No. 646,270. Patented Mar. 27, 1900.

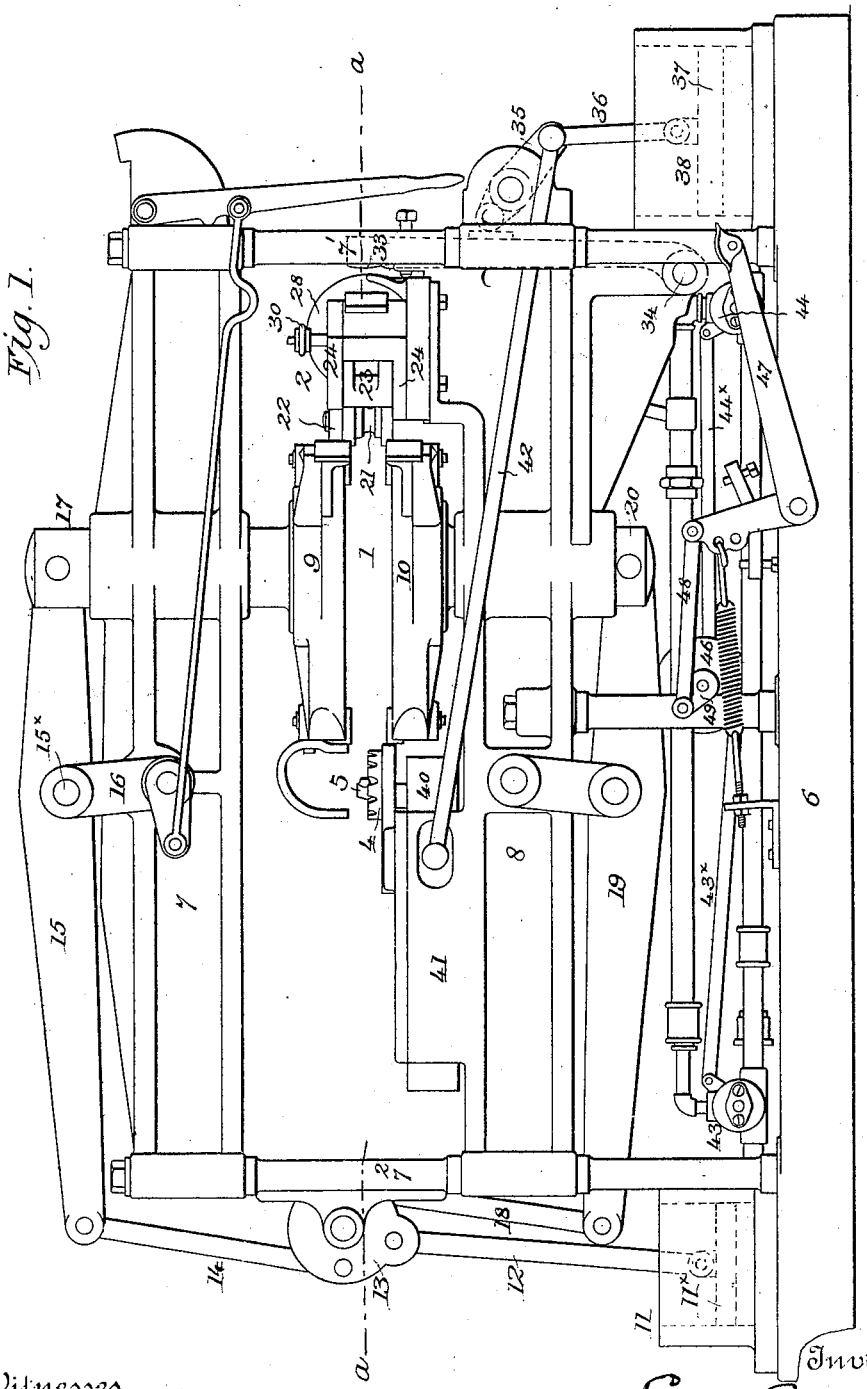
E. EINFELDT.

METHOD OF MAKING METAL WHEELS.

(Application filed Nov. 10, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



Witnesses
Sidney P. Hollingsworth
D. D. Elmore

Inventor
Emil Einfeldt
By Chas. F. Dodge
Attorney

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E. EINFELDT.

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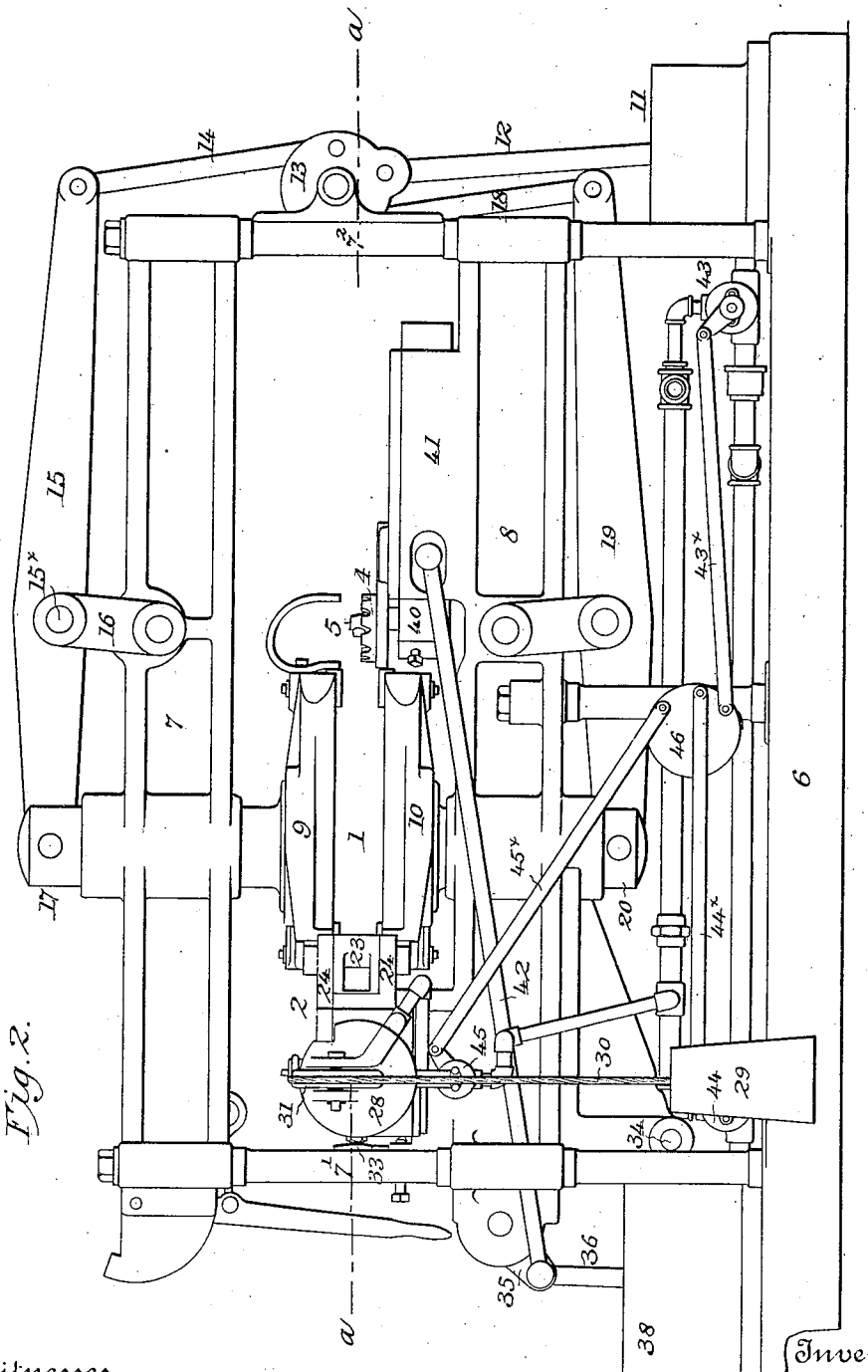

Fig. 2.

Witnesses

Sidney P. Hollingsworth

F. J. Connors

Inventor

Emil Einfeldt

By Phil. T. Dodge

Attorney

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E. EINFELDT.

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(No Model.) (Application filed Nov. 10, 1899.) 3 Sheets—Sheet 3.

Fig. 3.

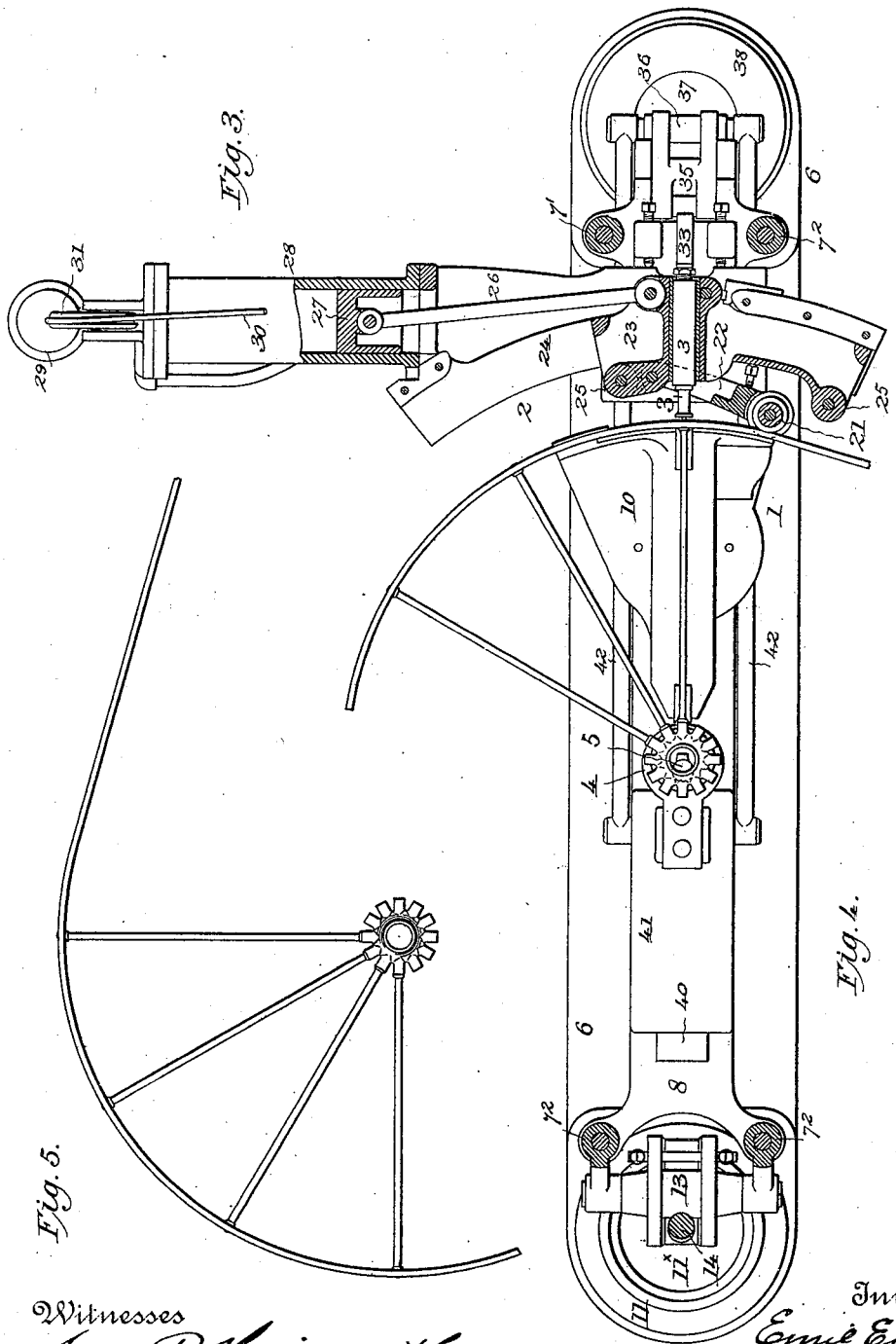

Fig. 4.

Fig. 5.

Witnesses
Sidney P. Hollingsworth
F. S. Elmore

Inventor
Ernie Einfeldt
By Phil. T. Dodge
Attorney

UNITED STATES PATENT OFFICE.

EMIL EINFELDT, OF DAVENPORT, IOWA, ASSIGNOR TO THE BETTENDORF METAL WHEEL COMPANY, OF IOWA.

METHOD OF MAKING METAL WHEELS.

SPECIFICATION forming part of Letters Patent No. 646,270, dated March 27, 1900.

Application filed November 10, 1899. Serial No. 736,480. (No model.)

To all whom it may concern:

Be it known that I, EMIL EINFELDT, of Davenport, county of Scott, and State of Iowa, have invented a new and useful Improvement in Methods of Making Metal Wheels, of which the following is a specification.

This invention has reference to the production of metal wheels and comprehends an improved method of making wheels, consisting, primarily, in progressively bending a strip into circular form step by step to form the tire and securing the spokes in place one after another as the bending operation progresses.

In carrying my method into effect in the preferred manner I provide a straight strip to form the tire, which has been previously provided at intervals with holes to receive the spokes, and I insert the outer end of a spoke through a hole, and after bending the strip on opposite sides of the hole in the arc of a circle of the diameter of the desired wheel I secure the spoke in place preferably by the formation of a head on its outer end. The next spoke is now put in place and its end extended through the next hole in the strip and the latter bent on opposite sides of this hole, continuing the bend made by the previous operation, and the spoke is secured as before, and so on, portions of the strip being successively bent and the spokes successively secured until the whole strip is in circular form and all the spokes fastened in place.

While I find it preferable to pass the spoke through the hole in the strip previous to the bending operation, this is not absolutely essential, for the strip in being bent may be caused to approach the end of the spoke and the latter be caused to extend in the opening. In this case the insertion of the spoke and the bending of the strip would be practically simultaneous. Further, the spokes at their inner ends may be secured to the hub previous to the bending of the strip and the fastening of their outer ends or their inner ends may be secured simultaneously with the fastening of the outer ends.

The essence of the invention resides in forming a wheel by progressively bending, step by step, a strip into circular form and securing the spokes to the strip as the bending operation progresses, and this irrespective of mechanical means for performing it.

My method of proceeding may be carried out by hand or by means of a suitable mechanism—such, for instance, as that shown in the accompanying drawings, which I have found to answer to a satisfactory degree the purpose in view. This mechanism *per se*, however, forms no part of the present invention, but is made the subject of a separate application of even date herewith.

In the accompanying drawings, Figure 1 is a side elevation of a machine suitable for carrying my improved method into practice. Fig. 2 is a similar view from the opposite side. Fig. 3 is a horizontal longitudinal section on the line *a a* of Figs. 1 and 2, showing the bending and heading mechanisms. Fig. 4 is a view of the strip to form the tire before it is operated on. Fig. 5 is an elevation of the wheel partly finished.

Referring to the drawings, the mechanism illustrated comprises a clamping device 1, adapted to clamp the spoke adjacent to its two ends, a bending mechanism 2, adapted to act on the strip and bend the same successively and progressively, a heading-tool 3, adapted to act on the outer end of the spoke to secure it to the strip, a hub-holder 4 to sustain the hub in position, and a heading-tool 5, adapted to act on the inner end of the spoke within the hub. These several parts are mounted in a suitable frame comprising a bed-plate 6, an upper cross-bar 7, sustained at its ends by front and rear standards 7′ and 7^2, rising from the bed-plate, and a central supporting-bed 8, sustained by the standards between the cross-bar and bed-plate.

The spoke-clamping device comprises upper and lower jaws 9 and 10, movable to and from each other vertically and simultaneously by a cylinder 11 and piston $11^\times$, sustained on the rear end of the bed-plate. The piston of this cylinder is connected by the link 12 with a rotary oscillating block 13, mounted in bearings on the standards, which block is connected by a link 14 with the rear end of a horizontal lever 15, having a bearing, as at $15^\times$, between two short links 16, pivoted on the upper cross-bar. The forward end of the lever is jointed to the upper end

of a vertical stem 17, extended through and guided in an opening in the cross-bar and fixed at its lower end to the upper jaw 9 of the clamping device. The rotary block 13 is similarly connected with the lower jaw of the clamping device through the medium of link 18, horizontal lever 19 at the under side of the central bed, and stem 20, passing upward through the bed and fixed to the lower jaw of the clamp. By the mechanism described when the piston rises from the admission of fluid under pressure to the cylinder the rotary block will be turned on its axis and separating the rear ends of the two levers their opposite ends will be brought together and will forcibly close the two jaws of the clamping device on the spoke.

The forward ends of the two clamping-jaws are curved in the arc of a circle of the diameter of the wheel to be formed, and they act as an abutment or anvil, against which the bending mechanism acts on the strip to bend the same and give it the proper curvature.

The bending mechanism in the present instance comprises a horizontally-reciprocating transversely-acting roller 21, mounted on the end of an arm 22, connected with a carriage 23, sliding between upper and lower fixed guide-plates 24, projecting laterally from the central supporting-bed, with their edges curved to correspond with the curvature the tire is to be given. The carriage in its movements is compelled to travel in a path conforming to the curvature of the guide-plates by means of friction-rollers 25, mounted on the carriage and bearing against the curved edges of the guide-plates. This carriage is connected by a link 26 with a piston 27 in a horizontal cylinder 28, sustained on the forward end of the central supporting-bed, and as the piston advances by the admission of fluid under pressure to the cylinder it pushes the carriage inward and the bending-roller travels along the curved ends of the clamping-jaws and, acting on the strip, bends the same against the jaws. The bending-roller is retracted when the supply of pressure is cut off from the cylinder by means of a weight 29, attached to a rope 30, which is connected at its opposite end with the carriage and which passes over the guide-wheel 31, mounted on the end of the cylinder.

From this description it will be seen that when the strip to form the tire is set in place, as shown in Fig. 3, and a spoke is held in position between the clamping-jaws, with its outer end in a hole in the strip, the bending-roller will act to bend a portion of the strip on opposite sides of the spoke, and after advancing as described it will remain at rest, holding the bent strip against the curved ends of the jaws until the spoke is secured to the strip by the heading device before alluded to. After this fastening operation the bending-roller is retracted to its original position.

The heading of the outer end of the spoke to secure the same to the rim is effected by the horizontal longitudinally-movable heading-tool 3, mounted in the carriage 23 in such position that when the carriage is in its advanced position and is holding the bent strip the tool will be opposite the end of the spoke. At this time the tool is also in line with a vertical longitudinally-vibrating lever 33, pivoted at its lower end, as at 34, to the frame and acted on by a rocking head 35, pivoted midway between its ends to the frame, with one end in position to engage the vibrating lever and its other end jointed to a piston-rod 36, connected to a piston 37 in a cylinder 38 on the forward end of the bed-plate. When fluid under pressure is admitted to this cylinder beneath the piston, the latter in rising will rock the head 35 and, depressing its free end, the vibrating lever will be forced rearward and will move the heading-tool, which, engaging the end of the spoke, will upset the same and form a head thereon.

In carrying my improved method into effect by the mechanism described a strip of metal, such as represented in Fig. 5, having at intervals holes to receive the outer ends of the spokes, is provided. The spokes for the wheel are secured in any suitable manner to the hub, and the latter is set in place in the hub-holder with a spoke extending between the clamping-jaws, and fluid under pressure is admitted to cylinder 11, causing the clamping-jaws to close on the spoke. The strip is now held in place and the end of the spoke passed through the hole therein. The bending mechanism is now operated by the admission of fluid to cylinder 28, and the bending-roller advancing will act on the strip and bend the same against the curved ends of the jaws. Before the retraction of the bending-roller the heading-tool 2 is operated by the admission of fluid to cylinder 38, resulting in the advance of the heading-tool and the upsetting of the outer end of the spoke. The bending-roller is now retracted by cutting off the communication with cylinder 28 and the clamping-jaws opened and the hub shifted in its holder to bring another spoke into position to be acted on, and this spoke being passed through the next hole in the strip the foregoing operations are repeated, and so on until the whole strip has been bent progressively step by step into circular form and all the spokes successively fastened in place. The ends of the rim are finally secured together in any suitable manner.

In carrying the foregoing operations into effect I prefer to heat the ends of the spokes previous to the heading of the same; but the strip to form the rim is preferably acted on in a cold state.

While this mechanism operating as described is sufficient to carry my method into effect in a practical manner, I find it convenient instead of first securing the spokes to the hub to effect their connection with the hub simultaneously with the fastening of

their outer ends to the rim, and this is accomplished in the present mechanism by the vertical heading-tool 5, adapted to act on the inner ends of the spokes within the hub and simultaneously with the operation of the heading-tool 3 for upsetting the outer ends of the spokes. This heading-tool 5 is carried on a horizontal longitudinally-movable header-bar 40, mounted in a guiding-casing 41 on the central supporting-bed of the frame. The bar is connected to rods 42, pivoted to the opposite sides thereof and jointed at their opposite ends to the rocking head 35 in such manner that when the frame is rocked, as described, to operate the heading-tool for the outer ends of the spoke it will through the medium of the connecting-rods pull the header-bar forward and cause the vertical heading-tool to upset the inner end of the spoke within the hub.

The admission of fluid under pressure to the several cylinders is controlled by valves 43, 44, and 45, respectively, for cylinders 11, 28, and 38, which valves are connected by rods $43^{\times}$, $44^{\times}$, and $45^{\times}$ with a rocking disk 46, mounted on the frame and operated by a foot-lever 47, connected by a rod 48 with a crank-arm 49 on the disk. The construction of the valves and the arrangement of the operating parts are such that the fluid is admitted successively to the cylinder 11 controlling the clamping-jaws, cylinder 28 controlling the bender, and cylinder 38 controlling the header-tools when the foot-lever is depressed. When the foot-lever rises, the supply of fluid is cut off from the several cylinders, but in reverse order, so that the heading-tools are first retracted, the bending-roller next retracted, and finally the clamping-jaws opened.

Having thus described my invention, what I claim is—

1. In the method of making wheels, progressively bending a strip into circular form, and securing the spokes to the strip as the bending operation progresses.

2. In the method of making metal wheels, alternately bending a portion of a strip to form the tire, and securing a spoke to the strip.

3. In the method of making metal wheels, providing a strip having holes at intervals, inserting a spoke in a hole, bending the strip on opposite sides of the hole, and fastening the spoke to the strip.

4. In the method of making metal wheels, progressively bending a strip into circular form by successive operations, and securing a spoke to the strip between each bending operation.

5. In the method of making metal wheels, progressively bending a strip into circular form, and fastening the spokes to the hub and strip as the bending operation progresses.

6. The method of making metal wheels which consists in progressively bending a strip into circular form, fastening the spokes to the hub and strip simultaneously as the bending operation progresses and as a final step securing the ends of the strip together.

7. The method of making metal wheels which consists in progressively bending a strip to form the rim, securing the spokes to the strip as the bending operation progresses, and as a final step securing the ends of the strip together.

In testimony whereof I hereunto set my hand, this 28th day of September, 1899, in the presence of two attesting witnesses.

EMIL EINFELDT.

Witnesses:
NATH FRENCH,
MAY L. DODGE.