A. CHRISTIANSON.

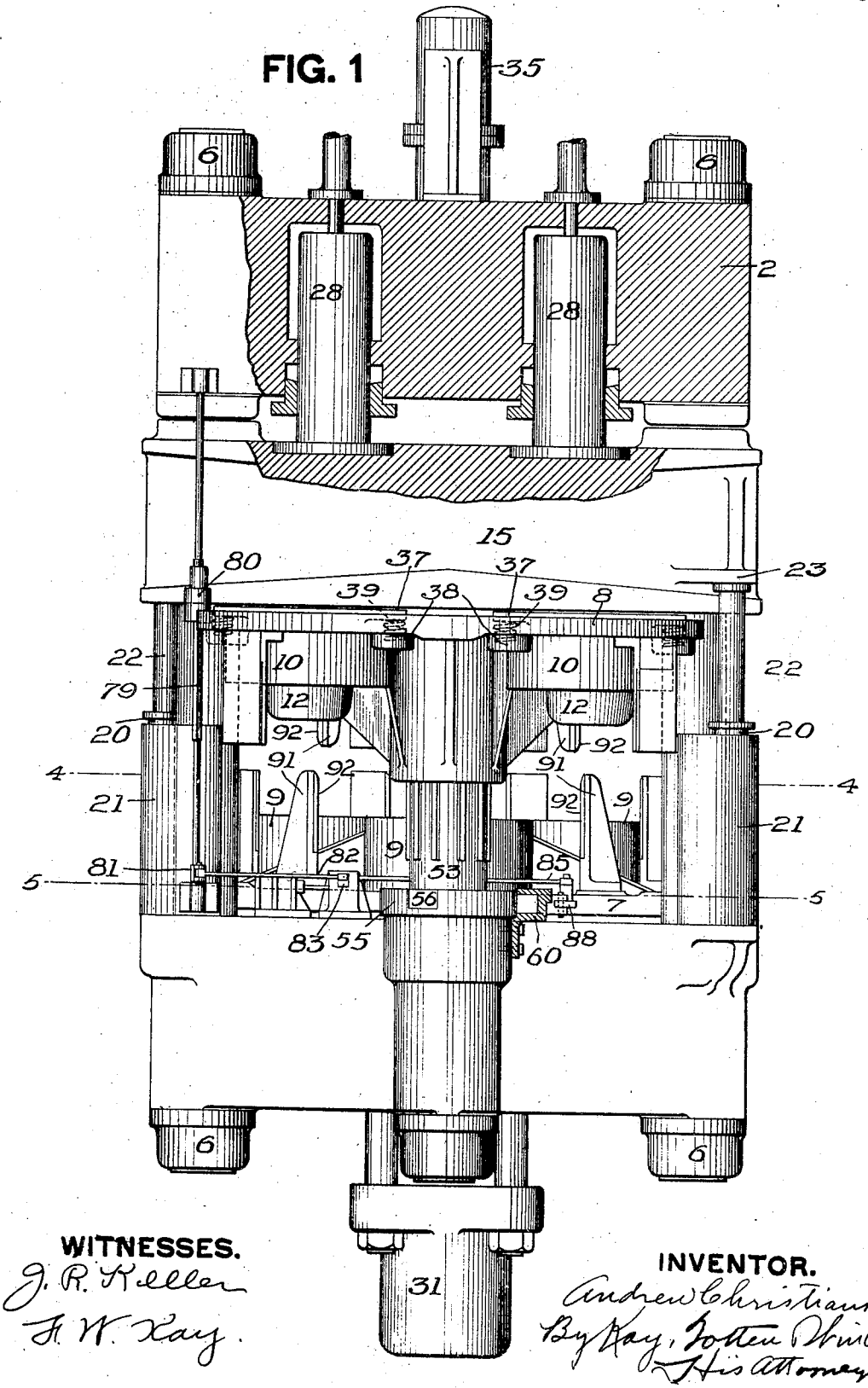
FORGING PRESS.

APPLICATION FILED AUG. 12, 1907.

922,392. **Patented May 18, 1909.**

6 SHEETS—SHEET 1.

FIG. 1



WITNESSES.

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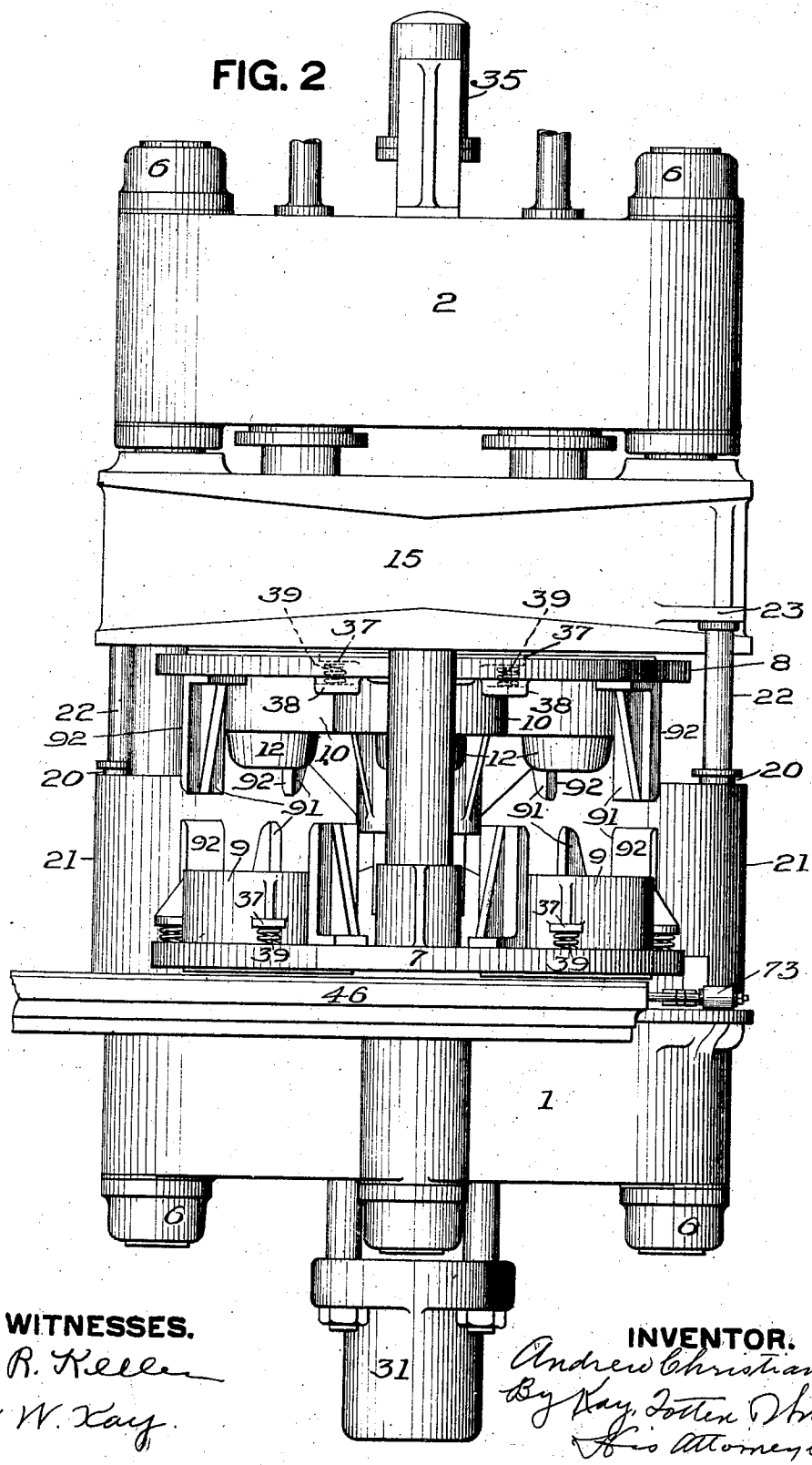
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922,392. Patented May 18, 1909.

6 SHEETS—SHEET 2.

FIG. 2



WITNESSES.

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FORGING PRESS.

APPLICATION FILED AUG. 12, 1907.

922,392.

Patented May 18, 1909.

6 SHEETS—SHEET 3.

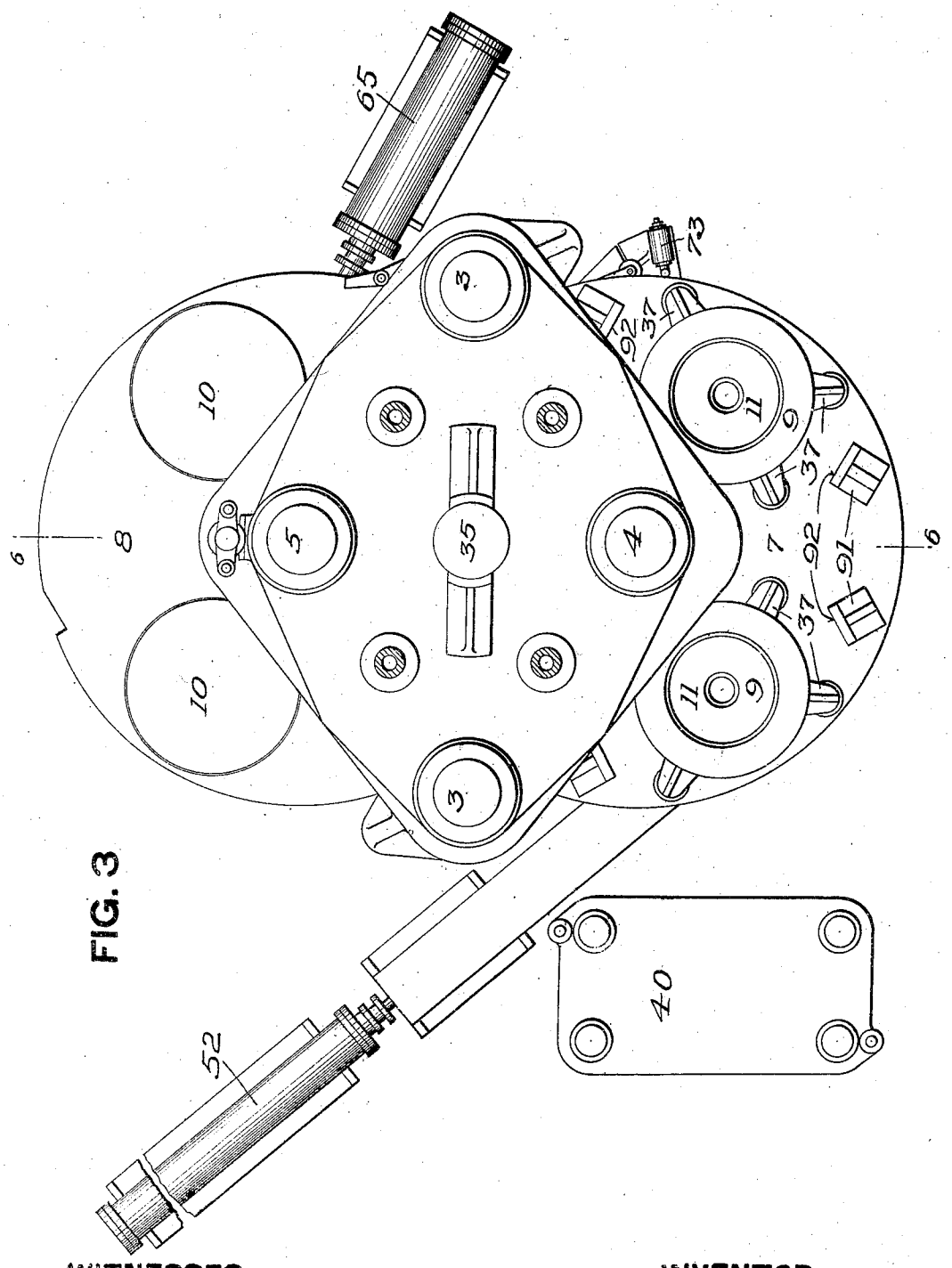


FIG. 3

WITNESSES.

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FORGING PRESS.

APPLICATION FILED AUG. 12, 1907.

922,392. **Patented May 18, 1909.**

6 SHEETS—SHEET 4.

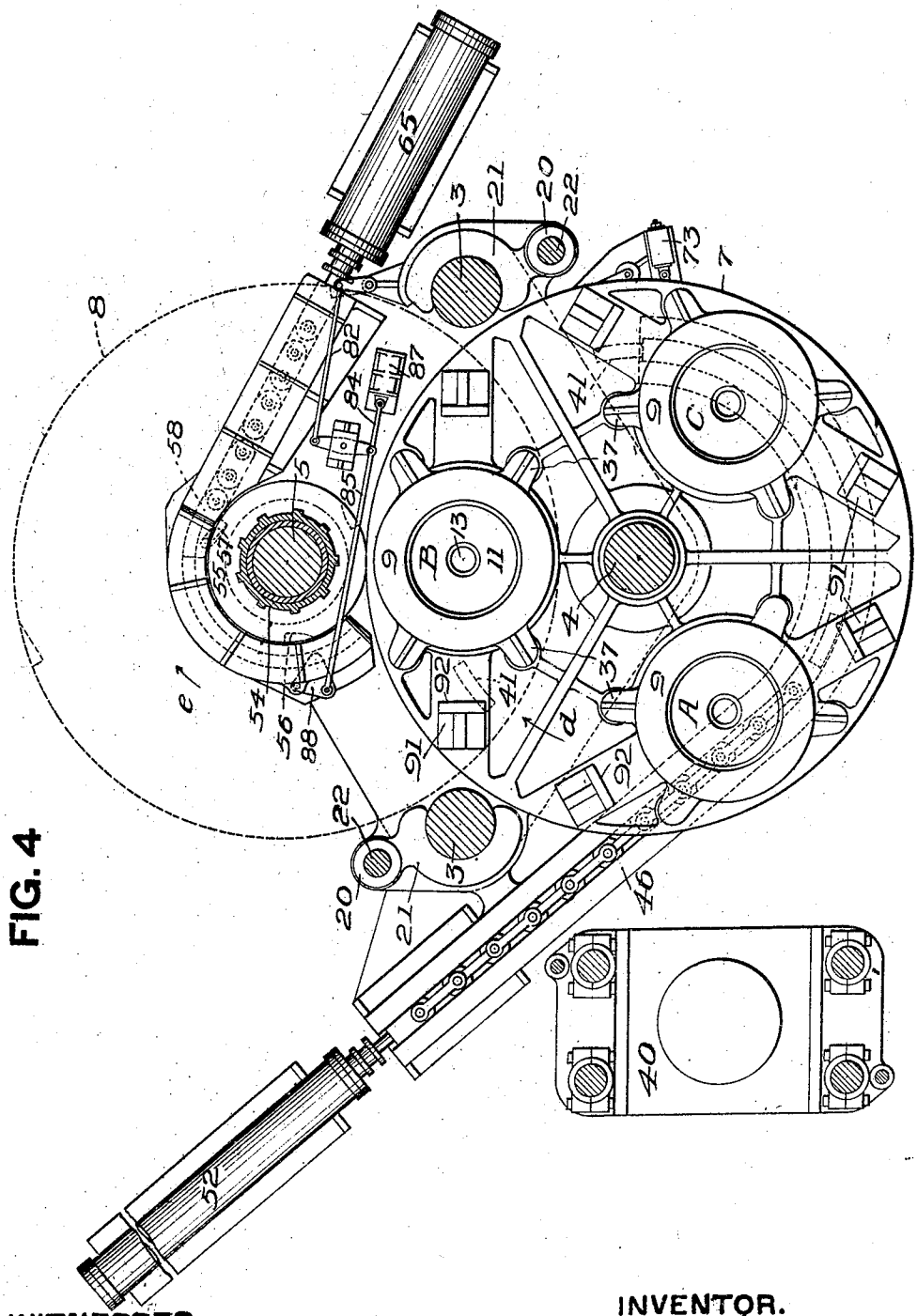


FIG. 4

WITNESSES.

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FORGING PRESS.

APPLICATION FILED AUG. 12, 1907.

922,392.

Patented May 18, 1909.

6 SHEETS—SHEET 6.

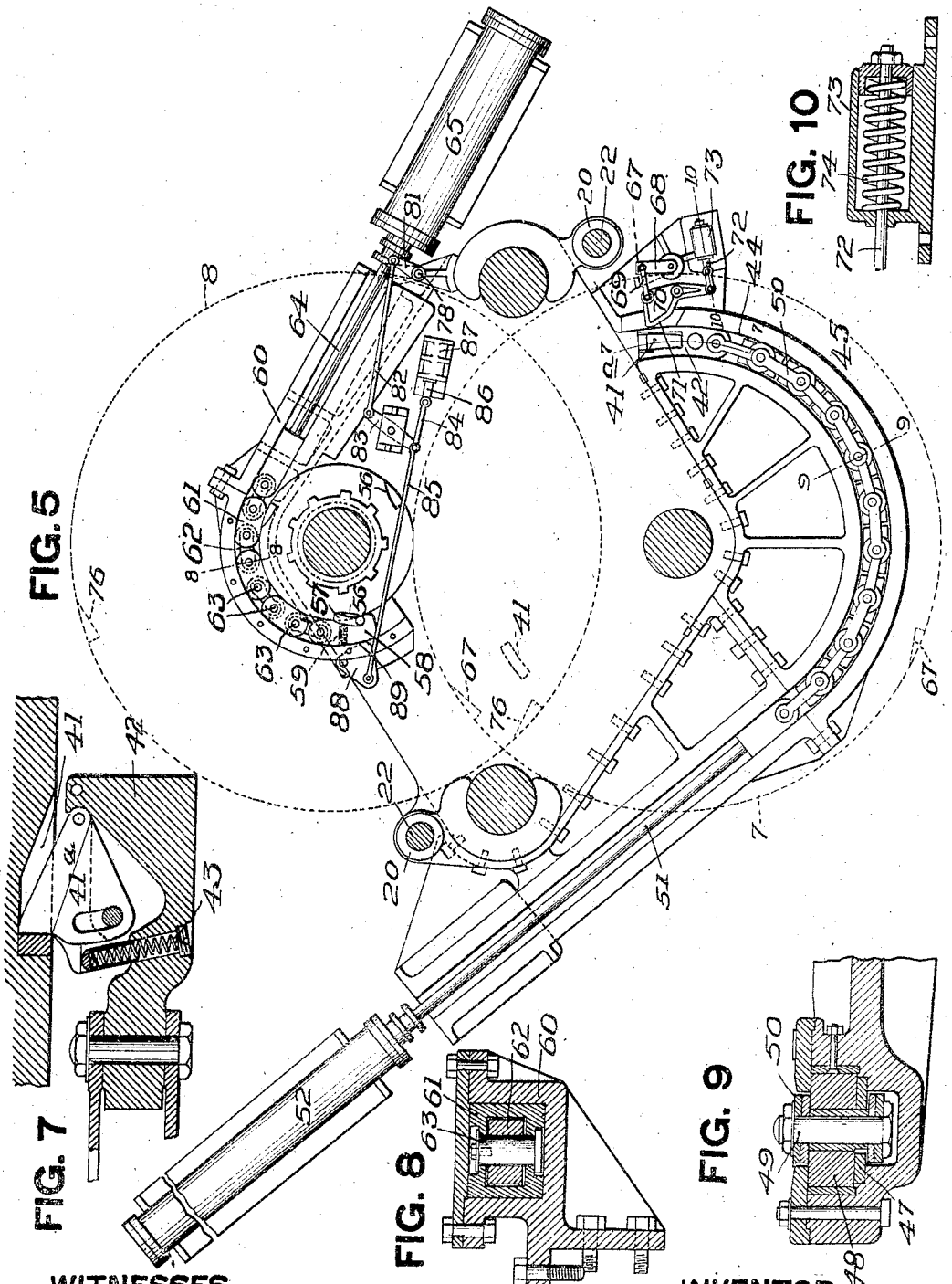


FIG. 5

FIG. 7

FIG. 8

FIG. 9

FIG. 10

WITNESSES.

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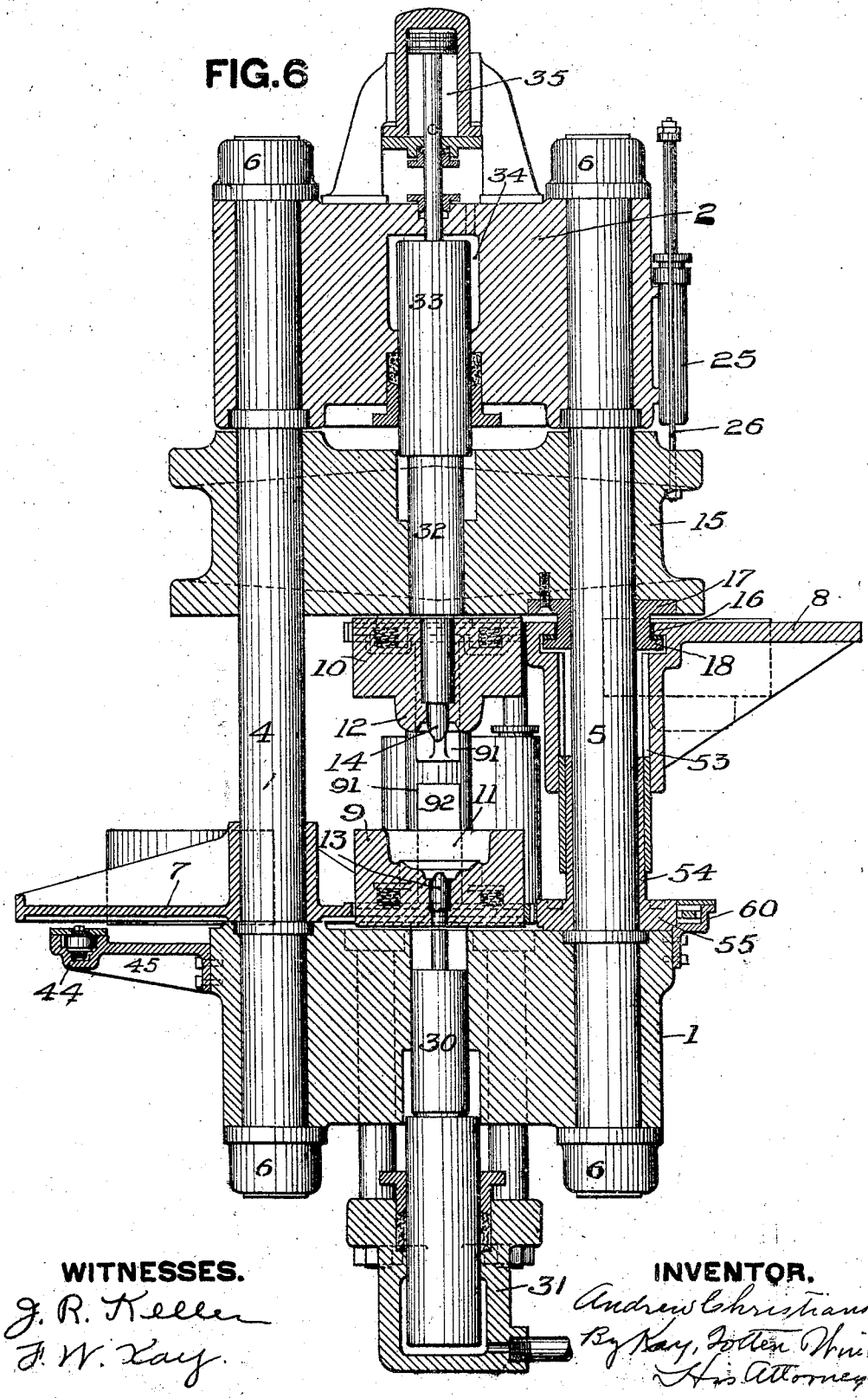
FORGING PRESS.

APPLICATION FILED AUG. 12, 1907.

922,392. Patented May 18, 1909

6 SHEETS—SHEET 6.

FIG. 6



WITNESSES.

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UNITED STATES PATENT OFFICE.

ANDREW CHRISTIANSON, OF BUTLER, PENNSYLVANIA, ASSIGNOR TO FORGED STEEL WHEEL COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

FORGING-PRESS.

No. 922,392. Specification of Letters Patent. Patented May 18, 1909.

Application filed August 12, 1907. Serial No. 388,217.

To all whom it may concern:

Be it known that I, ANDREW CHRISTIANSON, a resident of Butler, in the county of Butler and State of Pennsylvania, have invented a new and useful Improvement in Forging-Presses; and I do hereby declare the following to be a full, clear, and exact description thereof.

This invention relates to forging presses and more especially to hydraulic presses for making large forgings.

The object of the invention is to provide a press which will give a large output and by means of simple and strong mechanism.

The invention comprises, generally stated, a forging press having a pair of rotatable die carriers, each carrying a plurality of dies, together with mechanism for rotating said carriers to bring opposing dies in operative relation, and platens or pressure mechanism to cause the die carriers and dies to approach each other for the forging operation.

The invention also comprises certain details of construction and arrangement of parts hereinafter described and claimed.

In the accompanying drawings Figure 1 is a view principally in elevation and partly in section looking at one side of the press; Fig. 2 is a view looking at the opposite side of the press; Fig. 3 is a plan view of the press; Fig. 4 is a horizontal section on the line 4—4, Fig. 1; Fig. 5 is a similar view on the line 5—5, Fig. 1; Fig. 6 is a vertical sectional view on the line 6—6, Fig. 3; and Figs. 7, 8, 9 and 10 are detail sectional views taken respectively on the lines 7—7, 8—8, 9—9, and 10—10, Fig. 5.

The press comprises a suitable base 1 and head 2, of substantially diamond shape, united at the corners by four heavy rods or columns 3, 3, 4 and 5. These columns pass through holes in the base and head and are provided with suitable means, such as nuts 6, for preventing separation of the base and head, in the ordinary manner of constructing hydraulic presses. Rotatably mounted on the column 4 is a die carrier 7 and similarly mounted upon the post 5 is a corresponding die carrier 8. Each of these carriers carries a plurality of dies, the drawings showing each carrier as provided with three dies, namely, the bottom dies 9 on the carrier 7 and top dies 10 on the carrier 8. The particular dies shown are for forging steel wheel blanks, the bottom dies having the forging cavity 11 and the top dies having the projecting portion 12, and both dies being centrally perforated for the passage of piercing mandrels or punches 13 and 14 respectively to form the eye of the wheel blank. It will be understood that these dies may be replaced by others for shaping articles other than wheel blanks. One or both of the die carriers are mounted for vertical movement so as to cause the dies to approach each other to perform the forging operation. As shown the top die carrier 8 alone is vertically movable, being slidably as well as rotatably mounted on the column 5 and being vertically movable together with the top platen or pressure head 15 which is slidably mounted on the columns. The die carrier is rotatably connected to this platen by being provided on its upper side, around the opening surrounding the column 5, with an overhanging collar or flange 16 which is engaged by a ring 17 suitably secured to the platen or pressure head 15 and provided with a ledge 18 which lies underneath the flange or collar 16 on the carrier 8. Consequently, said carrier moves upwardly and downwardly with the platen 15 but is free to rotate on the column 5. The upper die carrier will be made in sections to permit assembling the same with the ring 17, but as this is a purely mechanical feature it has not been illustrated.

The platen 15 is raised by means of a pair of power cylinders 20 formed or secured to castings 21 which are clamped to the two diagonally opposite columns 3, the piston rods 22 of said cylinders bearing against lugs 23 on the platen 15. An additional cylinder 25 secured to the head 2 of the machine has its piston connected by means of rods 26 to the platen 15 approximately above the point of support of the die carrier 8 on said platen, for the purpose of counter-balancing the die carrier 8 and preventing the platen 15 from binding on the columns. The platen 15 is depressed to perform the forging operation by means of one or more hydraulic cylinders 28 formed in or secured to the head 2 and having their piston rods connected to said platen. The drawings show four cylinders for this purpose.

The bottom central die or punch 13 is operated by a plunger 30 actuated by a power cylinder 31 mounted in or below the base 1 of the machine, while the top central die or

punch 14 is actuated by a plunger 32 connected to the piston 33 of a power cylinder 34 in the head 2 of the machine. All of the cylinders described are single acting cylinders and in order to raise the plunger 32 an additional single acting cylinder 35 is provided having its piston rod connected to the piston 33 of the cylinder 34.

The punches 13 and 14 are only short members, not extending farther down or up than the bottom and top faces of the dies 9 and 10 respectively so as not to interfere with the free rotation of the die carriers 7 and 8. To prevent the dies 9 and 10 from scraping on the anvil 1 and platen 15 respectively when the die carriers are rotated, said dies are so mounted on the carriers that they automatically free themselves from contact with the base or anvil 1 and platen 15 as soon as pressure is relieved. As shown, the dies are provided with lugs 37 and the die carriers with corresponding lugs 38, and interposed between these lugs are springs 39. The springs 39 of the lower dies are sufficiently strong to lift the dies away from the anvil 1, while those of the upper dies are not quite strong enough to carry the full weight of the dies, so that the latter drop slightly out of contact with the platen 15. The springs 39 yield under pressure so that during the forging step said dies are in contact with the anvil 1 and platen 15 and therefore subjected to positive pressure. The die carriers are provided with openings in which the dies are held by means of the lugs 38.

In the operation of the press the heated blanks are given a preparatory shaping by a press diagrammatically represented at 40 and are then pushed into the main press onto a die 9 when at station A, Fig. 4, and are then carried by the rotation of the die carrier 7 to station B where the forging takes place, and again carried by the further rotation of the die carriers to station C where the blanks are removed. The die carrier 7 rotates in the direction of the arrow *d*, Fig. 4, while the die carrier 8 rotates in the direction indicated by the arrow *e*. The step by step rotation of the die carriers to the several stations described may be effected by any suitable mechanism. As shown in the drawings both die carriers are rotated by ratchet or dog mechanism connected by flexible members to power cylinders.

The lower die carrier 7 is provided on its bottom face with three notches 41 designed to receive a dog 41^a pivotally mounted in a head 42 and normally pressed against the lower face of the die carrier by means of a spring 43. The head 42 is slidably mounted in a circular groove or way 44 formed in a stationary bracket or shelf 45 and has connected thereto a flexible member located in the groove 44 and consisting of guide plates 47 and anti-friction rollers 48 mounted on studs 49, the latter being connected at top and bottom by links 50 so as to form in effect a chain. The end of this flexible member is connected to the piston rod 51 of a power cylinder 52. The upper die carrier 8 has a splined connection, shown at 53, with a sleeve 54 secured to or forming part of a ratchet wheel or disk 55 rotatable on the column 5. The disk 55 is provided on its periphery with three notches 56 with which coöperates a detent or dog 57 pivotally mounted in a head 58 and normally pressed against the periphery of the disk 55 by means of a spring 59. The head 59 is mounted in a guide way 60 formed in a suitable casting secured to the base 1 and has connected thereto a flexible member consisting of blocks 61 having links 62 connected thereto by means of pivot members 63. The end of this flexible member is connected to the piston rod 64 of a power cylinder 65.

When the piston rods of the two power cylinders 52 and 65 are pushed outwardly, the heads 42 and 58 are pushed around in their respective grooves until their dogs or detents engage one of the notches of the die carriers, when by pulling on the flexible members by means of the power cylinders the heads are drawn toward the power cylinders and the die carriers rotated. The stroke of the cylinders is sufficient to rotate the die carriers one-third of a complete revolution.

Locking means are provided for holding the die carriers in proper position after rotation, these locking means being designed to operate automatically. As shown, the lower die carrier is provided on its periphery with three notches 67 adapted to be engaged by a detent or dog 68 pivotally mounted on a suitable bracket secured to the base of the press. This dog is connected by means of a link 69 with a pivoted member 70 having a cam portion 71 projecting into the path of the head 42 and provided with an arm which is connected to a rod 72 extending into a case 73 where it is surrounded by a spring 74 which acts on said rod and normally holds the detent 68 in the notch 67 and the cam portion 71 projecting into or across the groove 44 in the path of the head 41^a moving in said groove. When the head 42 is pushed around to the limit of its stroke to get a new engagement with the die carrier, it strikes the cam portion 71 of the member 70 and through the link 69 pushes the detent 68 out of the notch 67, thus unlocking the die carrier. As soon as the carrier has rotated sufficiently far to dis-engage the head 42 from the cam portion 71, the spring 74 causes the detent 68 to bear against the periphery of the die carrier and as soon as the next notch comes opposite said detent the latter snaps into the same and thus locks and positions said die carrier.

The upper die carrier likewise is provided with three notches 76 and coöperating with

the same is a detent or dog 77 mounted on a rock shaft 78 and sliding up and down on said shaft with the raising and lowering of the upper die carrier. To permit this the detent has a splined connection with said rock shaft, or preferably the rock shaft is formed square, as shown at 79, and the detent is held by an arm or bracket 80 connected to the platen 15. The lower end of said rock shaft has connected thereto an arm 81 to which is connected one end of a link 82 whose opposite end is connected to one end of a lever 83 pivotally mounted on the base of the machine, and in turn having its opposite end connected to links or rods 84 and 85. The former is connected to a rod 86 projecting into a spring case 87 where it is surrounded by a spring similar to the spring 73 and acting normally to pull on the rod 82 and hold the detent 77 in engagement with the periphery of the die carrier. The rod 85 is connected to a member 88 pivotally mounted on the base and provided with a cam portion 89 projecting into the path of movement of the head 58. The action of the spring in case 87 and of the cam member 88 coöperating with the head 58 is exactly the same as the equivalent parts described in connection with the lower die carrier, the head 58 automatically dis-engaging the detent 77 from the notches 76 and the spring in the case 87 causing the said detent to snap into the notches in the periphery of the die carrier.

By means of the mechanism just described, the several die carriers are locked in their several positions to bring coöperating dies into alinement. As a further means for insuring exact alinement of the dies, the die carriers are provided with guide members 91 having coöperating faces 92 preferably provided with hardened wear surfaces and designed to engage when the die carriers approach and insuring the dies being in exact alinement when acting on the blank.

The power cylinders 52 and 65 will be operated from the same valve so as to insure their simultaneous operation and effect the rotation of the die carriers in unison. The two cylinders 20 will be provided with a common operating valve and the four cylinders 28 will also be provided with a common operating valve while all the other cylinders will have independent valves. The valves for actuating all of the cylinders of the press will be placed at a point where the operator can have a view of the entire machine so that he can operate the several parts in proper sequence.

By providing a plurality of dies in the die carriers, the over-heating of the dies is prevented, defective dies can be removed and replaced, for instance at station C, without materially interfering with the continuous operation of the press, and the feeding of the blanks into and out of the press can go on practically continuously so that a very large output is secured.

The operation of the press will be understood from the foregoing description, the blanks being laid on the lower die at station A, then being carried to station B where the top die carrier descends and presses the blank to shape and the central punches or mandrels are also caused to act on the blank in the proper sequence to shape the eye or central portion of the article, after which the die is carried to station C where the forged article is removed. The die carriers are rotated from the cylinders 52 and 65, being given thereby a step by step rotation at a speed under the control of the operator and are automatically locked in proper position for effecting the forging operation and also automatically unlocked in order to permit their rotation.

What I claim is:—

1. In a metal forging press, the combination of a pair of rotatable die carriers mounted on separate centers and overlapping in part, dies mounted on said carriers, an anvil against which one of said carriers bears when in pressing position, and pressure mechanism acting on the other carrier in line with said anvil.

2. In a metal forging press, the combination of a pair of rotatable die carriers mounted on separate centers and overlapping in part, dies mounted on said carriers, pressure platens located on opposite sides of said carriers and acting on the overlapping portions thereof, and mechanism for causing said platens to approach and recede from each other.

3. In a metal forging press, the combination of a pair of rotatable die carriers mounted on separate centers and having edge portions overlapping, dies mounted on said carriers, mechanism for imparting an intermittent rotary movement to said carriers, coöperating guide members on said carriers, and mechanism for causing said carriers to approach and recede from each other.

4. In a metal forging press, the combination of a pair of rotatable die carriers mounted on separate centers and having portions overlapping, dies mounted on said carriers, mechanism for imparting an intermittent rotary movement to said carriers, an anvil against which one of said carriers bears, a movable platen coöperating with the other carrier, and mechanism for actuating said platen.

5. In a forging press, the combination of two vertical columns or standards, rotatable die carriers mounted on said columns and having portions overlapping, dies mounted on said carriers, an anvil underneath the lower die carrier, a platen above the upper die carrier, and mechanism for actuating said platen.

6. In a forging press, the combination of a pair of vertical columns or standards, die carriers rotatably mounted on said columns and having portions overlapping, dies mounted on said carriers, an anvil underneath the lower die carrier, a vertically movable platen to which the upper die carrier is rotatably secured, and mechanism for actuating said platen.

7. In a forging press, the combination of a pair of vertical columns or standards, die carriers mounted on said columns with portions overlapping, dies mounted on said carriers, an anvil coöperating with one of said carriers, a platen to which the other carrier is rotatably and eccentrically secured, power cylinders for actuating said platen, and counter-balancing mechanism connected to said platen substantially in line with the point of connection of the die carrier therewith.

8. In a forging press, the combination of a base, a head, four columns or standards connecting the same, a rotatable die carrier mounted on each of two diagonally opposite columns and overlapping in part, dies mounted on said carriers, a platen guided on said columns and having one of the die carriers rotatably connected thereto, and power mechanism for actuating said platen.

9. In a forging press, the combination of two columns or standards, die carriers rotatably mounted on said columns and overlapping in part, dies mounted on said carriers, an anvil coöperating with one of said carriers, a movable platen coöperating with the other carrier, mechanism for actuating said platen, central dies or punches mounted in the main dies, and power plungers operating through openings in the anvil and in the platen for actuating said central dies.

10. In a forging press, the combination of a pair of rotatable die carriers mounted on separate centers and overlapping in part, dies mounted on each of said carriers, an anvil coöperating with one of said carriers, a platen coöperating with the other carrier, mechanism for actuating said platen, central dies coöperating with the main dies on one of said carriers, and a plunger for actuating said central dies, said plunger operating through an opening in the anvil or platen and being arranged to be withdrawn within said anvil or platen.

11. In a forging press, the combination of a pair of rotatable die carriers mounted on separate centers and overlapping in part, dies mounted on said carriers, mechanism for moving one of said carriers toward and from the other, a rotatable member having a splined connection with said movable carrier, and mechanism for intermittently rotating said rotatable member.

12. In a forging press, the combination of a rotatable die carrier, a head movably mounted adjacent to said carrier on a guide concentric with the center of said carrier, means on said head for engaging the carrier, and mechanism for reciprocating said head.

13. In a forging press, the combination of a rotatable die carrier, a head mounted adjacent to said carrier and moving in a guide concentric with the center of said die carrier, means on said head for engaging the die carrier, a flexible member connected to said head, and reciprocating mechanism connected to said flexible member.

14. In a forging press, the combination of a rotatable die carrier, pressure mechanism therefor, a detent or dog arranged to engage the carrier, a curved guide in which said detent moves, reciprocating mechanism, and a flexible carrier in said curved guide and connecting said detent and reciprocating mechanism.

15. In a forging press, the combination of a rotatable die carrier, a detent or dog arranged to engage the carrier, a curved guide in which said detent moves, reciprocating mechanism, a flexible connector in said guide and connecting the detent and reciprocating mechanism, and locking means for said carrier arranged to automatically lock the same and to be disengaged by the rotating mechanism.

16. In a forging press, the combination of two columns or standards, die carriers rotatably mounted on said columns and overlapping in part, mechanism for intermittently rotating said carriers, automatic mechanism for locking said carriers, and mechanism for causing said carriers to approach and recede from each other.

17. In a metal forging press, the combination of a vertically moving platen, two horizontal intermittently rotating die carriers mounted on separate centers and having their edge portions only overlapping, the bearings for said carriers being beyond the lines of the overlapping portions, and dies supported by said carriers.

18. In a metal forging press, the combination of a stationary anvil and a vertically moving platen, a horizontally but not vertically moving die carrier, and a die mounted in the carrier on yielding supports and thereby held out of contact with the anvil and adapted to be brought into contact with the anvil on the operation of the press.

19. In a metal forging press, the combination of an anvil and a vertically moving platen, two horizontal intermittently rotating carriers mounted on separate centers, dies supported by the carriers and adapted to be brought in line with each other between the anvil and platen, said dies being vertically movable in the carriers and adapted to contact with the anvil and platen, respectively, on the operation of the press.

20. In a metal forging press, the combina-

tion with the pressing elements, of a die carrier movable horizontally but not movable vertically with relation to one of the pressing elements, and a die mounted in the die carrier on yielding supports adapted to hold it out of contact with said pressing element, said die being vertically movable in the carrier and thereby adapted to contact with said pressing element on the operation of the press.

21. In a metal forging press, the combination with the pressing elements, of a movable die carrier and a die mounted therein on springs adapted to support a greater weight than the die and thereby hold it out of contact with the pressing element below it but adapted to contact therewith on the operation of the press.

22. In a metal forging press, the combination of pressing elements, a movable lower die carrier supporting a die on yielding supports adapted to carry a greater weight than the die, and a movable upper die carrier supporting a die on yielding supports not strong enough to carry the weight of the die, whereby the dies are held out of contact with pressing elements, and in the operation of the press are brought into contact therewith.

23. In a metal forging press, the combination of a pair of rotatable die carriers mounted on separate centers and having edge portions overlapping, dies mounted on said carriers, mechanism for imparting an intermittent rotary movement to each carrier, mechanism for causing said carriers to approach and recede from each other, and two or more coöperating guide members on the overlapping portions of said carriers having vertical faces opposed to each other to insure proper alinement of the dies.

24. In a metal forging press, the combination of a pair of rotatable die carriers mounted on separate centers and having edge portions overlapping, dies mounted on said carriers, mechanism for causing said carriers to approach and recede from each other, mechanism operating on each separate carrier for imparting an intermittent rotary motion thereto, locking mechanism for each separate carrier to hold it in approximately proper position, and coöperating guide members on the overlapping portions of the two carriers for causing exact alinement of the dies.

In testimony whereof, I the said ANDREW CHRISTIANSON have hereunto set my hand.

ANDREW CHRISTIANSON.

Witnesses:
ROBERT C. TOTTEN,
JOHN F. WILL.