Sept. 6, 1927. 1,641,366

T. N. AIKENS

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Fig. 1.

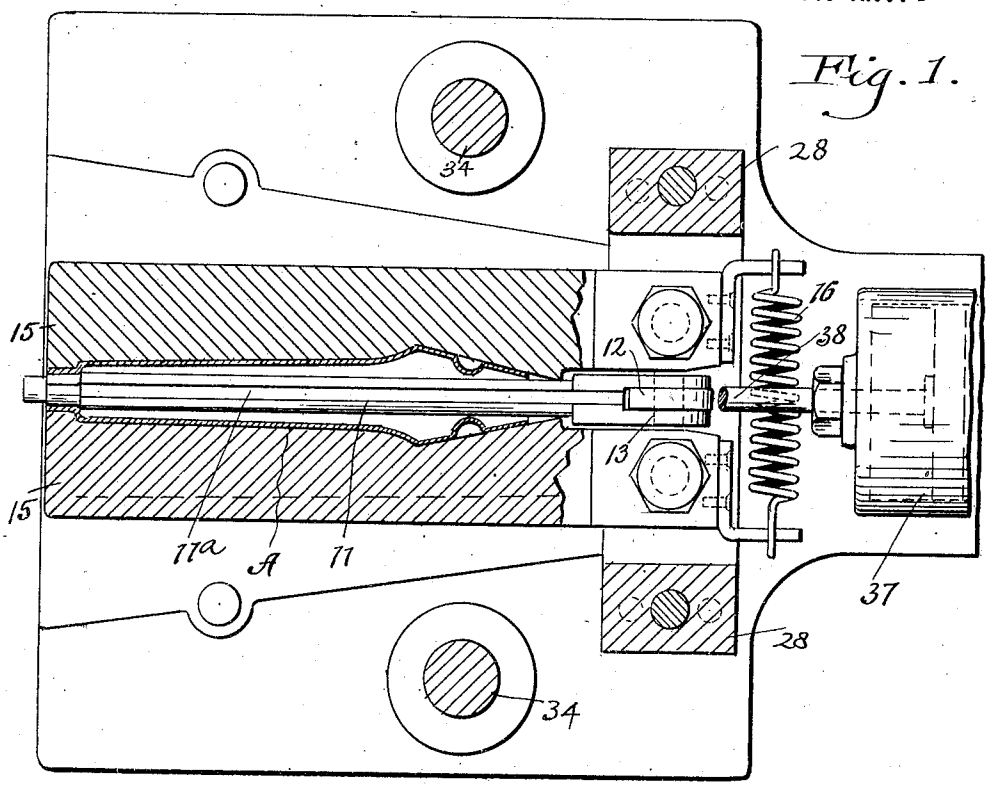
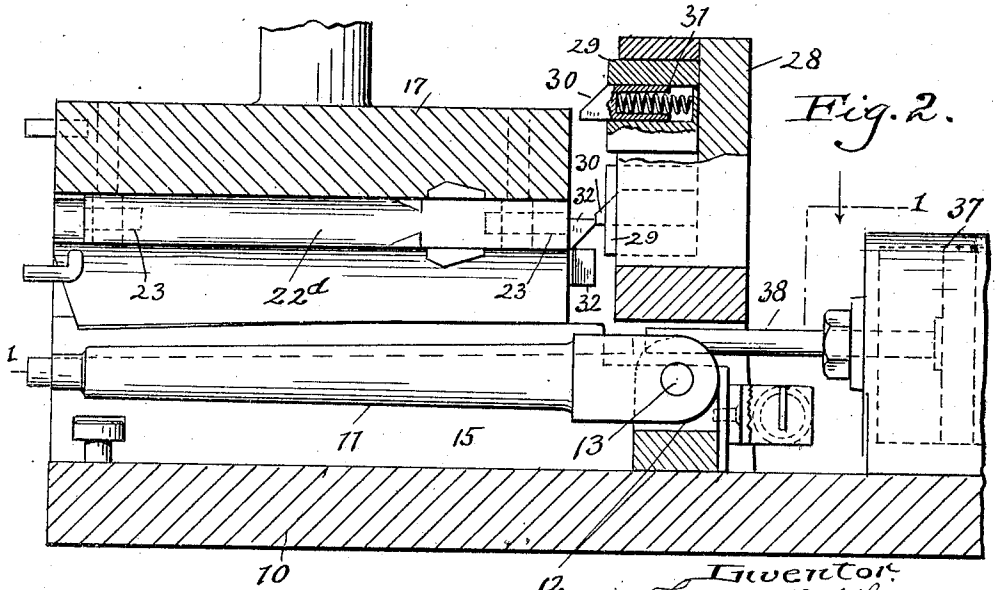


Fig. 2.



Inventor:
Thomas N. Aikens
By Thurston Kivis & Hudson
attys.

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Fig. 3.

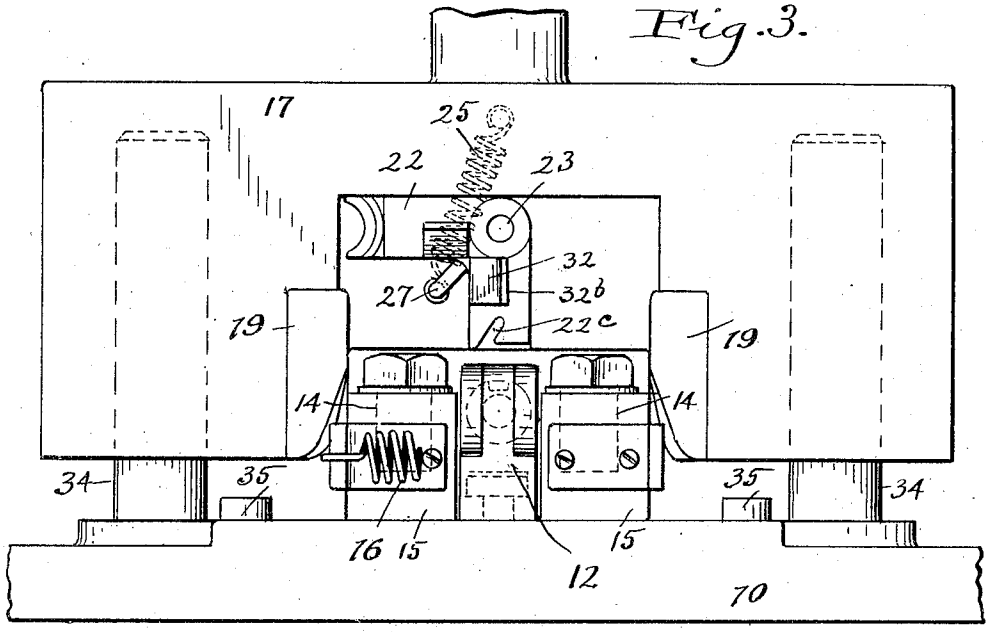


Fig. 8.

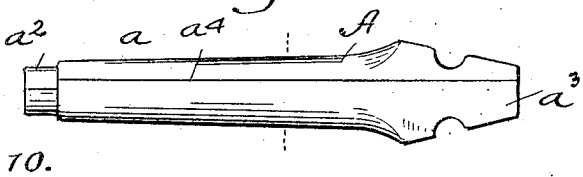
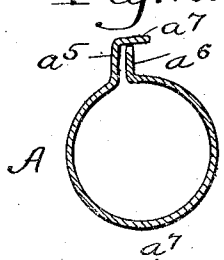


Fig. 10.



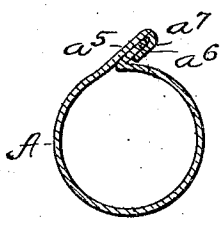


Fig. 12.

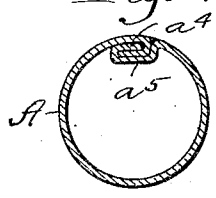


Fig. 11.

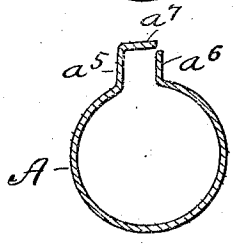


Fig. 9.

Inventor

Thomas N. Aikens

By Thurston Kerr & Hudson

Attorneys.

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Fig. 4.

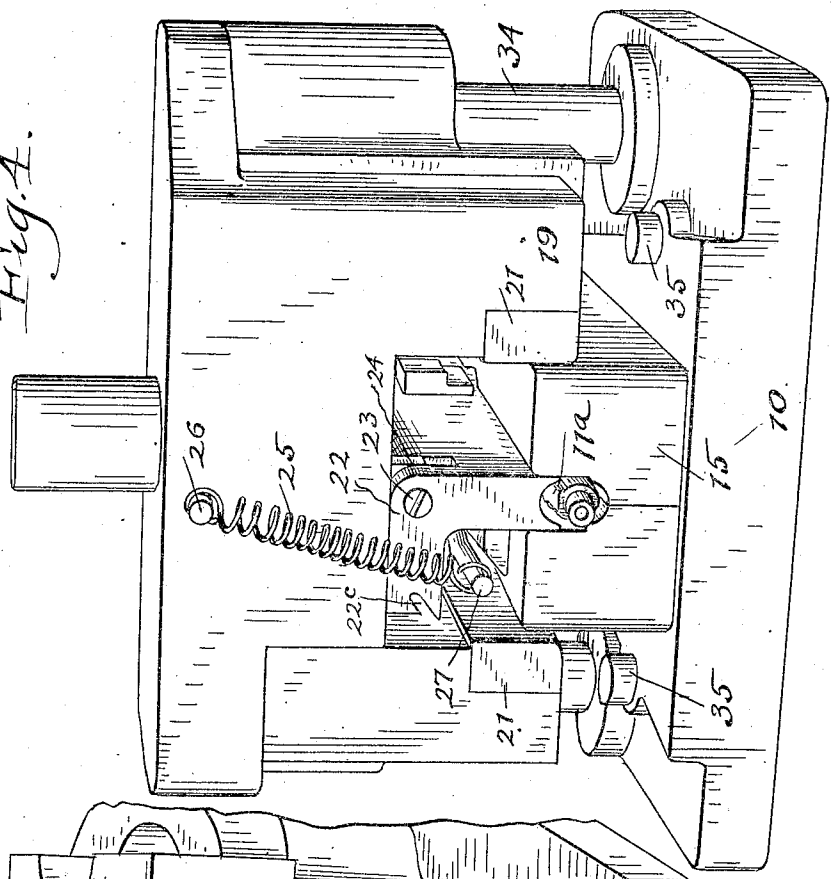
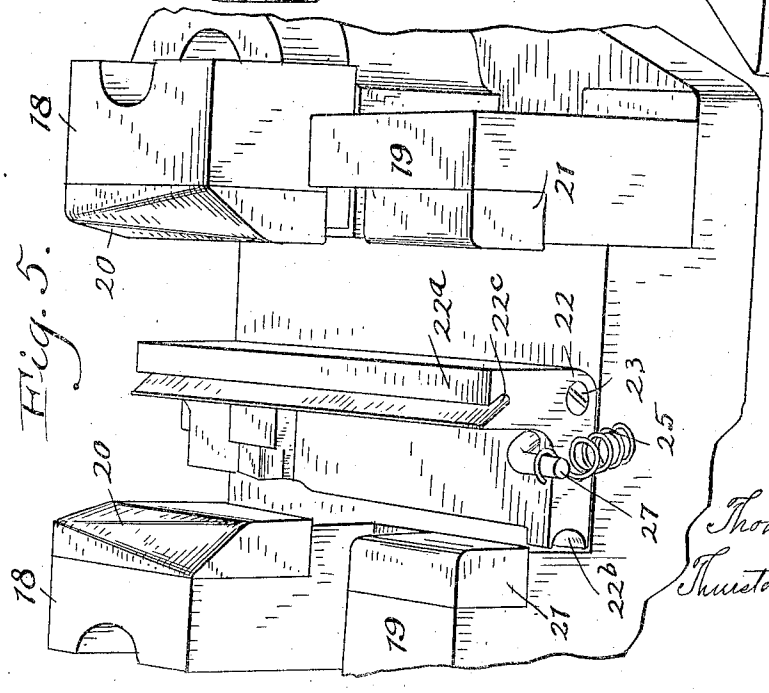


Fig. 5.



Inventor
Thomas N. Aikens
Thurston Kurz & Hudson
Attorneys.

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Fig. 6.

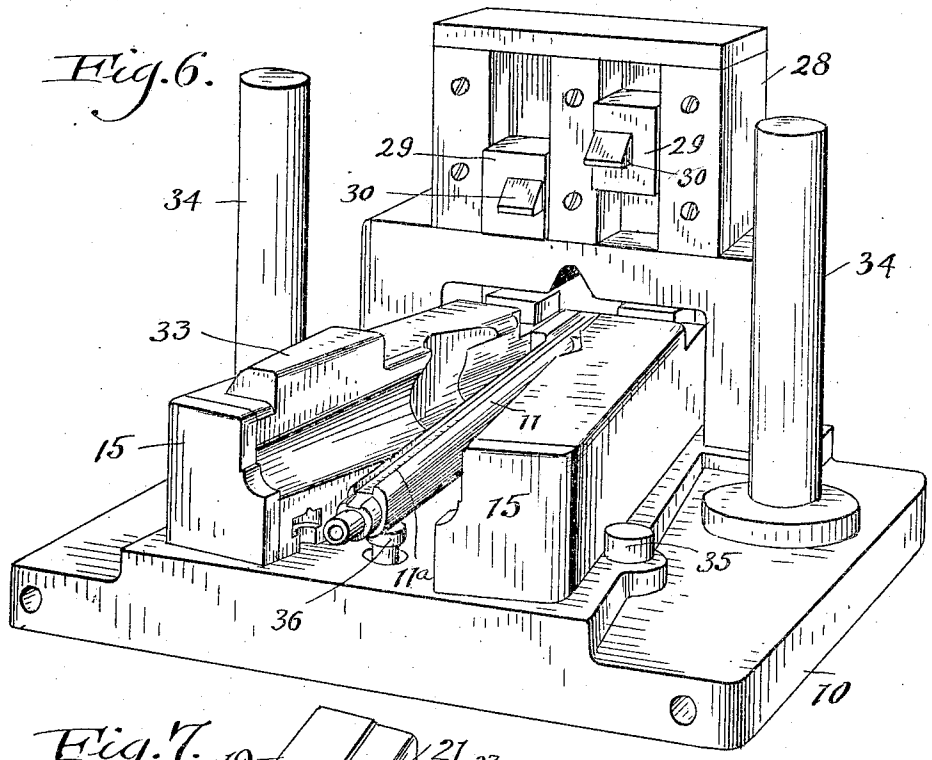
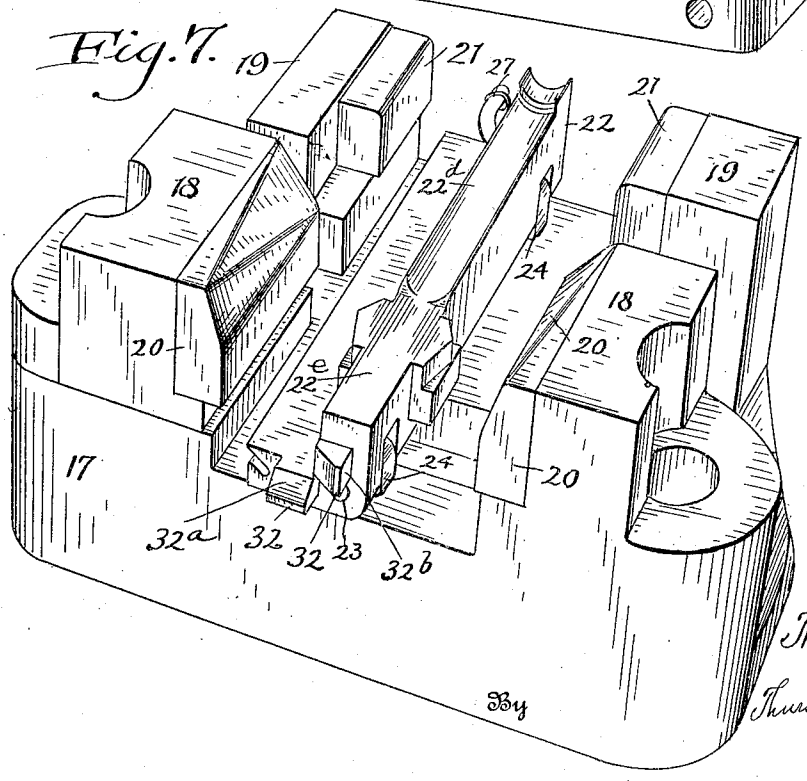


Fig. 7.



Inventor

Thomas N. Aikens

By Thurston, Kerr & Hudson

Attorneys

Patented Sept. 6, 1927.

1,641,366

UNITED STATES PATENT OFFICE.

THOMAS N. AIKENS, OF DAYTON, OHIO, ASSIGNOR OF ONE-HALF TO DAVID D. WALKER, OF LAKEWOOD, OHIO.

DIE.

Application filed January 24, 1925. Serial No. 4,424.

This invention relates to certain new and useful improvements in dies utilized in forming tubular articles from sheet metal, with the edges of the article folded or locked together in the form of a seam.

The die constituting the subject matter of the present application is an improvement over the die constituting the subject matter of my prior application Serial No. 499,354, filed September 8, 1921. In said application I have disclosed a die designed particularly for operating on a partially formed sheet metal spoke, the function of the die being to close the spoke by bringing its marginal edges together and then folding or locking them together in the form of a seam which extends the full length of the spoke.

The object of the present invention is to provide a die, so constructed and operated that the seam-forming operation is performed more effectively, and the invention may be here briefly summarized as consisting in certain novel details of construction, and combinations and arrangements of parts which will be described in the specification and set forth in the appended claims.

In the accompanying sheets of drawings I have shown my invention utilized in the formation of tubular spokes for vehicle wheels, and while the invention has particular utility in the production of articles of that kind, the main features of the invention may be utilized to advantage in forming other tubular articles.

In the drawings, Fig. 1 is a sectional plan view of my improved die, the section being taken partly along the line 1—1 of Fig. 2, looking downward; Fig. 2 is a vertical sectional view of the die, the section being taken through substantially the center plane; Fig. 3 is an end view looking toward the left of Fig. 2 with certain parts broken away and omitted; Fig. 4 is a perspective view with the die closed; Fig. 5 is a perspective view of the upper die member, looking at the under side thereof; Fig. 6 is a perspective view of the lower die member; Fig. 7 is a view showing the upper die member and looking at the under side thereof as in Fig. 5, but reversed end to end with respect to Fig. 5; Fig. 8 is a plan view of the completed spoke; Fig. 9 is a sectional view of a partially formed spoke which is adapted to be received in the die; and Figs. 10, 11 and 12 are similar views illustrating several stages of the seam-forming process performed by the dies.

In Fig. 8 I have shown a tubular spoke A, having a body portion a, a reduced felloe end a^2, and an enlarged wedge-shaped hub portion a^3, having two opposite parallel faces and two opposite tapered faces. The edge portions of the sheet of metal from which the spoke is formed, are locked together in the form of a seam a^4, (Fig. 12) which extends longitudinally of the spoke from the hub end up to the felloe portion. In Fig. 9 I show the partially formed spoke before the edge portions, here designated a^5 and a^6 are brought together and locked in the form of a seam, this being the form of the section when placed in the die. It will be noted that the edge portion a^5 has a flange a^7 at its free edge. In Fig. 10 I have shown the spoke closed, ready for the first seam-forming operation, this being the first operation performed by the die; in Fig. 11 the partly formed seam at the close of the first seam-forming operation; and in Fig. 12 a spoke with the seam completed.

In my prior application, as the upper die shoe is lowered, the open or twin spoke section is first closed and then the seam is formed in two steps, by two seam-forming plungers which are brought into operation successively in one stroke of the press with which the die is used. It is a feature of the present invention that the seam is formed by a double-acting seam-forming tool having two seam-forming portions which are successively brought into operation in two strokes of the press, this seam-forming tool being movably supported by the upper die shoe, and being shifted from one operating position to another as the plunger of the press moves up and down. In the preferred embodiment, the seam-forming tool is pivotally supported, with the die-forming portions in planes at right angles to each other, and is moved from one operative position to another by being swung through an arc of 90° by the aid of a tripper co-operating with projecting portions on the end of the seam-forming member.

In many respects my improved die is similar to the die of my prior application, and the portions which are similar in the two dies will only be briefly referred to herein.

My improved die, like that of the former die, includes a lower die shoe 10, adapted to be supported in fixed position on the bed of a press. The lower die shoe 10 carries a mandrel 11, which has a groove 11^a extending along the top thereof for substantially its full length. The mandrel is pivoted to the die shoe 10 preferably by a clevis 12 fixed to the lower die shoe and by a transverse pin 13 passing therethrough. The seam a^4 of the spoke is formed in the groove 11^a as will be explained presently.

Pivoted to the lower die shoe, on opposite sides of the clevice 12 by means of vertical pins 14, are a pair of laterally swinging jaws 15, which are on opposite sides of the mandrel and are held yieldingly apart, when the die is in open position, by a spring 16. These jaws have recessed portions, which, when the jaws are closed, envelop the lower half of the mandrel and conform to the shape of the lower half of the body portion of the spoke. When the jaws are closed, they close the partially formed spoke of Fig. 9, bringing the edges together in the manner illustrated in Fig. 10, with the upright edge portions adjacent each other, and with the laterally turned flange on one edge portion overhanging the other. Additionally, when the jaws are closed, the spoke engages the top and bottom portions of the mandrel for its full length.

Above the lower parts of the die, just described, is an upper die shoe 17, which is adapted to be secured to the vertically movable ram or plunger of the press. The parts carried by this die shoe 17 have the two-fold function of first closing the jaws 15 so that the latter will close the partially formed spoke in the manner already described, and of then forming the seam. For the purpose of closing the jaws onto the partially formed spoke and for locking the same in closed position, the upper die shoe 17 is provided at one end, which may be termed the rear end toward the pivoted ends of the jaws, with a pair of depending portions 18, which extend down from the opposite sides of the shoe. Likewise, the upper die shoe is provided at its opposite end with a pair of similar but shorter depending portions 19. The depending portions 18 are provided on their inner or adjacent faces with cam plates 20, which cam plates have their lower portions beveled, and their upper portions straight or parallel, as in my prior application, so that when the upper die shoe descends, the beveled portions engage the upper outer portions of the jaws 15, so as to swing them inward to closed position, and then as the shoe continues to descend, the upper parallel portions of the cam plates engage the opposite faces of the jaws so as to assist in locking them in closed position. The forward and shorter depending portions 19 of the upper die shoe have secured to their inner faces locking plates 21, which engage over the outer faces or sides of the jaws 15 when they have been moved inward to closed position by the cam plates 20, so as to securely lock the jaws in closed position during the remainder of the descent of the upper die shoe.

Additionally the upper die shoe is provided on its under side, between the depending portions 18 and 19 with a seam-forming tool 22, which extends the full length of the spoke to be formed. This seam-forming tool has two side portions at right angles to each other, an in cross-section is L-shaped. The edge portions 22^a and 22^b of this tool are the active seam-forming portions, the edge portion 22^a being provided with a slot 22^c, and the other edge portion being curved or rounded for a portion of its length, as shown at 22^d in Fig. 7, so as to conform to the surface of the body portion of the spoke, and for the remainder of its length being flattened as shown at 22^e in Fig. 7, to conform to the flat face of the hub portion of the spoke.

The seam-forming tool 22^a is pivoted to swing on an axis which is at the angle or at the junction of the two sides. The pivot is preferably formed by two pivot pins 23 which pivotally connect the tool 22 to lugs or ears 24, depending from and located on the center line of the upper die shoe near its ends.

It will be seen from the above, that when the tool 22 is in one operating position, one side extends vertically downward so as to bring the seam-forming face at the lower edge thereof to the proper position with respect to the spoke, the other side then lying against the under side of the upper die shoe, and that when the tool is in its other operating position it is turned 90° from the position just stated, the opposite side now extending vertically, swinging its seam-forming face in proper relation with respect to the spoke, while the other side now lies against the under side of the upper die shoe.

The seam-forming tool may be held in either of its operating positions by any suitable means. In the drawings I have shown a simple and effective way of accomplishing this, the means employed consisting of a spring 25, which at one end is connected to a pin 26 on the upper die shoe, and at its other end is connected to a finger 27 projecting out from one end of the tool, as illustrated in Figs. 4 and 5, the arrangement being such that as the seam-forming tool swings from one operating position to another, the line of pull of the spring passes from one side of the pivot or axis of move-

ment of the tool to the other, so that the spring will be effective to hold the tool in either operating position described above.

As stated above, the seam is formed in two strokes of the press with the seam-forming tool of the present invention, and on each upward stroke of the press the position of the tool is reversed by the action of a tripper, which will now be described.

On the lower die shoe adjacent one end of the upper die shoe 17, there is mounted an upright housing 28 for the tripper. This housing is provided on its inner face with two vertically movable slide blocks 29, each having an inwardly projecting latch 30, pressed yieldingly outward by a spring 31, and each having an upper beveled face, as shown in the drawings. The projecting ends of these latches are close to the end of the upper die shoe 17, as it moves up and down. On the adjacent end of the seam-forming tool 22, there are provided two projecting fingers 32, one being located on the end of each side portion of the tool. Each of these fingers has a beveled face 32^a, and a straight face or shoulder 32^b, the arrangement being such that the finger on the side of the tool which is horizontal has its bevel face downward, and its flat face or shoulder upward. Furthermore, these fingers are so disposed with reference to the latches 30, that on the upward stroke of the press the finger which is on the horizontal side of the tool is directly beneath one of the latches 30 of the tripper.

The construction is such that on the first down stroke of the press, during the seam-forming cycle, the face 22^a is in operative position, and as the upper die shoe descends, the action of the face 22^a of the tool is to first bend down the flange a^7 of the spoke over the edge portion a^6 and then the portions a^5, a^6 and a^7 enter the slot 22^c and are bent to an inclined position, illustrated in Fig. 11. This completes the first seam-forming step or operation, the edge portions having by this operation been folded together and bent over. Then the upper die shoe ascends, and in so doing, the finger 32 on the horizontal side of the tool engages under one of the latches 30 and elevates the corresponding block 29 until it reaches the upper end of the passageway of the housing which receives it, and when the block has reached the upward limit of its movement, the further upward travel of the upper die shoe swings the tool 22 about its axis until the spring 25 crosses the pivotal axis of the tool, whereupon the tool is quickly flipped to its other operating position, bringing the face 22^b downward. Then on the next downward stroke of the press the seam-forming face 22^b comes into operation and completes the formation of the seam by still further pressing the folded parts together and driving them down into the groove 11^a of the mandrel, forming the seam as shown in Fig. 12. This completes the second and final seam-forming operation, and completes the seam from the hub end up to the felloe end of the spoke.

As the upper dies shoe ascends following the stroke just described, the spoke, now fully seamed, is stripped from the mandrel, and another partially formed spoke is inserted thereon. During this upward stroke of the upper die shoe, the position of the seam-forming tool is again reversed so as to bring the face 22^a downward, or into position to perform the first seam-forming operation on the next spoke to be seamed. It might be stated that on each downward stroke of the press, the finger 32, which is on the horizontal side of the tool, passes the latch beneath it, the two bevel faces of the finger and latch engaging each other, causing the latch to be cammed inward. As soon as the finger passes it, it springs outward and occupies a position immediately above it, so that on the next upward stroke it is in position to reverse the position of the tool. Thus the two pairs of fingers and latches co-operate to cause the reversal of the tool on each upward stroke, one latch and one finger being inactive, and the other pair active during one cycle of the press, and vice versa for the next cycle. It might be stated also, that when the upper die shoe and seam-forming tool move upward, following the downward stroke during which the first seam-forming operation is performed, though the jaws swing outward, the spoke cannot open up but is retained in closed position due to the fact that the edge portions a^5, a^6 and a^7 were folded together and the seam partially formed in the first seam-forming operation. It will be observed by reference to Fig. 6, that one of the jaws 15 is provided on its upper face with a projection or abutment 33. The inner side or face of this projection constitutes an abutment against which the upright side of the tool 22 bears during the first seam-forming operation, thereby keeping the then vertical side of the tool in perfect alignment, and overcoming the tendency of the reactive force on the tool to swing the tool from its true and proper position.

As the plunger of the press moves up and down, the dies are kept in proper alignment by guide pins 34, which in this instance are carried by the lower shoe, and engage in properly positioned openings on the lower face of the upper shoe. Additionally the lower shoe is preferably provided with short upstanding studs 35, which limit the outward swinging movement of the jaws. Additionally it will be observed by reference to Figs. 2 and 6 that the center of the lower die shoe is provided near the free end of the

jaws with an upstanding stud 36, with a head or shouldered top portion, this stud being between the jaws when the latter are closed, and the jaws being recessed on their inner faces to receive the stud. The purpose of this is to hold the jaws downward against the lower shoe and resist the upward pull thereon exerted by the closing and locking portions of the upper shoe as the latter ascends.

As previously stated, the spoke is stripped from the mandrel when the upper shoe ascends, following the second and final seam-forming operation. This is preferably accomplished by a hammer 37, which is mounted on the lower die shoe 10, and is provided with a plunger 38, located in line with the seam of the spoke. This hammer can be operated either electrically or by air, and the plunger, when forced outwardly, engages the seam of the spoke and forces it from the mandrel either by a single sufficiently powerful thrust for the purpose, or by a plurality of successive hammer blows which will throw the spoke endwise from the mandrel.

The press is preferably controlled by means of a foot-operated pedal which the operator depresses. As soon as the spoke is slipped onto the mandrel, the operator depresses the pedal and the press makes two complete strokes or cycles in rapid succession, and during this time the seam is formed, the position of the seam-forming tool being reversed on each upward stroke. On the completion of the second stroke the operator stops the press until the completed spoke is stripped from the mandrel and a new spoke applied thereto, when the operation is repeated. In this manner the spokes are seamed rapidly, but very effectively.

While I have shown the preferred construction, I do not desire to be confined to the precise details or arrangements shown, but aim in my claims to cover all modifications which do not involve a departure from the spirit and scope of my invention. Furthermore, I wish it understood that the die may be used for seaming other tubular articles than spokes.

Having described my invention, I claim:

1. A die for forming a seam on tubular articles comprising two relatively movable members, one having means for holding the tubular member, and the other having a reversible or double-acting seam-forming tool.

2. In a die for forming a folded seam on tubular articles, a die shoe having a mandrel for the work, and a co-operating die shoe movable relatively to the first, and having a movable seam-forming tool with two seam-forming portions and means whereby said portions are brought into action successively on different relative movements between the die shoes.

3. In a die for forming a folded seam on tubular articles, a die shoe having a mandrel for the work, a co-operating die shoe movable relatively to the first, and having a movable seam-forming tool with two seam-forming portions, and means for automatically shifting the tool from one operating position to another during relative movement between the die shoes.

4. In a die for forming a seam in tubular articles, a die shoe having a mandrel for the work, and a second die shoe movable relatively to the first and provided with a double-acting pivotally supported seam-forming tool with two seam-forming portions adapted to successively engage the work to form a seam.

5. In a die for forming a seam in tubular articles, a die shoe having a mandrel for the work, a second die shoe movable relatively to the first and provided with a double-acting pivotally supported seam-forming tool with two seam-forming portions adapted to successively engage the work to form a seam, and means for reversing the position of the tool during the relative movements between the die shoes.

In testimony whereof, I hereunto affix my signature.

THOMAS N. AIKENS.