparted by means
of the straps h h', which are connected with
the lower shafts of the said harnesses by
means of the wire connections i and i' and
attached to the sheaves j j', respectively. The
sheave j' is connected with the sheave j and
the sheave j with the sheave j', as shown in
Fig. 9, and from the said sheaves j j' j' connec-
tion is made to the operating-levers n n' of
the doby L by means of flexible connection
k k', which pass over the sheaves l l' and m
m' to the said doby-levers. The reed F is
secured to the lay to beat up the weft by
means of the sliding catch-bolt a, (shown in
Figs. 10 and 12,) secured to the back of the
reed-beam M by means of the screws o' o' and
the slots o' o', the said catch-bolt being se-
crated in a forward direction for engagement
with the perforations o' in the catch-plate o',
at the lay-beam o', by means of the
spring o', the said catch-bolt being actuated
for release from engagement with the said
catch-plate by means of the cam projections
o', attached to the inner edge of the end bars
of the standard harness, as shown in Fig. 7,
whereby upon the downward movement of
the said harness the reed will be released
from the lay, the inclined end o of the said
cam projection engaging with the stud o of
the catch-bolt to cause the disengagement, as
shown in Fig. 13. The upper portion w of
the heddles of the standard harness I is made
of wire, with the eyes p p' formed by twist-
ing the wire loop, as shown in Fig. 15, and in
order to prevent injurious action upon the
weft-threads at the beat-up of the lay I make
the upper portion w' of the heddle of soft cord,
by means of which such injurious action will
be prevented, and in order to prevent the in-
jurious wear of the doup, which in its move-
ment back and forth with the lay is in frac-
tional engagement with the inclosed warp-
threads, the holding-loop g is preferably made
of metal and provided at its ends with eyes
q q', to which the doup-harness cords q q'
are attached, one of the said cords being made to
pass through the eye p and the other through
the eye p' of the standard heddle, as shown in
Figs. 4 and 5. In operating the loom it is nec-
essary to make blank picks or picks in which
the shuttle is not driven across the shuttle-
race, and in this case it is necessary to provide
means for preventing the engagement of the
weft-fork r with the stop mechanism, and for
this purpose I attach the arm r' rigidly to the
shuttle-binder r' and connect the bent lever r
of the back of the sword of the lay by means
of the bracket r, the lower arm r' of the said
cross-weave the doup-harness J is raised and
bent lever r extending parallel with the grid
w the upwardly-extending
standard healds, as shown in Fig. 10. The dop and standard harnesses then both go down together to make the cross, as shown in Fig. 11, and at the same time the reed-beam M becomes unlocked from the lay-beam by the engagement of the cam projections o', attached to the inner edge of the end bars of the standard harness I with the studs o" of the catch-bolts o, and then the connected reed and the dop and standard harnesses are carried back to their rearward position, as shown in Fig. 16, by the action of the torsion-springs bb. Then the drop shuttle-box is to be raised, so as to bring the blank member b' of the shuttle-box in line with the shuttle-race, the ground-filling shuttle being then in the upper box f', as shown in Fig. 8. Then two blank picks are to be made by the loom, the dop and standard harnesses I and J being lowered by the action of the dobby L during the time of making the second blank pick to cause the release of the reed and the connected dop and standard harnesses from the lay, and then the drop shuttle-box is to be still further raised, so as to bring the box f' in line with the shuttle-race and two picks of the loom made with the coarse filling-thread shuttle R'. Then the drop-box is to be lowered to again bring the blank shuttle-box member b' in line with the shuttle-race and two blank picks made as before, the dop and standard harnesses I and J being then raised by the action of the dobby L during the time of making of the second blank pick to cause the engagement of the reed and the connected dop and standard harnesses with the lay, the yielding movement of the buffer-springs c on the impact of the swords O O therewith serving to allow sufficient time for the proper engagement of the catch-bolt o with the catch-plate o', whereby the reed and the dop and standard harnesses will be locked to the lay for continued action therewith. Then the drop shuttle-box is to be lowered, so as to bring the upper box f' in line with the shuttle-race, as shown in Fig. 11, and thereafter the plain weaving resumed with the ground-filling shuttle R, and this operation repeated will result in the production of a fabric such as is represented in Fig. 17, the threads after passing through the denis of the reed being grouped together in the dop and crossed in the weaving. The warp-threads x, which are crossed by action of the dop and standard harnesses, are spooled upon the beam Q, and the warp-threads which pass through the dopps pass from the beam Q over the rod x' and around the rod x², the said rods being held together by opposite arms x² x³ to form a pendent frame, which is pivoted in the bearing-brackets x² x³, the said frame being provided with the projecting arm x², from which connection is made downwardly to the spring x² and upwardly to one of the levers 60 of the dobby by means of the cord x³, whereby when the threads in the dopps are being crossed over the other threads the dop threads may be properly slackened by the action of the dobby, while their weaving tension will be preserved by the action of the 70 spring.

It is evident that my improvement may be adapted to a pick and pick-loom, and in that case it will not be necessary to make two blank picks, a single blank pick being sufficient for the proper weaving of the fabric, the said blank pick serving to provide room for beating up the cross of the leno warp-threads without causing the distortion of the fabric.

I claim as my invention—

1. In a leno-loom, the combination of the lay, with a reed detachable from the lay, and dop and standard harnesses held for operative movement in front of the reed, and means for imparting such movement.

2. In a leno-loom, the combination of the lay, with a reed detachable from the lay, and dop and standard harnesses, arranged for operation in front of the reed, and means for locking the combined reed and dop and standard harnesses to the lay, and for disengaging the same.

3. In a leno-loom, the combination of the lay, with a reed detachable from the lay, and dop and standard harnesses arranged for operation in front of the reed, means for locking the combined reed and dop and standard harnesses to the lay, and for disengaging the same, and which the dopps of the dop-harness are adapted to resist the wear caused by the forward and backward movement of the dop-harness with the lay.

4. In a leno-loom, the combination of the lay, with a reed detachable from the lay, and dop and standard harnesses, arranged for operation in front of the reed, and adapted to swing back and forth with the lay, means for locking the combined reed, and dop and standard harnesses to the lay, and for disengaging the same, and the spring-buffers limiting the backward movement of the reed and the dop and standard harnesses.

5. In a leno-loom, the combination of the lay, with a reed detachable from the lay, and dop and standard harnesses arranged for operation in front of the reed, means for locking the combined reed, and dop and standard harnesses to the lay, and for disengaging the same, and the shuttle-guide-bar having guide pins attached thereto, and means for raising the pins of the shuttle-guide-bar into the shed.

6. In a leno-loom, the combination of the lay, with a reed detachable from the lay, and dop and standard harnesses arranged for operation in front of the reed, means for locking the combined reed, and dop and standard harnesses to the lay, and for disengaging the same, and the shuttle-guide-bar having guide pins attached thereto, and means for raising the pins of the shuttle-guide-bar into the shed.

7. In a leno-loom, the combination of the
lay, and a drop shuttle-box provided with a box for holding a ground-filling shuttle, and a box for holding a shuttle which carries the binding-thread for securing the crossed warp-threads, and means attached to the drop shuttle-box to provide for the normal actuation of the lay upon the protector-rod, when the shuttle is not thrown through the shed at the crossing of the grouped warp-threads.

8. In a leno-loom, the combination of the lay, and a drop shuttle-box provided with a box for holding a ground-filling shuttle, a box for holding a shuttle carrying the binding-thread for the crossed warp-threads, and a blank shuttle-box member provided with a projection representing a deflected shuttle-binder.

9. In a leno-loom, the combination of a drop shuttle-box provided with a box for holding the shuttle carrying the binding-thread for the crossed warp-threads, a blank shuttle-box, and a projection which represents a deflected shuttle-binder, with the shuttle-binder of the shuttle-box at the opposite end of the lay, the weft-fork, the grid and the guard-arm, arranged back of the grid, and connected with the shuttle-binder.

10. In a leno-loom, the combination of the reed, and the standard and doup harnesses held for operation in front of the reed, with the lay, and the doup-protecting rod attached to the lay to prevent the engagement of the doup with the flying shuttle.

11. In a leno-loom, the combination of the reed, and the standard and doup harnesses held for operation in front of the reed, with the lay, the shuttle guide-bar provided with the guide-pins, and means for raising the pins into the shed at each backward movement of the lay.

12. In a leno-loom, the combination of the reed, and the standard and doup harnesses held for operation in front of the reed, with the lay, the doup-protecting rod, attached to the lay to prevent the engagement of the doup with the flying shuttle, the shuttle guide-bar provided with the guide-pins, and means for raising the pins into the shed at each backward movement of the lay.

13. In a leno-loom, the combination of the reed for beating up the weft, the doup and standard harnesses arranged in front of the reed for crossing action upon groups of threads in front of the reed, and means for imparting movement to the doup and standard harnesses to effect the required crossing of the groups of threads.

EUGENE H. BALLOU.

Witnesses:

Socrates Scholfield,

John Walker.