No. 640,548. Patented Jan. 2, 1900.

E. EINFELDT.

MACHINE FOR FASTENING SPOKES IN WHEEL HUBS.

(Application filed May 16, 1899.)

(No Model.) 3 Sheets—Sheet 1.

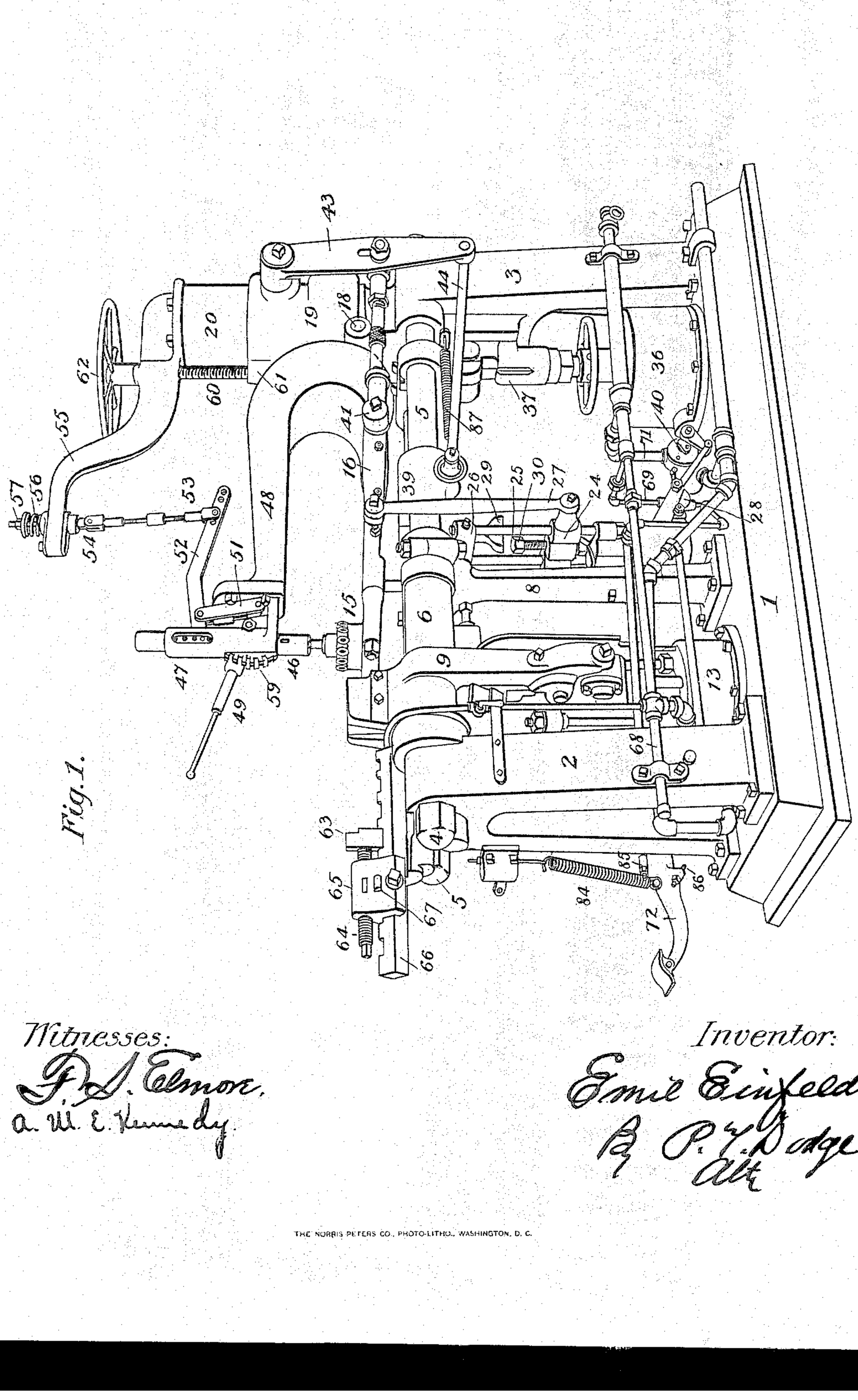

Fig. 1.

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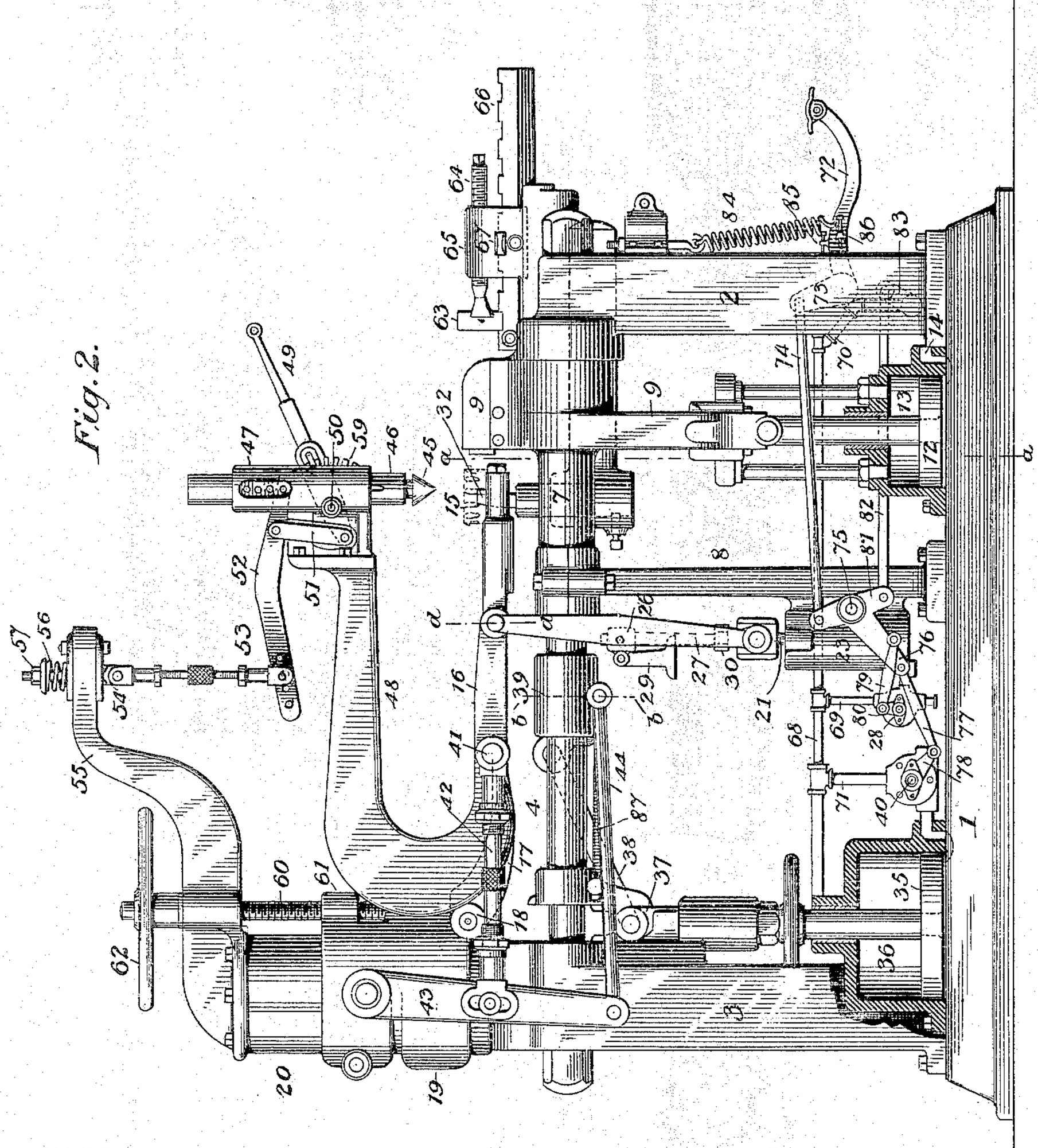
(No Model.) 3 Sheets—Sheet 2.

Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

Fig. 3.

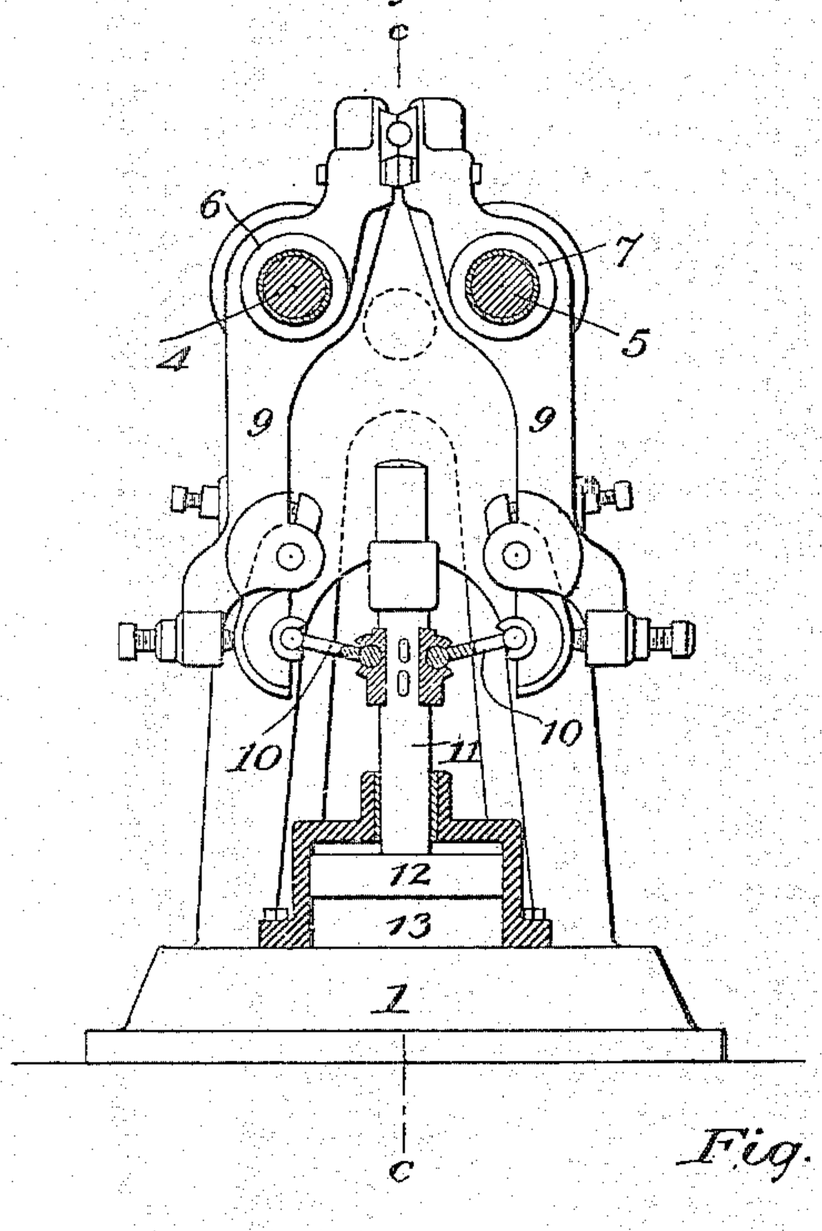


Fig. 4.

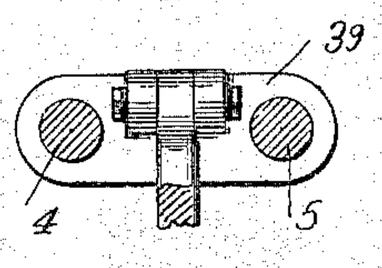


Fig. 6.

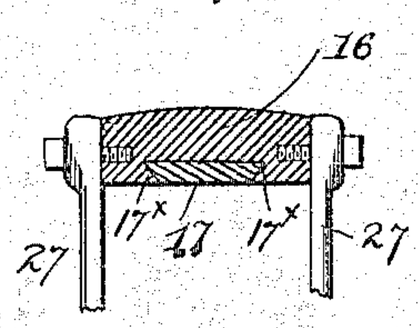
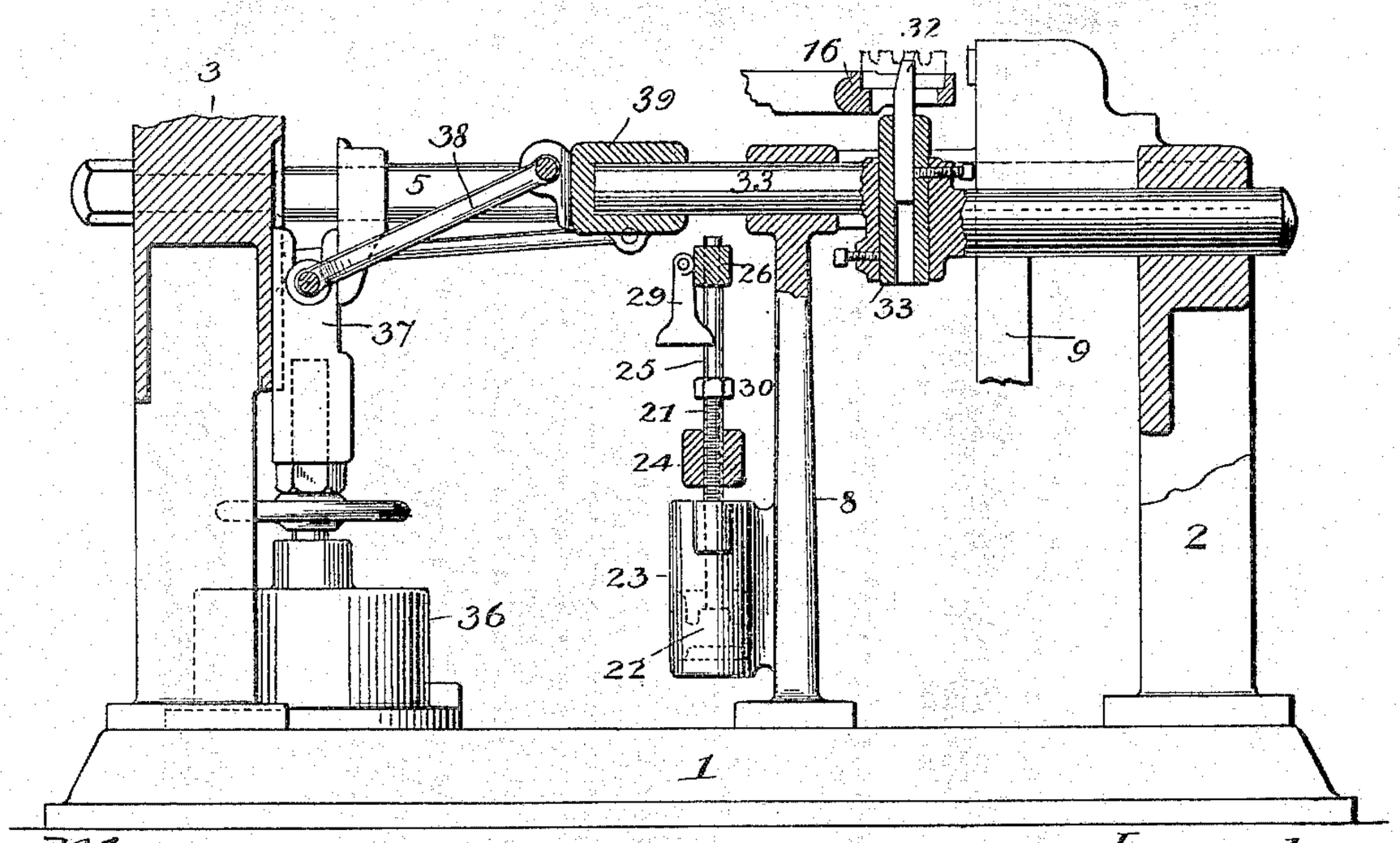


Fig. 5.



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UNITED STATES PATENT OFFICE.

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

MACHINE FOR FASTENING SPOKES IN WHEEL-HUBS.

SPECIFICATION forming part of Letters Patent No. 640,548, dated January 2, 1900.

Application filed May 16, 1899. Serial No. 717,094. (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 Machines for Fastening Spokes in Wheel-Hubs, of which the following is a specification.

This invention relates to a riveting-machine designed more particularly for securing spokes in wheel-hubs; and it consists in improved mechanism for forming a head on the end of the spoke within the hub.

The invention also consists in combining with means for heading the spoke within the hub mechanism for simultaneously forming a shoulder on the spoke outside the hub.

The invention also consists in the details of construction and combination of parts hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a perspective view of my riveting-machine. Fig. 2 is a side elevation of the same, partly in section. Fig. 3 is a vertical transverse sectional elevation on the line *a a* of Fig. 2, showing the spoke-clamp. Fig. 4 is a horizontal sectional view on the line *b b* of Fig. 2. Fig. 5 is a vertical longitudinal sectional elevation on the line *c c* of Fig. 3. Fig. 6 is a transverse section on the line *d d* of Fig. 2. Fig. 7 is a transverse section on the line *e e* of Fig. 2.

Referring to the drawings, 1 represents a bed-plate having at its forward end a standard 2 and at its rear a standard 3, between which are firmly secured two horizontal parallel guide-bars 4 and 5, circular in cross-section. Loosely encircling these bars near the forward standard are two sleeves 6 and 7, having a bearing at their forward ends in the standard 2 and at their rear ends in a post 8, rising from the bed-plate and embracing the guide-bars at its upper end. These sleeves constitute the axes of a spoke-clamping mechanism comprising two vertical clamping-jaws 9, connected, respectively, to the sleeves, with their upper ends above the guide-bars and their lower ends jointed by links 10, Fig. 3, to a vertical piston-rod 11, extending between them and connected to a piston 12 in a cylinder 13, supported on the bed-plate. The admission of fluid under pressure to the cylinder through a valve 14, Fig. 2, more fully described hereinafter, will cause the piston and rod to rise and, separating the lower ends of the clamping-jaws, will close their upper ends on the spoke and hold the same firmly in a horizontal position to be acted on by the heading-tool, hereinafter described.

The hub in which the spoke is to be secured is seated in a supporting-ring 15, having notches in its upper edge in which the hub-bosses rest. This ring is seated loosely to turn in a socket in the forward end of a hub-supporting arm 16, mounted to slide horizontally on a sustaining-frame 17, pivoted at its rear end on a horizontal axis 18 to a collar 19, loosely encircling a cylindrical extension 20, rising from the rear standard. The sliding connection between the support and its frame is in the form of a dovetail $17^{\times}$, Fig. 6, on the upper side of the frame, extending in a similarly-formed groove on the under side of the hub-support, this connection permitting the support to move longitudinally with respect to the frame, but preventing the separation of the two transversely. By the construction described the hub-supporting arm is movable horizontally on its supporting-frame to and from the spoke-clamp, by which action a shoulder is formed on the spoke outside the hub, as will be described more fully hereinafter. The hub-supporting arm is also by this construction movable vertically transversely with respect to the spoke-clamp on the axis 18 and beyond the clamp, the purpose of which is to permit the insertion in the hub-boss of the spoke before it is clamped and to permit the turning of the hub to bring a new boss into position. This vertical movement of the supporting-arm transversely of the clamp is controlled by means of a vertical piston-rod 21, Fig. 2, connected to a piston 22 in a cylinder 23, sustained by the bed-plate. The rod has fixed to it a cross-head 24, sliding on two vertical guide-rods 25, rising from the cylinder and connected at their upper ends by a horizontal plate 26. The cross-head is connected to the opposite sides of the hub-support 16 by two vertical links 27, jointed at their upper ends to the support and at their lower ends to the cross-head. On the admission of fluid under pressure to the cylinder

23 through valve 28 the piston will rise and through its connection with the hub-support 16 will elevate the same and carry the hub above the clamp. The upward movement of this clamp is limited by a pendent stop 29, pivoted on a horizontal axis to the plate 26 and adapted to be engaged by a bolt 30, carried by the cross-head 24 and forming a continuation to the piston-rod 22. The form and relative arrangement of the bolt and stop are such that the piston is permitted to rise far enough to carry the hub supported by the arm above the clamp to permit the insertion of the spoke in the boss. Where the machine is operating on hubs of larger sizes, it is necessary to provide for the elevation of the hub to a higher point, in which event the pendent stop 29 is swung aside out of the path of the bolt on the piston-rod and the latter limited by the plate 26. The heading of the spoke within the hub is effected by means of a horizontally-movable vertically-adjustable tool 32, extending upward through the socket in the forward end of the hub-supporting arm in position to act on the end of the spoke within the hub supported by said arm. This heading-tool is carried on a horizontally-movable header-bar 33, extending longitudinally of the frame between the parallel guide-bars and through a bearing-opening in the front standard, the rear end being fastened to a block 39, sliding on the guide-bars. The header-bar is advanced to cause the tool to act on the end of the spoke through the medium of a vertical piston 35 in a cylinder 36, mounted on a bed-plate adjacent to the rear standard. At its upper end the piston-rod carries a block 37, sliding vertically in guides on the inner side of the rear standard, and this block has pivoted to it the rear end of a link 38, whose forward end is pivoted to the sliding block 39, fixed to the header-bar. On the admission of fluid under pressure to cylinder 36 through a valve 40 the piston will rise, thereby elevating the sliding block and through its connection with the header-bar forcing the same forward and causing the header-tool to advance and act on the spoke within the hub. In certain cases the spoke before the insertion of its end within the hub has formed on it by separate operation in any suitable manner a shoulder adapted to bear on the end of the hub-boss, and by the mechanism described, the spoke being clamped with the hub in place, the heading-tool will act to upset the end of the spoke within the hub and form a head thereon. In order, however, that this shoulder on the outside of the hub may be formed in the same machine and simultaneously with the upsetting of the end of the spoke, I propose to upset the metal of the spoke between the hub-boss and clamp while the heading-tool is acting on the end of the spoke. This I accomplish by moving the hub-support, with its hub, positively and bodily with respect to the spoke-clamp and toward the same while the heading-tool is acting on the end of the spoke. The amount of travel required by the hub to form a suitable shoulder outside the boss varies, but is usually about one-half the distance the heading-tool travels, so that one half the metal from the end of the spoke to the clamp within the hub will be upset for the head on the end of the spoke and the other half outside the hub will be upset to form the shoulder. In order to effect this relative movement of the hub-support and heading-tool, the former has pivoted to it on opposite sides, as at 41, the forward ends of two horizontal links 42, the rear ends of which are pivoted, respectively, to two vertical pendent levers 43 at about midway between their ends. At the upper ends these levers are pivoted to the vertically-movable sleeve 19 on the rear standard and are connected at their lower ends by rods 44 to the sliding block 39, before alluded to as being movable with the heading-bar. As a result of this arrangement when the header-bar advances to cause the heading-tool to act on the spoke the pendent levers will be pulled forward and through their connection with the hub-supporting arm will move the same forward positively and bodily, carrying with it the hub sustained thereby. The hub-supporting-arm, by reason of its connection with the pendent levers between their ends, will move a distance less than the movement of the heading-tool and at less speed, the result being that the heading-tool will upset the end of the spoke, and advancing further with the hub the metal outside the hub will be upset between the same and the spoke-clamp, thereby forming a shoulder at this point.

In order to vary the relative movements of the hub-support and heading-tool to meet the varying conditions encountered in practice, I provide the horizontal links 42 with turnbuckles or other adjusting means and connect these links adjustably to the pendent levers by pins and slots or otherwise. It will be noted that by the construction described the hub-support is moved toward the spoke-clamp positively by reason of its connection with the header-bar through links 42, pendent levers 43, and rods 44. This positive movement of the hub-support I deem of great advantage in that I am enabled to control and vary the amount of metal on the spoke to be upset outside of the hub-bosses. Further, notwithstanding any variation in the size of the hub-bosses or diameter of the spokes, the hub being moved positively and a uniform distance, the amount of shortening of the spoke due to the upsetting outside will be the same and all the spokes when fastened will be of a uniform length.

In order that the hub may be held firmly in its support during the heading operation, I provide a conical clamping-head 45, adapted to extend in the opening in the hub and bear firmly on the edge of the same. This head is carried on the lower end of a clamping-bar 46, mounted to move vertically in a

cylindrical casing 47, sustained on the end of an arm 48, rising from the rear end of the hub-supporting arm and movable with it and overhanging its forward end. The clamping-head is elevated to permit of the hub being seated in its socket by a hand-lever 49, extending through a slot in the clamping-bar and pivoted to the casing, as at 50. The end of the lever is pivoted to the lower end of a link 51, whose upper end is pivoted to a horizontal lever 52, which latter has its forward end extended through a slot in the rear side of casing 47 and pivoted to the vertically-movable clamping-bar and its rear end jointed to the lower end of a vertical link 53. The upper end of this link is jointed to a rod 54, extending loosely upward through an arm 55, projecting forward from the upper end of the extension on the rear standard. The link is encircled by a spring 56, bearing at its lower end on the upper surface of the arm and at its upper end against a nut 57 on the end of the link. As a result of this arrangement the clamping-head may be elevated in its casing by depressing the hand-lever, and when the hub is inserted in its socket the hand-lever is raised, by which the head is lowered on the hub and held by a locking-dog on the lever engaging a toothed plate 59 on the casing. This movement of the clamping-head by the hand-lever is effected while the hub-supporting arm is elevated above the spoke-clamp, and by the construction described I utilize the descent of the hub-supporting arm to further and automatically depress the clamping-head to engage with considerable pressure the hub and firmly hold the same during the heading operation. From the construction described and shown it will be seen that when the hub-supporting arm is lowered to bring the spoke within the clamp the lever 52, by reason of its connection with the vertical link 53, will rock on the link 51 as a fulcrum and the forward end of the lever, which is connected to the clamping-bar, will be caused to descend and will force the clamping-bar downward and firmly press the clamping-head in engagement with the upper edge of the hub. It is seen, therefore, that by the construction described I utilize the descent of the hub-support as a means for automatically clamping the hub in the support. I propose in order to provide for various sizes of hubs and other conditions to make the link 53 adjustable by the turnbuckle shown or by other means, and I propose also to provide for connecting this link to the lever 52 by the series of holes shown, and, further, for the adjustable connection of the lever with the clamping-bar by similar or other suitable means.

By the hub-supporting mechanism described the hub is sustained during the heading operation at right angles to the spoke within the spoke-clamp, so that the spoke will be secured in place at right angles to the axis of the hub. When, however, it is desired to set "staggered" spokes or those at an inclination to the hub, it is necessary to sustain during the heading operation the hub at an inclination to the spoke. I accomplish this by raising the rear end of the hub-supporting arm by elevating the sleeve 19, to which the frame 17 is pivoted, which is effected by a vertical screw 60, mounted in the arm 55 on the rear standard and engaging in a lug 61, projecting from the sleeve. The screw has on its upper end a hand-wheel 62 for operating it. By the rotation of this screw in the proper direction the collar will be raised, thereby lifting the rear end of the hub-supporting arm and lowering its forward end and tipping the hub sustained thereby downward. In this position of the parts the spoke within the clamp will extend at an inclination to the hub and may be secured in this position by the heading operation.

The outer end of the spoke during the heading operation receives support by a gage-block 63, carried on the end of a horizontal screw 64, tapped through a block 65, sliding on a horizontal longitudinal guide-bar 66, having its upper edge toothed to receive a pin 67, extending through the block. By this means the block may be set at any desired position on the guide-bar and the gage-block adjusted by means of the screw carrying it.

The valves 28, 14, and 40, controlling the admission and discharge of the fluid under pressure, respectively, to the cylinders 23, 13, and 36, are mounted each in a casing in communication with the source of pressure, with the interior of the cylinders, and with the external air, the valves being so arranged that when in one position they establish a communication between the cylinders and source of pressure, and in another position they cut off this communication and establish a communication with the external air to permit of the discharge of the contents of the cylinders to permit the pistons to retract. The fluid under pressure is furnished from any suitable source of supply through a main pipe 68, from which are branch pipes 69, 70, and 71, leading to the respective casings. The valves are all operated by the depression of a foot-lever 72, pivoted to the front standard 2 and provided with an arm 73, jointed to the forward end of a rod 74, connected at its rear end to a rocking plate 75, pivoted to the vertical post 8. This plate is formed with a long rearwardly-extending arm 76, jointed at its end by a link 77 to a crank-arm 78 on the valve 40, controlling the header-bar-operating mechanism. Adjacent to its end the arm 76 of the rocking plate is connected by a link 79 with a crank-arm 80 on the valve 28, controlling the operation of the mechanism for moving the hub-supporting arm transversely of the spoke-clamp. The rocking plate is also provided with a forwardly-extending arm 81, which is connected by a link 82 with a crank-arm 83 on the valve 14, which controls the

operation of the spoke-clamp. The relative arrangement of the valves and their system of operating-levers is such that when the foot-lever is elevated and held upward by its spring 84, Fig. 2, the valve 28 is in a position to admit fluid under pressure to cylinder 23 to elevate the hub-supporting arm, and the other valves are in opposite positions to cut off from their cylinders the communication with pressure. On the first downward movement of the foot-lever valve 28 is turned to cut off pressure and exhaust its cylinder, the result being that the hub-supporting arm descends to its operative position. On the further movement of the foot-lever downward valve 14 is operated to admit pressure to its cylinder to close the spoke-clamp on the spoke, and on the final movement of the foot-lever downward valve 40 is operated to admit pressure to its cylinder to advance the header-bar and perform the heading operation. On the release of the foot-lever it is elevated by the spring 84, the respective valves being operated to open the spoke-clamp, retract the heading-tool, and elevate the hub-supporting arm for the next operation.

The upward movement of the foot-lever is limited by a stop 85 in the form of an adjusting-screw carried by the lever and adapted to engage the forward standard. It is obvious that by the adjustment of this screw the position of the valve 28 may be varied to vary the amount of fluid admitted to the cylinder. The downward movement of the foot-lever is limited by a second stop 86, similar in construction to that just described and adapted to engage the forward standard when the lever is depressed. By this screw the position of the valves 40 and 14 may be varied.

The heading-tool is retracted through the medium of a spring 87, Figs. 1 and 2, connected to the sliding block 39 and the rear standard in such manner that it will be extended by the advance of the header-bar and, resuming its normal position, will draw the header-bar rearward. The spoke-clamping jaws are opened when the valve is operated to discharge the contents of the cylinder by the weight of the lower ends of the jaws and the piston and the cylinder, and the discharge of the contents of cylinder 23, controlling the operation of the hub-supporting arm, is effected by the weight of the arm and the attached parts.

The operation of the machine is as follows: The foot-lever being in its elevated position, the hub-support is raised, the hub-clamp elevated, the header-bar retracted, and the spoke-clamp opened. The hub is set in place in its socket with the bosses extending in notches therein and the socket seated in the forward end of the hub-supporting arm. The lever 49 is raised, thereby engaging the clamping-head with the hub. A spoke is now heated to a proper degree and inserted in the boss on the hub and the foot-lever is depressed, which will result in the lowering of the hub-support to bring the spoke within the spoke-clamp and the simultaneous descent of the hub-clamping head forcibly on the hub. The spoke-clamps are next closed on the spoke and finally the heading-tool advances simultaneously with the forward movement of the hub-support to form a head on the end of the spoke and upset the spoke to form a shoulder outside the hub. On the release of the foot-lever the spoke-clamp is opened, the heading-tool retracted, the hub-supporting arm raised, and the hub-clamp elevated. The hub is now turned in its socket to bring the next boss in position, and a second spoke being heated and inserted in its boss the operation just described is repeated, and so on until all the bosses are filled.

Where the shoulder is previously formed on the spoke and the inner end only is to be headed, I remove the horizontal links 42, move the hub-supporting arm forward, so that the hub-boss will touch the shoulder on the spoke in the clamp, and then fasten the hub-supporting arm in this position. When, therefore, the header advances, the hub remains stationary and the heading-tool acts only to upset the end of the spoke within the hub.

Having thus described my invention, what I claim is—

1. The combination with a spoke-clamp and hub-support, one movable to and from the other to form a shoulder on the spoke outside the hub, of means independent of the spoke or hub, for positively moving one toward the other a predetermined distance.

2. In combination with a spoke-clamp, a hub-support movable to and from the clamp, a heading device adapted to act on the spoke within the hub, and means independent of the spoke or hub for positively moving the hub-support toward the spoke-clamp a predetermined distance.

3. In combination with a spoke-clamp, a hub-support, a heading device movable toward the spoke-clamp, and means for positively moving the hub-support toward the clamp a distance less than the movement of the heading device.

4. In combination with a spoke-clamp, a hub-support, a heading device movable toward the spoke-clamp, and means for simultaneously moving the hub-support toward the clamp at a speed less than the movement of the heading device.

5. In combination with a spoke-clamp, a hub-support movable to and from the same, a heading device movable also toward the clamp, and connecting devices between the header and support constructed and arranged to cause the support to be moved positively with the header.

6. In combination with a spoke-clamp, a hub-support movable to and from the same, a heading device also movable to and from the clamp, and adjustable connecting devices between the hub-support and heading device: whereby the amount of movement of the hub-

support with reference to the heading-tool may be varied.

7. In combination with a spoke-clamp a hub-support movable with relation to the spoke-clamp transversely of the axis of the spoke, a hub-clamping device, and suitable connections betweeen the hub-support and clamping device, arranged to cause the clamping device to be actuated by the transverse movement of the support.

8. In combination with the frame, a spoke-clamp, a hub-support movable with relation to the spoke-clamp transversely of the axis of the spoke, a hub-clamping device operatively connected with the hub-support, and suitable connections between the hub-clamping device and the frame formed and arranged to cause the clamping mechanism to be operated by the movement of the hub-support.

9. In combination with a spoke-clamp, a hub-support movable with relation to the spoke-clamp transversely of the axis of the spoke, a hub-clamping device operatively connected with the hub-support, means for manually adjusting said hub-clamping device, and means for automatically operating the hub-clamping device by the transverse movement of the support.

10. In a machine for securing spokes in hubs, the combination with a spoke-clamp, of a hub-support, means for adjusting one at an inclination with respect to the other and means for securing the spoke to the hub.

11. In a machine for securing spokes in hubs the combination with a spoke-clamp, of a hub-support, means for adjusting said support to sustain the hub at an inclination to the spoke, and means for securing the spoke in the hub.

12. In a machine for securing spokes in hubs, the combination with a spoke-clamp, of the hub-support, means for tipping the support with reference to the clamp, and means for securing the spoke in the hub.

13. In combination with a spoke-clamp and the cylinder and piston operating the same, a heading device, a cylinder and piston adapted to operate the same, a hub-support movable with relation to the clamp, transversely of the axis of the spoke, a cylinder and a piston controlling the movement of the support, valves controlling the admission of pressure to the cylinder and its discharge therefrom, and means for operating said valves relatively to successively cut off pressure to the cylinder controlling the hub-support, and admit the pressure to the cylinder controlling the spoke-clamp, and the cylinder controlling the heading device.

14. In combination with a spoke-clamp, a hub-support movable to and from the same, a heading-tool, means for moving the heading-tool toward the clamp, a lever, connections between the heading-tool and lever, and connections between the lever and the hub-support.

15. In combination with a spoke-clamp, a sustaining-frame movable transversely of the same, a hub-support movable longitudinally on the sustaining-frame, a piston and cylinder, and jointed connections between the hub-support and the piston.

16. In a machine for securing spokes in hubs, the combination with a spoke-clamp, of a hub-support movable with relation to the spoke-clamp transversely of the axis of the spoke, a cylinder and piston, and a link connecting the piston with the hub-support.

17. In combination with the frame, a spoke-clamp, a hub-support pivotally connected at one end to the frame and movable transversely at its opposite end with reference to the clamp, and means for adjusting the pivotal connection of the support with the frame.

18. In combination with the frame, a spoke-clamp, a hub-support movable with relation to the spoke-clamp transversely of the axis of the spoke, means for controlling the movement of the support, a hub-clamping head sustained by the support and movable with relation to the same, a lever pivoted at one end to the head and fulcrumed on the support, and connections between the other end of the lever and the frame.

19. In combination with the hub-support, a spoke-clamp and heading-tool, operating cylinders and pistons for the same, valves controlling the admission of fluid under pressure to said cylinders and its discharge therefrom, a rocking plate, means for rocking said plate, and connections between the plate and said valves.

20. In combination with a spoke-clamp and hub-support, a heading-tool movable toward the clamp, a header-bar to which the tool is connected, a sliding head movable transversely of the bar, a link connecting the head with the bar, and means for moving the head.

21. In combination with the spoke-clamp, a hub-support, a vertically-adjustable member 19, and a pivotal connection between this member and the hub-support; whereby the hub-support may be adjusted at an inclination and at the same time is movable vertically on its pivotal axis.

22. In combination with the spoke-clamp, a hub-support movable transversely and longitudinally, a heading-tool movable toward the clamp, a lever as 43, a connection between the lever and the header, and a connection between the lever and the hub-support.

23. In combination with a spoke-clamp, a frame 17, a vertically-adjustable member 19 to which the frame is pivoted, a hub-support having a longitudinal sliding connection with the frame but movable vertically with it, a lever carried by the adjustable member, a jointed connection between the lever and hub-support, a longitudinally-moving heading device, a jointed connection between the same and the lever, and means for moving the hub-support vertically.

24. In combination with a spoke-clamp, a hub-support movable vertically transversely

of the axis of the spoke, an arm overhanging the hub-support and movable vertically with it, a vertically-moving hub-clamping head mounted in the arm, an adjusting-lever pivoted to the arm, a lever 52 pivoted at one end to the head, a link 51 connecting the lever 52 with the adjusting-lever, and a link connecting the other end of lever 52 with the main frame.

25. In combination with a spoke-clamp, a vertically-movable hub-support, a vertical cylinder and piston, two vertical links having their upper ends jointed to the hub-support and their lower ends jointed to the piston, a horizontal header-bar movable between the two vertical links, and means for moving said bar horizontally.

In testimony whereof I hereunto set my hand, this 10th day of April, 1899, in the presence of two attesting witnesses.

EMIL EINFELDT.

Witnesses:
NATH. FRENCH,
MAY L. DODGE.