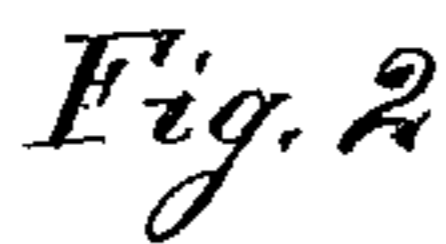
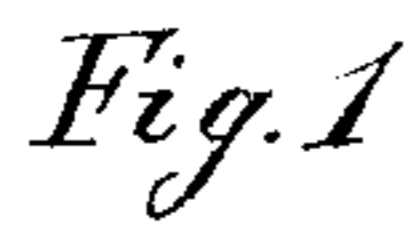


3 Sheets—Sheet 1.

Patented Sept. 3, 1889.

Inventors

John H. Bentley
Thomas W. Bentley.
John Duplo atty

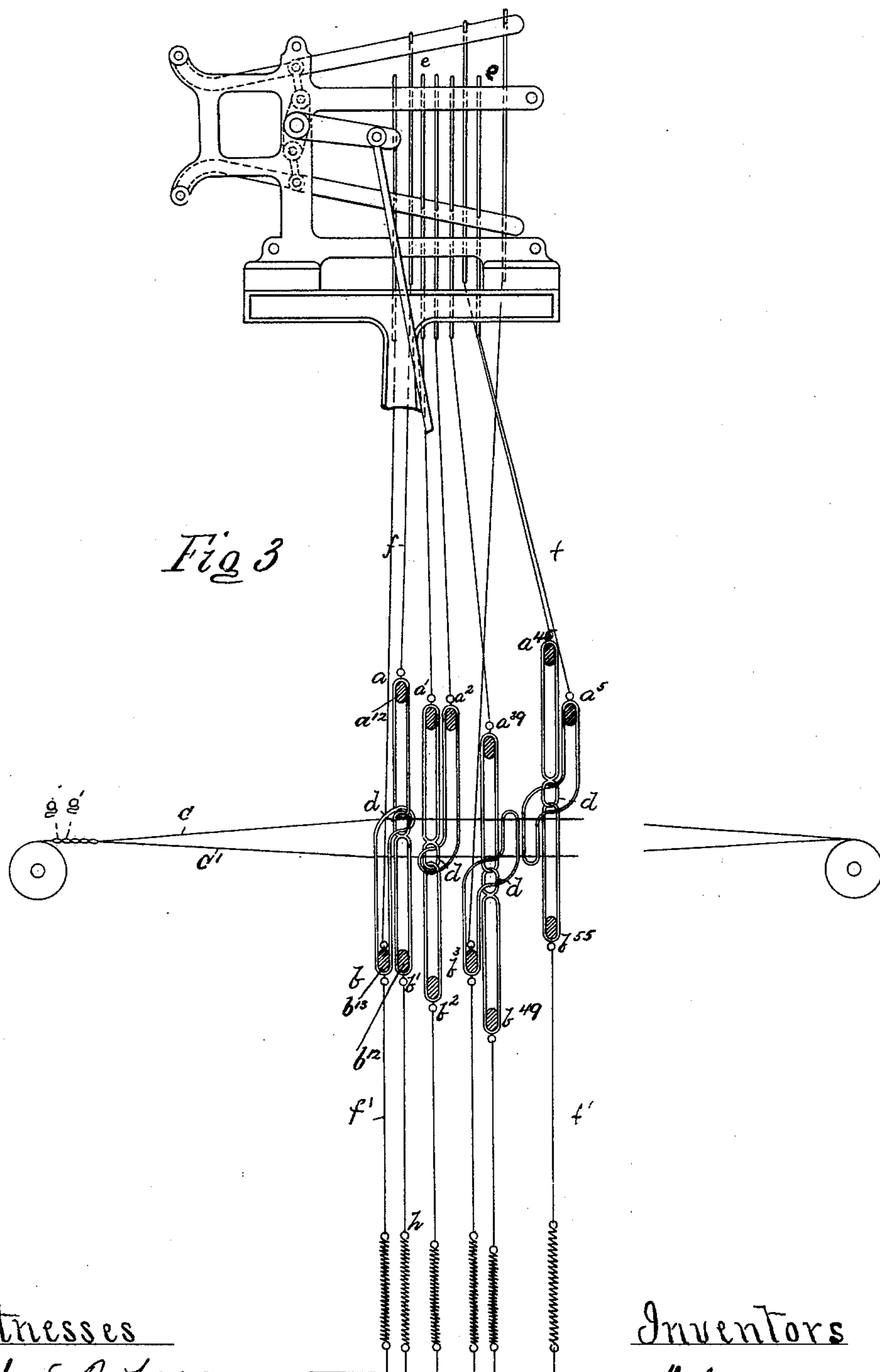
(No Model.)

3 Sheets—Sheet 2.

J. H. & T. W. BENTLEY.
HEDDLE FOR WEAVING GAUZES.

No. 410,483.

Patented Sept. 3, 1889.



Witnesses

Alfred B. Watson
H. Warner

Inventors

John H. Bentley
Thomas W. Bentley
By John Douglas atty

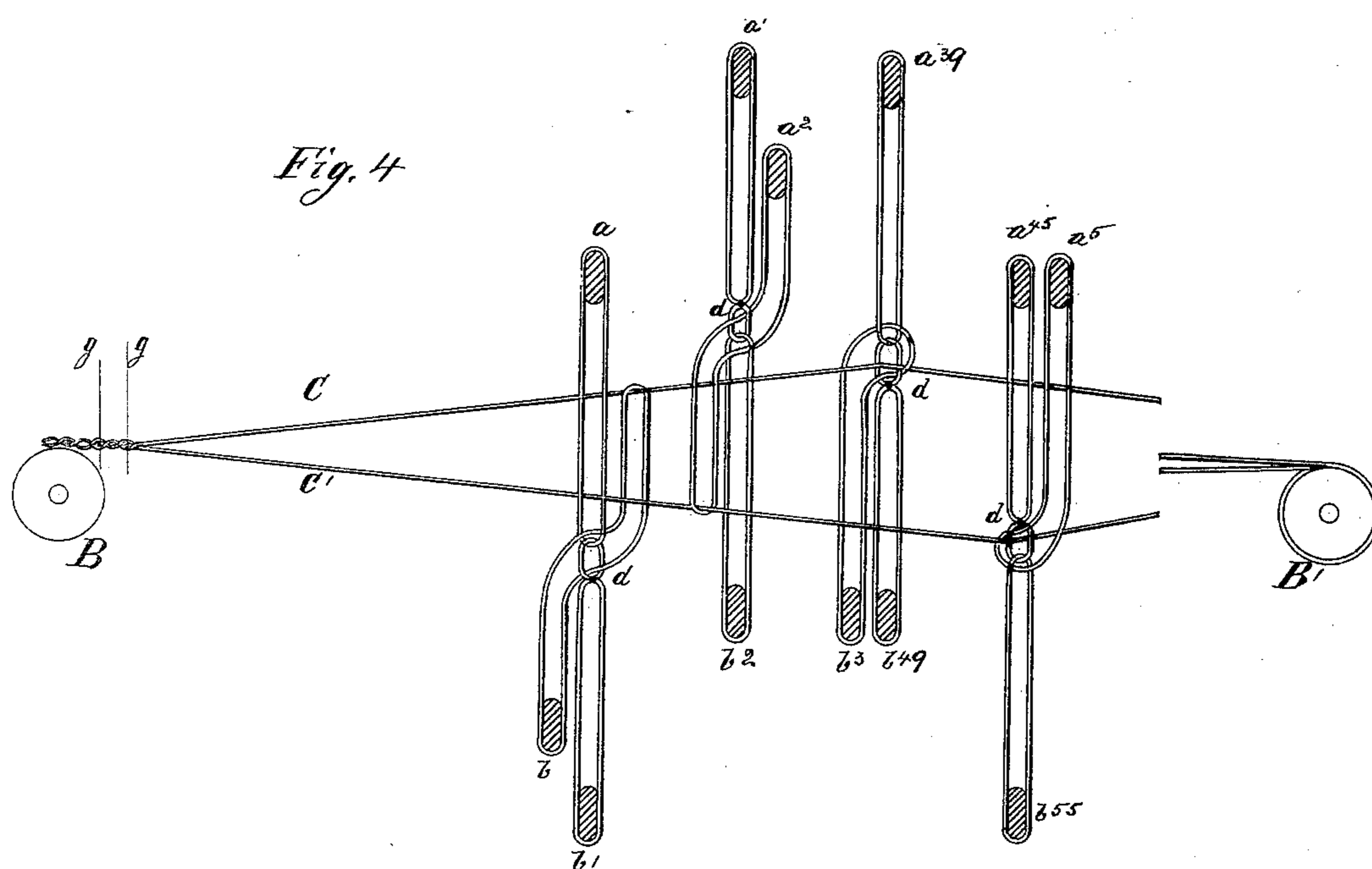
(No Model.)

3 Sheets—Sheet 3.

J. H. & T. W. BENTLEY.
HEDDLE FOR WEAVING GAUZES.

No. 410,483.

Patented Sept. 3, 1889.



Witnesses
Fred J. Warner.
Hattie Warner

Inventors
John H. Bentley,
Thomas W. Bentley,
John D. Bentley, atty.

UNITED STATES PATENT OFFICE.

JOHN H. BENTLEY AND THOMAS W. BENTLEY, OF PATERSON, NEW JERSEY.

HEDDLE FOR WEAVING GAUZES.

SPECIFICATION forming part of Letters Patent No. 410,483, dated September 3, 1889.

Application filed August 14, 1885. Serial No. 174,397. (No model.)

To all whom it may concern:

Be it known that we, JOHN H. BENTLEY and THOMAS W. BENTLEY, citizens of the United States, residing at Paterson, Passaic county, State of New Jersey, have invented a new and useful Improvement in Heddles for Weaving Gauzes, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

Figures 1 and 2 of the drawings are diagrams of a combination of heddles heretofore used for weaving gauze, the heddle-shafts being shown in section and the heddles in the position occupied by them when the sheds are formed. This combination consists of two full heddles $a a' b' b^2$, half-heddles $b a^2$, and standards $a^3 b^3 a^4 b^4$ for one pair of warp-threads $c c'$. These heddles are generally arranged as shown in diagrams 1 and 2, there being considerable space left between the inner full heddle $a' b^2$ and standards $a^3 b^3$ to throw the half-twist in the warp-threads in said open space and between the said full heddle and standard when the shed is open, as shown in Fig. 1.

To form the shed in Fig. 1, the full heddle $a b^2$ is raised by elevating its shafts $a^{12} b^{12}$ by the usual means employed therefor, taking with it in its upward movement the half-heddle b and the warp-thread c , the shaft b^{13} of the half-heddle being raised simultaneously with shafts $a^{12} b^{12}$. The thread c , while the same is being thus elevated, passes from the left-hand side of thread c' under thread c' , and is raised on the right-hand side of warp-thread c' , as viewed from the front of the loom. Shafts $a^{13} a^{14} b^{13}$, carrying the full heddle $a' b^2$ and its half-heddle a^2 , are depressed by the usual means, and the said heddle $a' b^2$ takes with it in its downward movement half-heddle a^2 and warp-thread c' , the warp c' being drawn from the right-hand side of warp-thread c and depressed on the left-hand side of warp-thread c . These movements of the heddles and threads throw a half-twist f between heddles $a' b^2 a^2$ and standards $a^3 b^3$, in addition to crossing the warp-threads at the front for the introduction of the weft-threads. When the full and half heddles are thus moved, the standard $a^4 b^4$ is slightly elevated by raising its

shafts $a^{12} b^{12}$ to raise its middle looped portion a^{15} out of the way of the shed.

To form the shed shown in Fig. 2, the heddle or standard $a^4 b^4$ is depressed by the usual means, and takes with it warp-thread c' . The said thread c' is depressed by this movement of the standard and takes with it in its downward movement half-heddle a^2 on the right side of warp-thread c , as viewed from the front of the loom, drawing the said half-heddle across and above the warp c from the position shown in Fig. 1. At the same time the full heddle $a' b^2$ is elevated to remove the loop or eye d out of the way of the shed. The heddle or standard $a^3 b^3$ is elevated, drawing the warp-thread c and half-heddle b across from right to left beneath the warp c' and raising them on the left-hand side of warp c' . At the same time the heddle $a b'$ is depressed to remove the loop or eye d out of the way of the shed.

This combination of heddles is objectionable, for the reason that it throws a half-twist or cross f in the warp-threads $c c'$ between the heddles, which occasions a small cramped shed, preventing a free movement of the heddles, and by reason of friction and chafing of the warp-threads thereon causing early fracture of the heddle-strands from excessive wear, making frequent changes of the heddles necessary, and frequently severing the warp-threads.

The object of our invention is to provide a new combination of heddles for weaving gauze, whereby the heddles are caused to throw the twist of the warp-threads on each side outside of the heddles, by which means a more extended and open shed is secured for the shuttle, and the heddles are left free to operate without the friction and strain from the warp-threads produced by the twisting or crossing of the warp-threads between the heddles by the pre-existing combination. These objects we attain by the arrangement of heddles shown in Figs. 3 and 4 of the drawings, which are diagrams of heddles arranged according to our invention, the heddle-shafts being shown in section, and in all the figures of the drawings are shown in elevation the cloth-roller and warp-roller.

In diagrams 3 and 4 four full heddles $a b'$,

$a' b^2$, $a^{39} b^{49}$, $a^{45} b^{55}$ and four half-heddles $b a^2$
 $b^3 a^5$ are used for one pair of warp-threads $c c'$,
 this being in accordance with our invention,
 the full and half heddles being arranged, as
 5 shown, with just enough space between them
 for the full heddles and half-heddles to oper-
 ate without interference. The warp-thread
 c passes through half-heddle b on the left-
 hand side of heddle $a b'$, on the right-hand
 10 side of heddles a' , b^2 , a^2 , a^{39} , b^{49} , and a^5 ,
 through half-heddle b^3 , and on the left hand
 of heddles $a^{45} b^{55}$. Warp-thread c' passes on
 the left-hand side of heddles $b a b'$, through
 half-heddles a^2 at the right-hand side of hed-
 15 dle $a' b^2$, on the right-hand side of heddle a^{39}
 b^{49} , and through half-heddle a^5 on the left-
 hand side of heddle $a^{45} b^{55}$. The heddle-
 shafts are connected with their respective
 dobby-hooks e by cords f , and with springs h
 20 by cords f' , and are operated by the dobby
 and springs in the usual way, as are all the
 heddles and half-heddles in the different dia-
 grams 1, 2, 3, and 4, the half-heddles passing
 through their respective loops, as shown.
 25 In Fig. 3 full heddle $a b'$ is raised, tak-
 ing with it half-heddle b and warp-thread c ,
 shaft b^{13} of the half-heddle b having been
 raised simultaneously with shafts $a^{12} b^{12}$.
 Thread c passes, in such movement of the
 30 heddles and half-heddles, on the right-hand
 side of warp-thread c' . Heddle $a^{39} b^{49}$ is de-
 pressed at the same time to remove the loop
 d out of the way. The full heddle $a' b^2$ is de-
 pressed, and takes with it in its downward
 35 movements half-heddle a^2 and warp-thread
 c' , which passes on the left-hand side of warp-

thread c . The full heddle $a^{45} b^{55}$ is elevated
 to remove loop d out of the way. The weft-
 thread is thrown in at this formation of the
 shed and those following in the usual way. 40

By this our invention the crossing of the
 warps in the formation of the shed is effected,
 as shown by the diagrams, outside of the
 heddles, by reason of the first and third sets
 of full and half heddles working simultane- 45
 ously in opposite directions and acting upon
 one warp-thread, and the second and fourth
 sets of full and half heddles working simul-
 taneously in opposite directions and acting
 upon the other warp-thread. The warp- 50
 threads are therefore operated in an im-
 proved manner, by which a more extended
 and open shed is secured for the introduction
 of the weft by the shuttle and a more free
 exercise of the harness and warps. 55

To form the shed in Fig. 4 the action of
 the heddle is reversed.

We claim—

In a loom for weaving gauze, the combina-
 tion of four full heddles and four half-hed- 60
 dles for one pair of warp-threads, wherein, as
 described, the first and third sets of full and
 half heddles work in unison in connection
 with one thread, and the third and fourth sets
 work in unison in connection with the other, 65
 substantially as shown and set forth.

JOHN H. BENTLEY.

THOMAS W. BENTLEY.

Witnesses:

FRED I. WARNER,
 JOHN INGLIS.