July 26, 1927.

G. P. THOMAS

1,637,013

METAL PUNCHING APPARATUS

Filed July 1, 1925

5 Sheets-Sheet 1

FIG. 1.

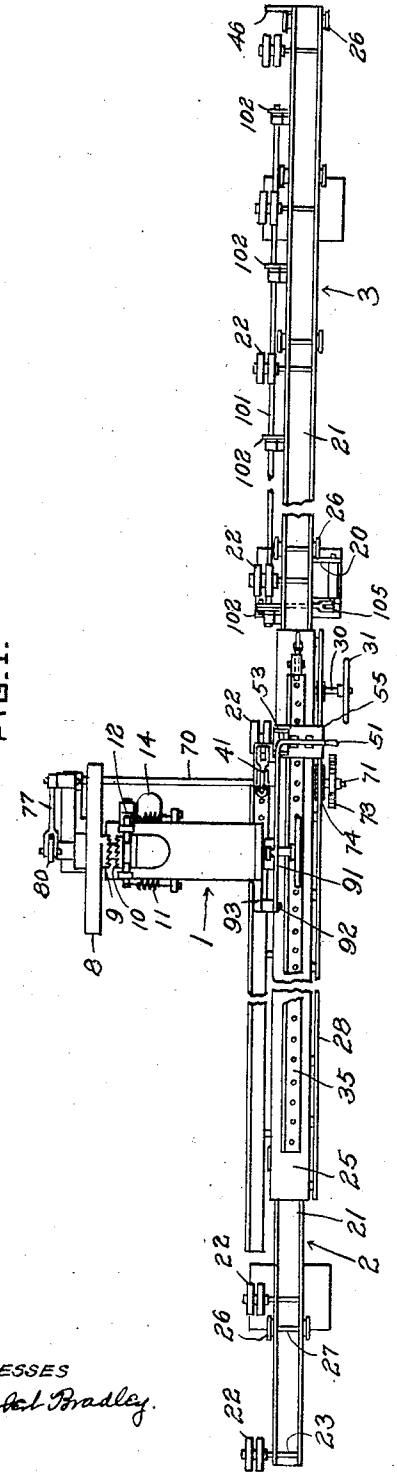
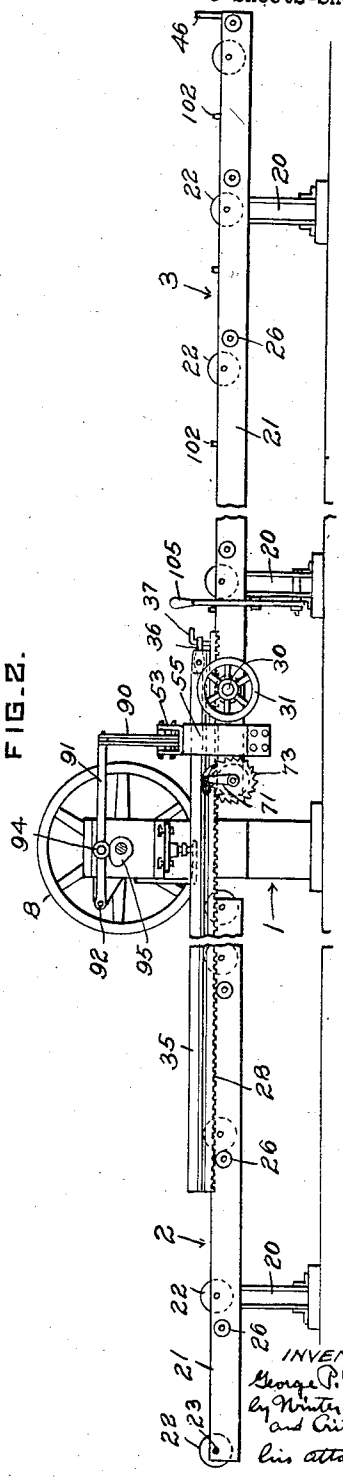


FIG. 2.



WITNESSES

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METAL PUNCHING APPARATUS

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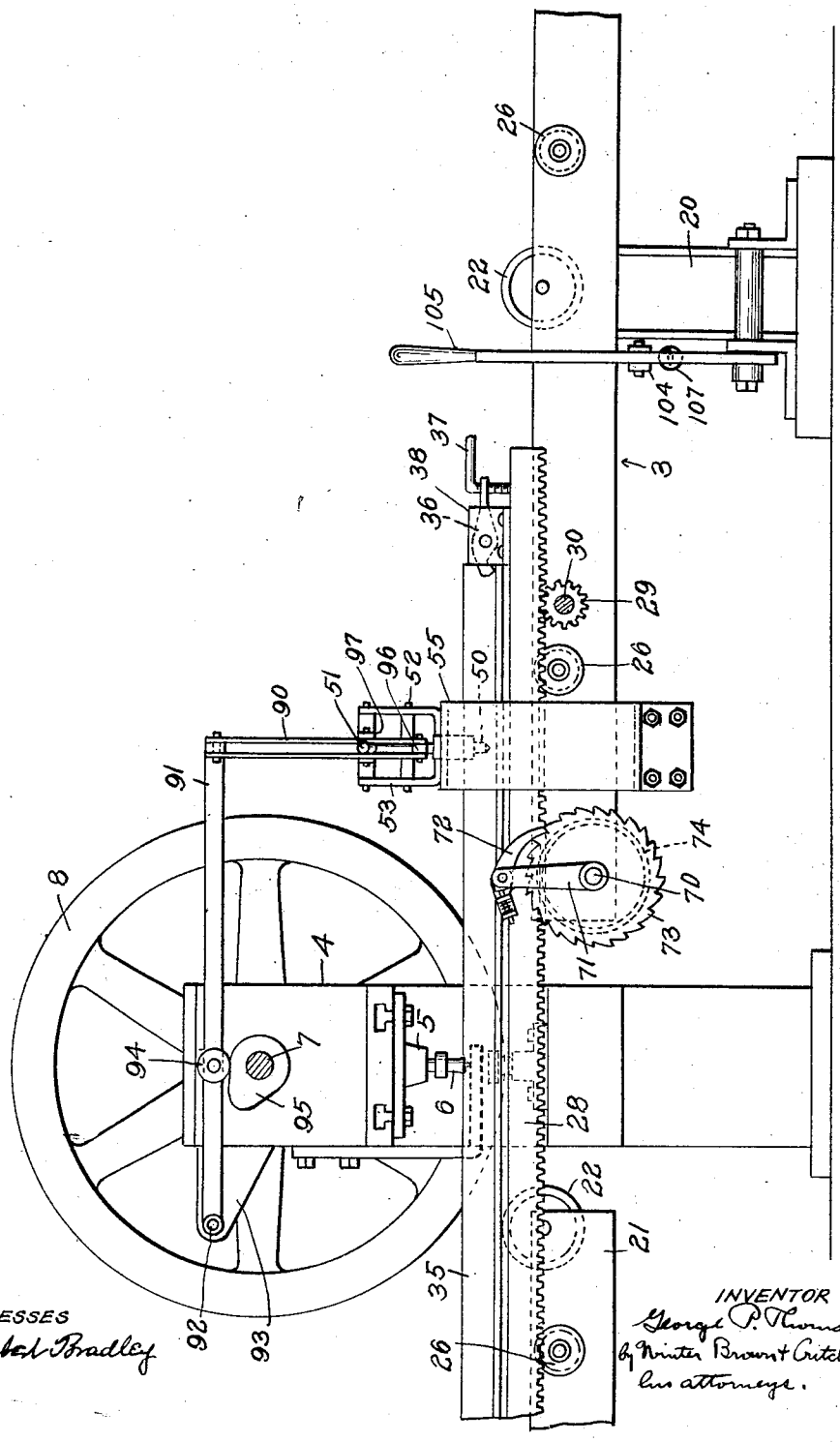


FIG. 3.

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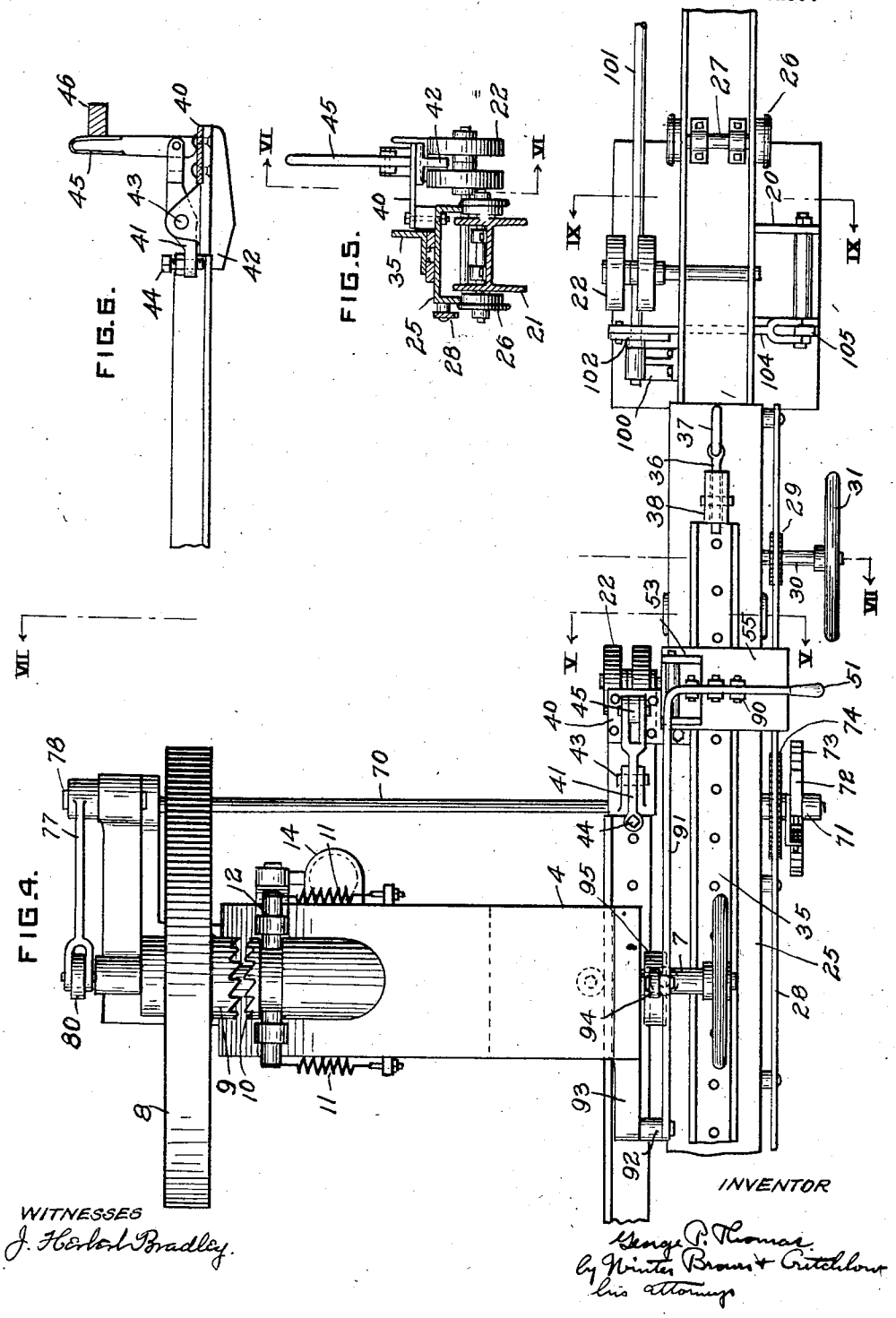
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METAL PUNCHING APPARATUS

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FIG. 8.

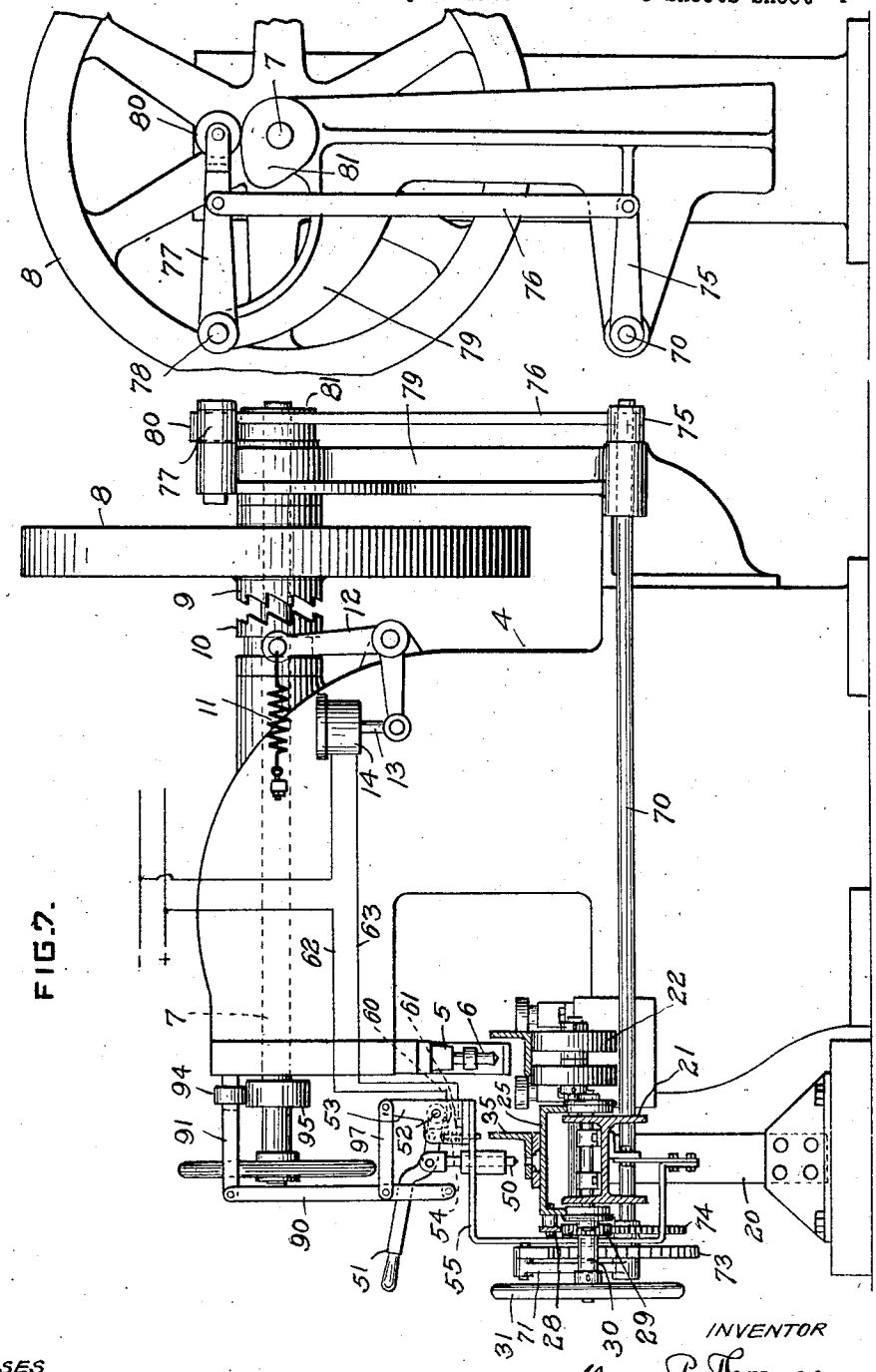


FIG. 7.

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METAL PUNCHING APPARATUS

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FIG. 10.

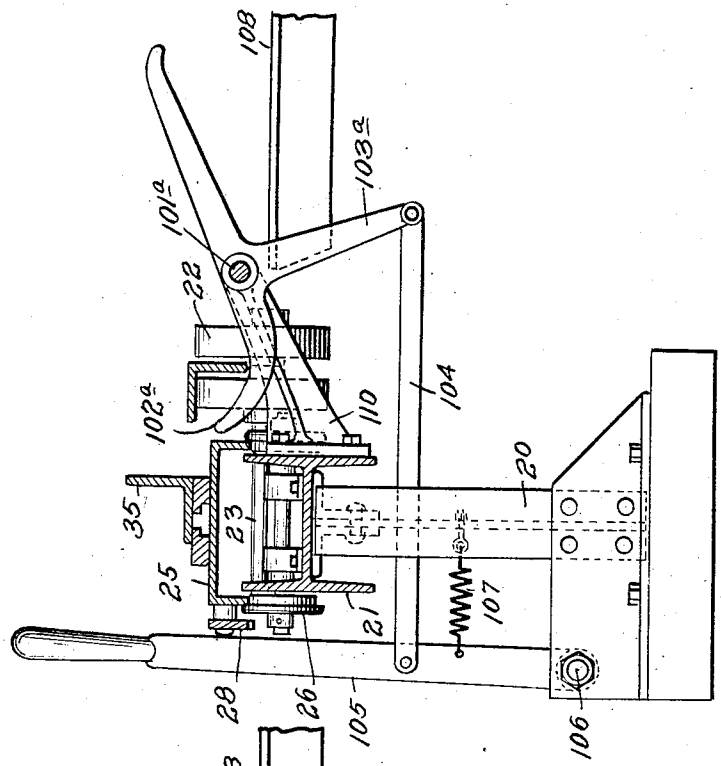
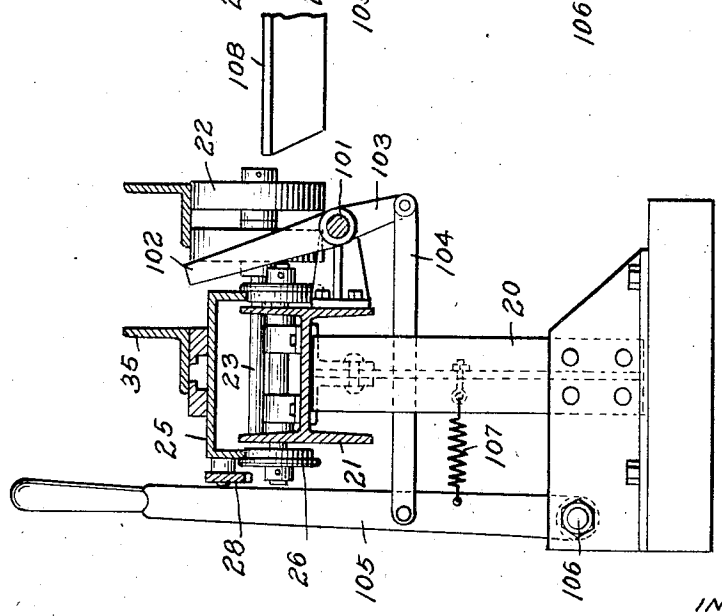


FIG. 9.



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Patented July 26, 1927. 1,637,013

UNITED STATES PATENT OFFICE.

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METAL-PUNCHING APPARATUS.

Application filed July 1, 1925. Serial No. 40,821.

The invention relates to machinery or apparatus for punching or otherwise perforating a plurality of metal blanks so that they will have a like arrangement of rivet or bolt holes.

An object is to provide an improved and simplified machine of the type stated, which, although broadly unlimited to any particular use, is especially suitable for small shops or for perforating small work in large shops.

A further object is to provide a machine in which, after a perforating operation, the initial movement of a work carriage for a further perforating operation is effected, and its inertia consequently overcome, by mechanical connections coordinated with the perforating apparatus, and in which the final movement of the carriage to properly position a blank for a succeeding perforating operation is effected manually.

A further object is to improve the mounting, construction and operation of finder-pin mechanism for machinery of this sort, to the end that when a long perforated templet is used the finder-pin may be moved transversely of the templet to compensate for lateral distortions or displacements of the templet or of its perforations, and also to the end that when the initial movement of the carriage is effected mechanically the finder-pin may be mechanically withdrawn from a templet perforation before the carriage is moved.

A further object is to provide an improved unloader for machinery of the type here contemplated.

The invention is illustrated in the accompanying drawings, of which Figs. 1 and 2 are a plan view and front elevation, respectively, of the complete apparatus; Fig. 3 a front elevation of the punch and the spacing table and mechanism adjacent to it shown in the central portion of Figs. 1 and 2; Fig. 4 a plan view of the apparatus shown in Fig. 3; Fig. 5 a transverse sectional view taken on the line V—V, Fig. 4; Fig. 6 a detail sectional view taken on the line VI—VI, Fig. 5; Fig. 7 a side view of the punch and a transverse sectional view of the spacing mechanism, the plane of view being indicated by the line VII—VII, Fig. 4; Fig. 8 a right end view of the punch as seen in Fig. 7; Fig. 9 a transverse sectional view of the right hand portion of the work table showing the construction of an unloader, the plane of view being indicated by the line IX—IX, Fig. 4; and Fig. 10 a view corresponding to Fig. 9 showing a modification of construction.

The invention is illustrated in its applicability to apparatus for punching a line of holes in an elongate blank, such as a structural steel angle, channel, plate and the like, although some of the features of the invention are applicable to apparatus for punching or otherwise perforating wider blanks. The apparatus includes a punching machine 1 and a work table which is preferably formed in two sections, a section 2 at the left and a section 3 at the right of the punch.

The punch may be of any desired form or construction. As shown particularly in Figs. 3, 4 and 7, it comprises a frame 4 of the horseshoe type having a vertically reciprocable punching head 5 equipped with a punching tool 6, the head being adapted to be reciprocated in the usual manner by an eccentric on a shaft 7 to which rotation may be imparted by a driving or power wheel 8 rotatably mounted on the shaft. For establishing driving connection between the wheel 8 and shaft 7, the wheel is provided with a clutch element 9, and the shaft has splined on it for longitudinal movement a clutch element 10 normally urged towards clutch-breaking position by springs 11 and adapted to be moved into clutch-making position by a bell crank lever 12. The upwardly extending arm of this lever is provided with a yoke-engaging clutch element 10, and the other arm may be attached to an armature 13 of an electromagnet 14 adapted to be energized in a manner presently to be explained. The construction and operation of the clutch somewhat diagrammatically illustrated in the drawings is fully disclosed in my pending application Serial No. 28,797, filed May 8, 1925. However, I desire to have it understood that my present invention is unlimited to any particular form of clutch for the punching or perforating machine.

As far as concerns some features of the invention the work table may be variously constructed. However, for the sake of simplicity of construction and consequent economy of manufacture, and also for ease of operation of a work and templet moving carriage supported by the table, the table preferably comprises a plurality of pedestals 20 and H-sections 21 attached to the upper ends of the

pedestals with the webs of these sections disposed horizontally. The side of the table adjacent to punch 1 is provided with a plurality of work-supporting rollers 22, preferably arranged in pairs with the elements of each pair spaced apart. The pairs of work-supporting rollers may be conveniently mounted rotatably upon shafts 23 extending through the upwardly extending flanges of the H-sections.

Mounted upon the two sections 2 and 3 of the work table, and adapted to be moved longitudinally on them, there is a templet and work carriage which for simplicity of construction preferably comprises a channel 25 having its flanges extending downwardly and resting upon grooved rollers 26 rotatably mounted upon rods or shafts 27 supported by the upwardly extending flanges of the H-sections. The outside flange of channel 25 is provided with a rack 28 which meshes with a pinion 29 attached to a shaft 30 which may be rotated by a hand-wheel 31 to move the carriage longitudinally of the table.

A plurality of spaced elements are borne by the carriage for engagement by a finder-pin or finger which is attached to the table and is manually movable into engagement with these elements to position the carriage for blank-perforation. These elements preferably take the form of perforations in an elongate strip, such as an angle 35 illustrated as being mounted upon the back of channel 25. This perforated templet angle may be, and preferably is, the first of a plurality of blanks which it is desirable to provide with a like arrangement of holes. This first blank may be punched in the usual manner by hand, and thereafter used as a templet on the machine. The templet 35 may be attached at its forward end to the forward end of carriage 25 by means of a suitable clamp 36 (Fig. 3), which may be tightened upon the templet angle by a hand screw 37, and may be mounted in a block 38 attached to the carriage.

It has been previously explained that blanks to be punched are supported upon rollers 22. For moving a blank through the punching machine and transversely of the line of reciprocation of its head, the blank is attached to carriage 25 preferably by a single clamp at the forward end of the carriage. As shown particularly in Figs. 5 and 6, this clamp comprises a resilient plate 40 extending laterally from carriage 25 and having attached to its outer end a pair of jaws 41 and 42 pivoted to each other at 43. The inner end of jaw 41 may be provided with an adjustable set screw 44 so that the clamp may firmly engage blanks of different thicknesses, and its outer end may have pivotally connected to it an arm 45, the upper end of which lies in the path of a trip finger 46, and the lower end of which bears upon the top of plate 40. Trip finger 46 is arranged at or near the outer end of table section 3 in a position to be struck by arm 45 to release clamping jaw 41 during the movement of the carriage after the last hole has been punched in a blank. By connecting the blank-engaging clamp to carriage 25 through a resilient plate 40, such plate may yield vertically to compensate for any irregularities in the horizontal alignment of blank-supported rolls 22.

As seen particularly in Fig. 7, a vertically reciprocable finder-pin 50 is arranged adjacent to punch 1 and above carriage 25 and templet 35. At its upper end this finder-pin is pivotally attached to a hand lever or arm 51, which in turn is pivotally connected at 52 to a bracket 53, and is yieldingly held upwardly by means of a spring 54. Bracket 53, as well as finder-pin 50, are mounted upon the horizontal portion of an arm 55 which is preferably U-shaped and is preferably securely attached to the lower face of the table in a plane in vertical alignment with the finder-pin. It occasionally happens that a long templet such as angle 35 is slightly bent, so that the perforations in it do not lie exactly in a straight line. To compensate for this and any other lack of straight alignment of the templet perforations, arm 55 is preferably formed of resilient metal so that when upon the lowering of lever 51 the lower tapered end of finder-pin 50 engages the side of a templet perforation, the further downward movement of the hand lever will cause arm 55 to yield transversely of the templet and carriage to permit the finder-pin to fully enter the perforation. By forming arm 55 of resilient metal and of the general U-shape shown in Fig. 7, the finder-pin may be properly moved transversely of a templet.

As is customary in apparatus of the general type herein disclosed provision is made for setting punch head 5 in operation as soon as the finder-pin fully enters a templet perforation. For this purpose hand lever 51 is provided with a contactor 60 adapted to make contact with a contactor 61 mounted upon bracket 53 when such lever is moved downwardly to a position in which the finder-pin 50 lies fully within a templet perforation. These contactors close a circuit through conductors 62 and 63 in circuit with electro-magnet 14. It will be understood that when the electro-magnet is so energized clutch element 10 is thrown into engagement with its cooperating element 9 to cause shaft 7 to rotate a complete revolution.

It has been explained that carriage 25 may be moved longitudinally upon table 2, 3, by the manual rotation of hand wheel 31. It will be readily understood that after the car-

riage has been brought to rest for a punching operation considerable effort is required to overcome its inertia to set it in motion again. Furthermore, during a punching operation a burr is usually formed on the die side of a blank, and this burr partially enters the die and offers considerable resistance to the initial movement of the carriage. A further feature of this invention has to do with the provision of mechanism coordinated with the reciprocation of the perforating tool or punch head for mechanically setting the carriage in motion just after the tool has been withdrawn from a perforation which it has made. In addition to facilitating the movement of the carriage, this setting of the carriage in motion just after the perforating tool has been withdrawn has the effect of speeding up the entire perforating operation, because the workman who finally positions the carriage for each punching operation will, in case an initial movement is mechanically imparted to the carriage, immediately follow that movement up by the necessary manual movement of the carriage to position the blank for a succeeding punching operation.

The preferred mechanism for mechanically imparting initial movement to the carriage is illustrated particularly in Figs. 3, 4, 7 and 8. At the side of punch frame 4 there is mounted a rock shaft 70, the outer end of which has attached to it the inner end of an arm 71, which arm is provided at its outer end with a pawl 72 spring pressed toward a ratchet wheel 73. Formed as a part of, or rigidly connected to this ratchet, there is a pinion 74 which engages rack 28 attached to carriage 25, and both the ratchet wheel and pinion are rotatably mounted on shaft 70. Projecting laterally from the inner end of shaft 70 there is an arm 75 connected by a link 76 to an arm 77 pivoted at 78 to a bracket 79, arm 77 being provided at its outer end with a roller 80 resting upon a cam 81 attached to punch shaft 7. The position of cam 81 upon shaft 7 is such that just after punch 6 is withdrawn from a perforation which it has made, the projection of the cam will raise arm 77, and through link 76 and arm 75, will rotate shaft 70 to cause pawl 72 to rotate ratchet wheel 73. This rotation of the ratchet wheel causes pinion 74 to move carriage 25. The amount of this carriage movement is not more than the minimum permissible spacing of holes, and therefore the final positioning of the carriage for a succeeding punching operation must, in most cases, be effected manually by the rotation of hand wheel 31, or by equivalent mechanism.

When in the practice of this invention initial movement is given to the carriage by the mechanism just described, or by equivalent mechanism, provision is made for mechanically removing the finder-pin from a templet perforation or element before the carriage is set in motion. This is to avoid injury to the finder-pin in case a workman should fail to release the finder-pin operating lever 51 before the carriage is mechanically set in motion.

The preferred mechanism for this purpose is particularly illustrated in Figs. 3, 4 and 7. As there shown, a link 90, comprising a pair of bars arranged one on each side of arm 51, is connected at its upper end to the outer end of an arm 91 pivotally connected at 92 to a bracket 93 attached to punch frame 4. Intermediate of its ends, arm 91 is provided with a roller 94 which rests upon a cam 95 attached to punch-operating shaft 7. Between the lower ends of the bars which form links 90 there is a spacer or block 96 which, upon the upper movement of link 90, engages arm 51 to raise it in case the arm is in a downward position. The position of cam 95 upon shaft 7 is such that, through arm 91 and link 90, finder-pin operating arm 51 will be positively raised to remove the finder-pin from a templet perforation before the carriage is mechanically set in motion by the mechanism explained above. If desired, link 90 may be held in its indicated vertical position by a link 97 which connects it to bracket 53. It will be understood that after link 90 has been raised to move arm 51 upwardly, the link is promptly returned to its downward position to permit the arm to be moved downward manually to cause the finder-pin to enter a succeeding templet perforation.

A further feature of the invention has to do with the provision of improved unloading mechanism, that is to say mechanism for removing a completely perforated blank from the blank-supporting rollers 22 of table section 3. The mechanism for this purpose is illustrated particularly in Figs. 3, 4 and 9. Rotatably mounted in brackets 100 attached to the inner flange of H-section 21 there is a shaft 101 provided with a plurality of fingers 102 which normally lie in the positions shown in Fig. 9 with their upper ends above the blank-supporting plane of rollers 22. Attached to and depending from shaft 101 there is an arm 103 connected by a link 104 to a hand lever 105 pivotally attached at 106 to the bottom of a table support 20. Normally lever 105 is urged towards the table by a spring 107, and in consequence thereof fingers 102 are normally urged to the positions indicated in Fig. 9, or in other words outside of the longitudinal path of movement of a blank resting upon rollers 22. After a blank has been punched and clamping jaw 41 (Fig. 6) has been released either automatically or manually, lever 105 may be pulled outwardly to cause fingers 102 to move the blank laterally from rollers 22 and cause it to fall upon suitable skids or supports 108.

Not infrequently it is desirable to punch flanged members, such as angles, with their vertical legs downwardly rather than upwardly as shown in Fig. 9. When the blanks are so positioned for punching, it is necessary to raise their downwardly extending flanges above rollers 22 before the blanks can be moved laterally. Accordingly, in Fig. 10 there is shown a modified form of unloader in which shaft 101ª is supported by brackets 110 outside of rollers 22 and at a higher elevation than shaft 101 of Fig. 9. Shaft 101ª is provided with fingers 102ª so positioned that when the shaft is rotated they will rise to lift the downwardly turned flange of a blank above the plane of the tops of rollers 22, and then cause the blank to move laterally upon the rolls. Fingers 102ª preferably extend also to the right of shaft 101ª as viewed in Fig. 10 to form downwardly inclined skids for a blank to direct it to supports 108.

In the operation of the machine a templet 35 is attached to carriage 25 by clamp 36 (Fig. 3) and a blank resting upon rollers 22 is attached to the forward end of the carriage by clamping jaws 41, 42, (Fig. 6). Thereafter hand wheel 31 is rotated to bring the first of the templet perforations into registration with finder pin 50. Arm 51 is then lowered to cause the finder-pin to enter the perforation, and when it has completely entered, contactor 60 of arm 51 makes contact contactor 61 of bracket 53 to close the circuit through electro-magnet 14. Through armature 13 and lever 12, this energizing of the electro-magnet becomes effective to move clutch element 10 into engagement with clutch element 9 to cause a complete rotation of punch shaft 7. Before the punching operation is completed, cam 95 raises arm 91 and link 90 attached to it to lift arm 51 so as to remove finder pin 50 from the perforation which it had entered, in case the workman had not previously released arm 51. Just after punch 6 is withdrawn from the perforation it has made, the carriage is set in motion by the pawl-and-ratchet mechanism shown in Figs. 3, 4, 7 and 8. This mechanism is actuated by cam 81, and comprises arm 77, link 76, arm 75, shaft 70, arm 71, pawl 72, ratchet wheel 73, and pinion 74. After the initial movement of the carriage has been thus mechanically effected, the workman turns wheel 31 to position the next templet perforation below finder pin 50, and from this point on the next operation proceeds as that just explained. After a blank has been completely perforated, it is removed from its supporting rollers by pulling hand lever 105 outwardly, which results in the proper movements of fingers 102 or 102ª to move the blank laterally from rollers 22 so that it falls upon supports 108.

According to the provisions of the patent statutes, I have explained the principle and operation of my invention, and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced by other forms of construction than that particularly shown and described.

I claim as my invention:

1. In a metal punching apparatus, the combination of a reciprocable punching head provided with a punch, means for reciprocating said head, a work table, a carraige borne by said table for moving a blank transversely of the path of reciprocation of said punching head, a perforated templet attached to and movable with said carriage, a finder-pin manually movable into engagement with a perforation of said templet, mechanical driving connections extending from said head-reciprocating means to said carriage adapted after said punch has perforated a blank to initially move said carriage a limited distance less than a full spacing interval, and manually operable means for further moving said carriage the remainder of a spacing interval to bring a succeeding templet perforation into registration with said finder-pin.

2. In a metal punching apparatus, the combination of a reciprocable punching head provided with a punch, means for reciprocating said head, a carriage borne by said table for moving a blank beneath said head, a perforated templet attached to and movable with said carriage, a finder-pin mounted for vertical reciprocation and manually movable into engagement with a perforation of said templet, pawl-and-ratchet mechanism actuated by said head-reciprocating means for initially moving said carriage a limited distance less than a full spacing interval after said punch has perforated a blank, and manually operable means for further moving said carriage, the remainder of a spacing interval to bring a succeeding templet perforation into registration with said finder-pin.

3. In a metal punching apparatus, the combination of a punching head provided with a punch, means including a rotatable shaft for reciprocating said head, a work table provided with a plurality of rollers for supporting a blank, a carriage borne by said table and coextensive in length with a blank to be punched, means for attaching the forward end of a blank to the forward end of said carriage, a perforated templet coextensive in length with a blank to be punched borne by and movable with said carriage, a finder-pin mounted for vertical reciprocation and manually movable into engagement with a perforation of said templet to directly position a blank for perfo-

ration, a cam attached to said punch-reciprocating shaft, pawl-and-ratchet mechanism actuated by said cam for mechanically setting said carriage in motion after said punch has perforated a blank, and manually operable means for further moving said carriage to bring a succeeding perforation into registration with said finder-pin.

4. In a metal perforating apparatus, the combination of a reciprocable perforating tool, a work table, a carriage borne by said table for moving a blank transversely of the path of reciprocation of said tool, a plurality of spaced elements borne by said carriage for engagement by a positioning finger, a finger attached to said table and movable into engagement with said elements to directly and positively position said carriage for blank perforation, mechanism coordinated with the reciprocation of said tool for mechanically setting the carriage in operation after the tool has perforated a blank, and mechanism coordinated with the reciprocation of said tool for removing said finger from engagement with one of said elements before the movement of said carriage by said carriage-moving mechanism.

5. In a metal punching apparatus, the combination of a reciprocable punching head provided with a punch, a work table, a carriage borne by said table for moving a blank transversely of the path of reciprocation of said punching head, a perforated templet attached to and movable with said carriage, a finder pin manually movable into engagement with a perforation of said templet to directly and positively position said carriage for blank perforation, a mechanism coordinated with the reciprocation of said head for mechanically setting said carriage in motion after said punch has perforated a blank, and mechanism coordinated with the reciprocation of said head for removing said finder-pin from engagement with a templet perforation before the movement of said carriage by said carriage-moving mechanism.

6. In a metal punching apparatus, the combination of a punching head provided with a punch, a work table, means including a rotatable shaft for reciprocating said head, a carriage borne by said table for moving a blank transversely of the path of reciprocation of said punching head, a perforated templet attached to and movable with said carriage, a finder-pin manually movable into engagement with a perforation of said templet, mechanism coordinated with the reciprocation of said head for mechanically setting said carriage in motion after said punch has perforated a blank, a cam connected to said head-reciprocating shaft, and connections from said cam to said finder-pin for removing the finder-pin from a templet perforation before movement of said carriage by said carriage-moving mechanism.

7. In a metal punching apparatus, the combination with a reciprocable punching head provided with a punch, of a table provided at one side with a plurality of rollers for supporting a blank, and provided also with carriage-supporting rollers, an elongate carriage borne by said carriage-supporting rollers, a vertically yieldable plate extending laterally from said carriage and provided at its outer end with means for engaging a blank, a plurality of spaced elements borne by said carriage for engagement by a positioning finger, a finger attached to said table and manually movable into engagement with said elements to directly position said carriage for blank perforation, and means for moving said carriage upon said table.

8. In a metal punching apparatus, the combination with a reciprocable punching head equipped with a punch, of a work table comprising pedestals arranged at each side of said head and H-shaped sections supported on the pedestals with their flanges extending vertically, blank-supporting rollers at one side of said sections and supported by them, carriage-supporting rollers attached to the upwardly extending flanges of said sections, a carriage comprising a channel-shaped section having its flanges extending downwardly and resting upon said carriage-supporting rollers, means for attaching to said carriage a blank resting upon said blank-supporting rollers, a plurality of spaced elements borne by said carriage for engagement by a positioning finger, a finger attached to said table and manually movable into engagement with said elements to directly position said carriage for blank perforation, and manually operable means for moving said carriage upon said table.

9. In a metal punching apparatus, the combination with a reciprocable punching head equipped with a punch, of a table comprising pedestals arranged at each side of said head and H-shaped sections supported on the pedestals with their flanges extending vertically, blank-supporting rollers at one side of said sections and supported by them, carriage-supporting rollers attached to the upwardly extending flanges of said sections, a carriage comprising a channel-shaped section having its flanges extending downwardly and resting upon said carriage-supporting rollers, means for attaching to said carriage a blank resting upon said blank-supporting rollers, a perforated templet attached to the top of said carriage, a finder-pin mounted for vertical reciprocation and manually movable into engagement with a perforation of said templet to directly position said

carriage for blank perforation, and manually operable means for moving said carriage.

10. In a metal punching apparatus, the combination with a reciprocable punching head equipped with a punch, of a work table extending laterally from opposite sides of said head, and provided with blank-supporting rollers, a carriage borne by said table and provided with means for engaging a blank borne by said rollers, manually operable means for moving said carriage upon the table, an elongate perforated templet mounted on said carriage, a vertically reciprocable finder-pin for engaging the perforations of said templet, and means including a resilient arm yieldable transversely of said templet for attaching said pin to said table whereby said pin may be brought into proper registration with the templet perforations.

11. In a metal punching apparatus, the combination with a punching machine, of a work table having a plurality of work-supporting rollers at its side adjacent to the punching machine, a rotatable shaft extending longitudinally of and supported by said table and having a plurality of fingers attached to it in positions to engage a blank supported by said rollers, and means to rotate said shaft to cause said fingers to move a blank laterally from said rollers.

12. In a metal punching apparatus, the combination with a punching machine, of a work table having a plurality of work-supporting rollers at its side adjacent to the punching machine, a rotatable shaft extending longitudinally of said table at the sides of said rollers adjacent to the said punching machine, said shaft being provided with a plurality of fingers in positions to engage the lower portions of a blank supported by said rollers, and means to rotate said shaft to cause the said fingers to first raise and then move laterally from said rollers a perforated blank supported by the rollers.

In testimony whereof, I sign my name.

GEORGE P. THOMAS.