No. 696,084. Patented Mar. 25, 1902.

C. F. ROPER.

HEDDLE FOR LOOMS.

(Application filed Sept. 20, 1901.)

(No Model.) 2 Sheets—Sheet 1.

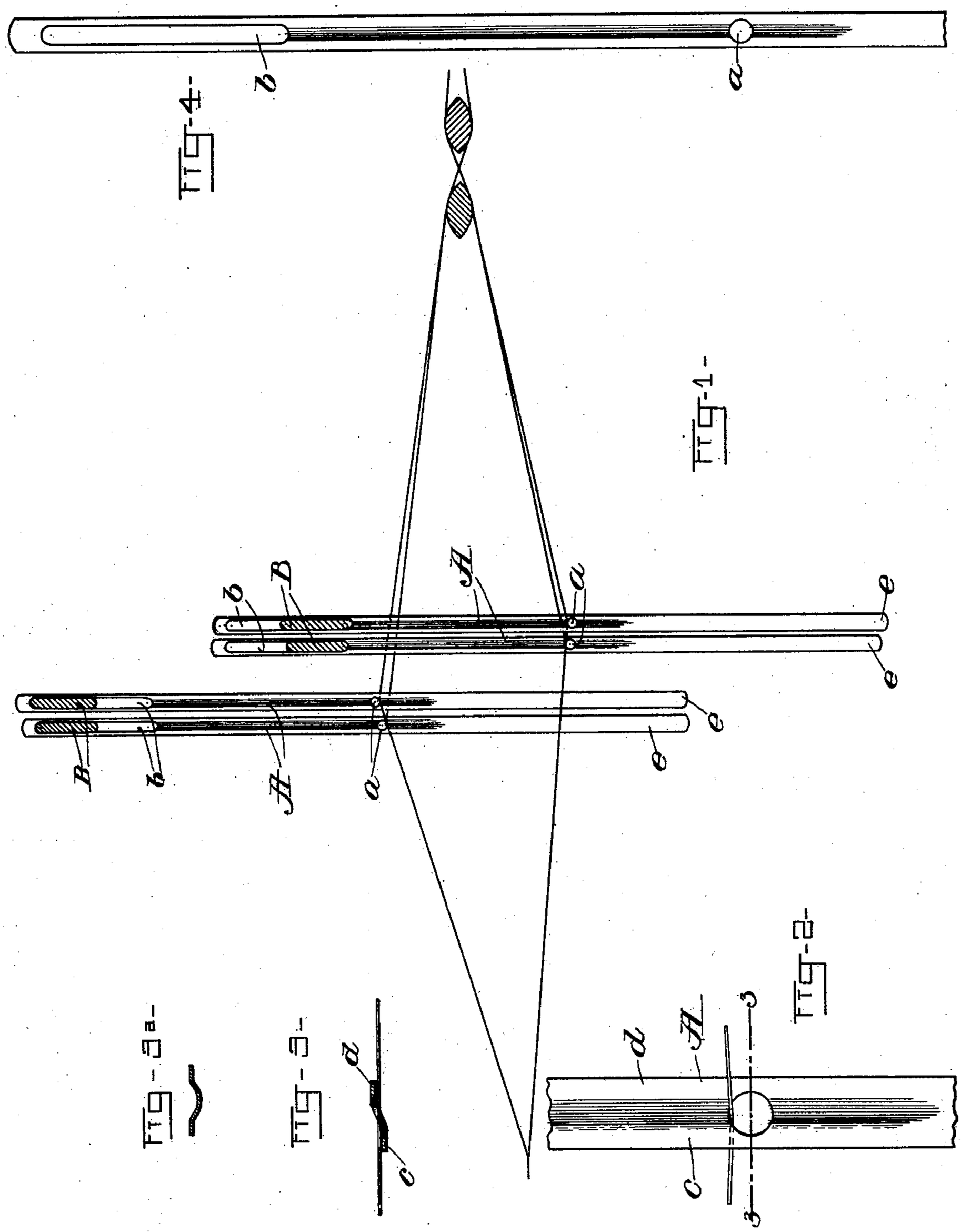

FIG-4-

FIG-1-

FIG-3a-

FIG-3-

FIG-2-

WITNESSES-

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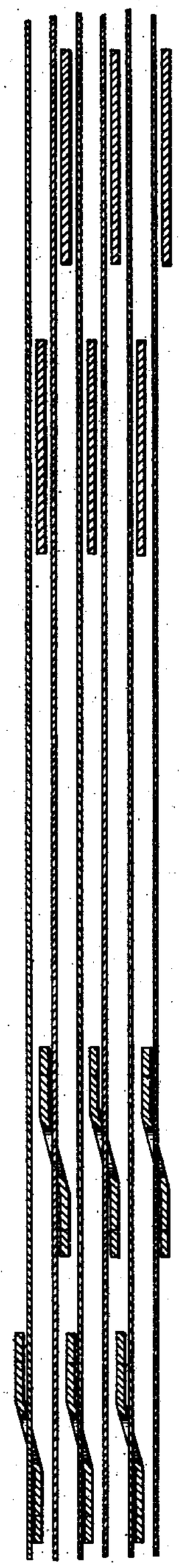

FIG-5-

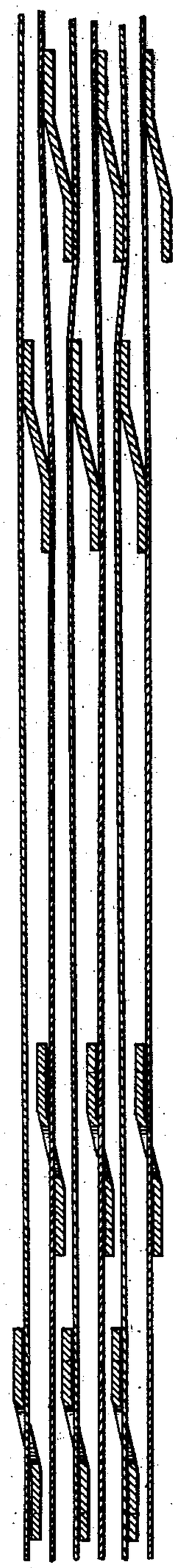

FIG-6-

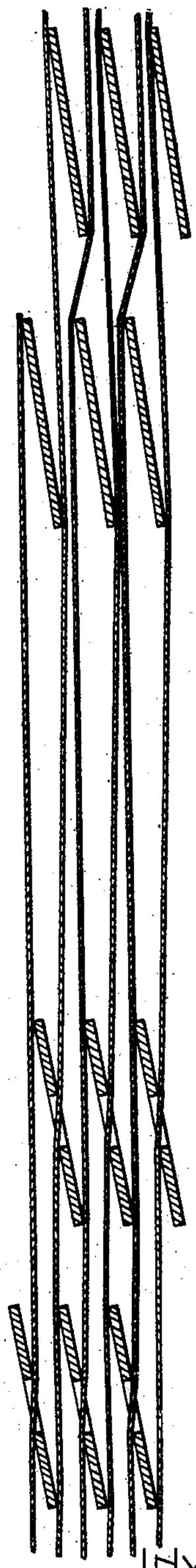

FIG-7-

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UNITED STATES PATENT OFFICE.

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HEDDLE FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 696,084, dated March 25, 1902.

Application filed September 20, 1901. Serial No. 75,821. (No model.)

To all whom it may concern:

Be it known that I, CHARLES F. ROPER, a citizen of the United States, residing at Hopedale, in the county of Worcester and Commonwealth of Massachusetts, have invented certain new and useful Improvements in Looms, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a diagram of so much of the harness mechanism of a loom as is necessary for an understanding of the present invention. Fig. 2 is a detail side view of the middle part of one of the heddles. Fig. 3 is a cross-section of one of the heddles in the plane indicated by the line 3 3 in Fig. 2. Fig. 3ª is a cross-section of a modified form of heddle. Fig. 4 is a side view of the upper part of a heddle. Figs. 5, 6, and 7 are diagrams illustrating the manner in which the heddles and warp-threads are related.

It has long been a practice to utilize the harness-heddles as warp-stop detectors, so that when the warp-thread belonging to a particular heddle breaks the heddle will have an additional movement, which brings it into position to coöperate with some extraneous device and as the result to stop the loom. For the purpose of explaining the present improvement it will suffice to refer to United States Patent of J. H. Northrop, No. 594,355, dated November 23, 1897. The here accompanying drawings illustrate so much of the mechanism of said Northrop patent as is necessary to explain the present improvement, and said patent may be referred to for details of construction with which the present improvement is not concerned.

As illustrated in the accompanying drawings, two harnesses are employed, and of the harness-frames only the upper cross-bars B B are shown, upon which the thin sheet-metal heddles A A are strung. The heddles belonging to each harness are arranged in two banks, alternate warp-threads controlled by said harness passing through the heddles of one of said banks, thus enabling the harnesses to accommodate fine threads arranged closely together. Each heddle has a warp-eye *a* at its middle, through which its warp-thread passes, and it has above said eye and near its upper end an elongated vertical slot *b*, by means of which it is strung upon one of the harness cross-bars B. When the heddles are also utilized as warp-stop detectors, the slots *b* are of a length greater than the vertical width of the cross-bars, so that each heddle is capable of an independent vertical movement on its harness-frame, thus permitting such additional movement of the heddle (when its thread breaks) as will bring about the stoppage of the loom, as by numerous well-known devices of which one example is set forth in said Northrop patent. The portion of each heddle below the eye is plain and usually plays between suitable guides, and if a vibrating feeler is used to coöperate with an abnormally-positioned heddle (as when its thread breaks) it is this lower portion of the heddle which is struck by the feeler.

During the regular shedding operation the heddles are moved up entirely by the action of the harness-bars B B upon the upper margins of the heddle-slots *b b*, so that the threads are pulled to form the upper plane of the shed, whereas as the harness moves down the downward movement of the threads (below the plane where the threads cross) to form the lower plane of the shed is caused by said harness-bars pushing down upon the lower margins of said heddle-slots. The heddles are necessarily made thin, and as the tension on the warp-threads when occupying the lower plane of the shed is considerable (usually exceeding the tension on the warp-threads when occupying the upper plane of the shed) it follows that this downward push on the heddles tends to buckle them between the stringing slots *b b* and the eyes *a a*, which is objectionable, because the buckling tends to injure the heddles and also causes irregularity in the lower plane of the shed.

One object of the present invention is to stiffen the heddle between the upper stringing slot and the eye, so as to avoid this buckling when the heddle is pushed down. To this end the heddle is corrugated between said slot and eye, the corrugating extending longitudinally, as best shown in Fig. 4. In cross-section the corrugation may be as shown

in Fig. 3ª; but, preferably, the corrugation is as shown in Figs. 3 and 5, so as to offset one longitudinal edge as compared with the other for reasons which will hereinafter appear. This corrugation stiffens the heddle where stiffening is necessary to avoid buckling due to the pushing strain between the slot and eye.

The lower part of the heddle is left plain and is not corrugated, first, because no stiffening is there necessary to the proper formation of the shed, and, secondly, because to leave this lower part plain is efficacious in preventing chafing of the threads by the heddles. This latter point demands consideration. As shown in Figs. 1 and 4, the preferred form of corrugation is extended a short distance below the eye, so that the margins at the front and back of the eye are offset, as shown in Figs. 3 and 5, thus enabling the thread to pass straight through the eye without tending to twist the heddle into a plane at an angle to the line of travel of the warp. This in itself is of importance, as will be explained in connection with the diagrams Figs. 5, 6, and 7, which are drawn substantially to scale, so as to indicate approximately the actual conditions in a loom. Each of the diagrams is supposed to be a cross-section through both harness along the threads constituting the lower plane of the shed when the front harness (at the left) is down and the rear harness is up. Fig. 7 illustrates what occurs in a construction and arrangement like that of said Northrop patent. The warp-threads are taut and as the result they tend to turn the heddles at an angle as shown, and at the same time the heddles tend to divert the threads from their straight paths. This figure shows the heddles in the position which they would occupy if they were free to hang uniformly on their respective threads. The effect on the threads may be noted by following a particular thread—say one which extends through the eye of a heddle of the front bank of the front harness. It will be noted that this thread is diverted as it passes through its own heddle, owing to the edges of the heddle bearing upon the adjacent threads. It then comes in contact first with the front edge and then with the back edge of two adjacent heddles of the rear bank of heddles belonging to the same harness, tending thereby to twist both of said heddles and to be diverted from its straight path by them. It then extends back through the two banks of heddles of the rear harness, coming in contact with the rear edge of one of the front heddles and the front edge of one of the rear heddles, tending to twist both and to be diverted from its path by both. For the sake of showing the heddles symmetrically arranged the threads are shown more diverted than they are in practice, the heddles being, in fact, twisted to accommodate the threads as they pass through. It will thus be seen that each thread bears frictionally against several heddles, which is objectionable, because the threads must be drawn along such edges as the warp feeds forward, thus being chafed, and is especially objectionable where a thread comes in contact with the edges of the heddles of a harness other than its own, because in such case the heddle edges seesaw on the threads as the harnesses shift, the threads going in one direction as the heddles go in the opposite direction. This often causes warp breakage with the stoppage of the loom, loss of production, and attention by the weaver, if a warp stop-motion is employed, or defective cloth, if not. This latter defect is most marked in the formation of the lower plane of the shed, since the threads in such plane are subjected to a greater tension, as a general rule, than in the upper plane, as already stated. This defect was in part avoided by the heddle construction set forth in United States Letters Patent to Oberlin Smith, No. 569,805, dated October 20, 1896, in which the heddles are corrugated throughout their entire lengths, so as to offset the opposite edges, and thereby permit the threads to go straight through their respective heddles. It will be noted that in said Smith patent the corrugation has no beneficial strengthening function, since each heddle is slotted at both ends to straddle upper and lower cross-bars of the harness-frame, so that the heddles are pulled down as well as up. The diagram Fig. 6 shows the effect of the employment of the Smith heddles. They coöperate all right with the threads belonging to the same harness as themselves, as shown at the left in Fig. 6, but in the other harness they have the same effect in character (though less in degree) upon the threads as in the arrangement shown in Fig. 7. This is shown at the right in Fig. 6. The Smith construction and arrangement therefore retains the chief defect of the other construction—that is to say, the seesawing under tension of the heddles of one harness upon the threads of another harness during the formation of the lower plane of the shed. Fig. 5 illustrates how the present invention overcomes this defect. When the threads pass through their own heddles, (at the left,) the effect is the same as in the Smith construction; but when they pass through the other harness they do not touch the edges of the heddles, because said heddles hang straight owing to being offset by their corrugations at the eyes and because their lower ends are plain and not corrugated.

Some seesawing effect results in the formation of the upper plane of the shed after the threads cross; but this is less objectionable, because the tension on the threads in the upper plane is less and the corrugations are there important to enable them to properly push the threads down.

I claim as my invention—

1. A harness having a cross-bar, and heddles strung thereon, each heddle having a slot

through which said bar is strung and an eye below said slot, said slot being longer than the vertical width of said bar so that the heddle is capable of an independent vertical movement on the harness-frame (whereby it is capacitated to act as a warp-stop-motion detector,) said cross-bar acting to pull said heddle up and to push it down, and said heddle being stiffened between the eye and slot to withstand the pushing strain, said stiffening being by corrugation so as to offset the two longitudinal edges of the heddle, said corrugation being extended to include the eye so as to permit the heddle to hang parallel with the line of warp travel, but said corrugation being omitted at the lower part of the heddle, whereby during the formation of the lower plane of the shed the threads therein do not chafe on the heddles of an oppositely-moving harness.

2. A harness having a cross-bar, and heddles strung thereon, each heddle having a slot through which said bar is strung and an eye below said slot, said cross-bar acting to pull said heddle up and to push it down, and said heddle being stiffened by corrugation between the eye and slot to withstand the pushing strain, but said corrugation being omitted at the lower part of the heddle.

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

CHARLES F. ROPER.

Witnesses:
E. D. BANCROFT,
ERNEST W. WOOD.