

Feb. 19, 1946.

W. WILSON

2,395,083

PRESS

Filed Aug. 30, 1943

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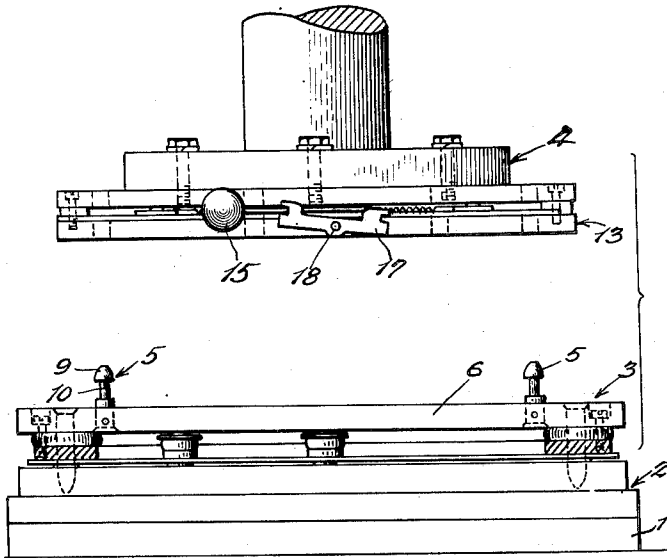


Fig. 1.

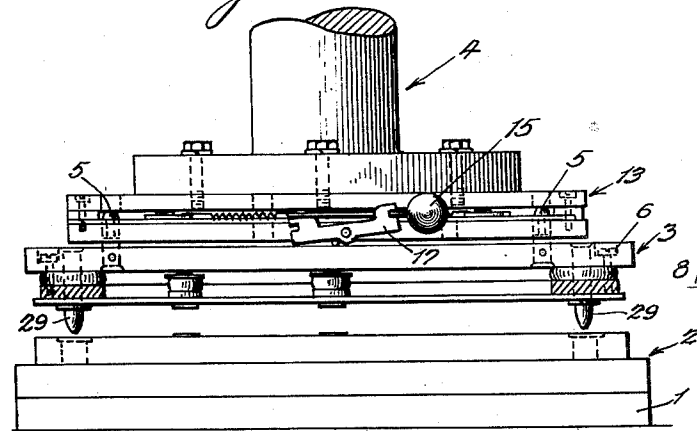


Fig. 2.

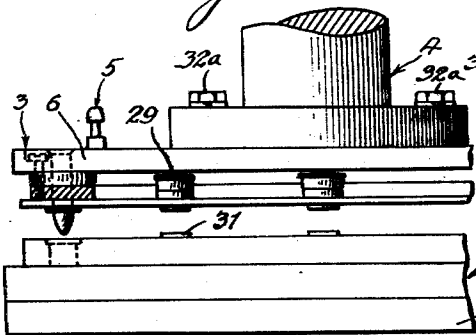


Fig. 6.

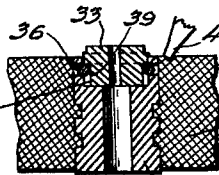


Fig. 8.

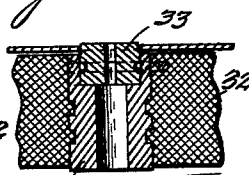


Fig. 9.



Fig. 10.



Fig. 11.

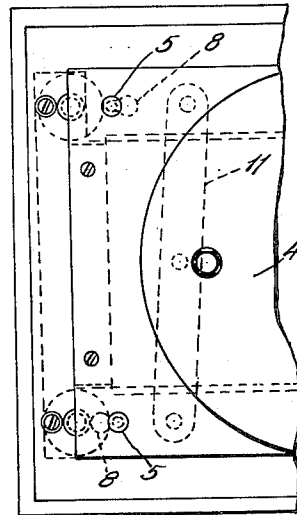


Fig. 3.

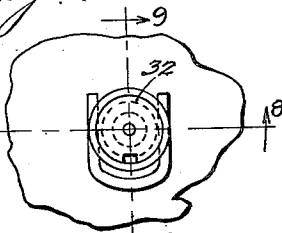


Fig. 7.

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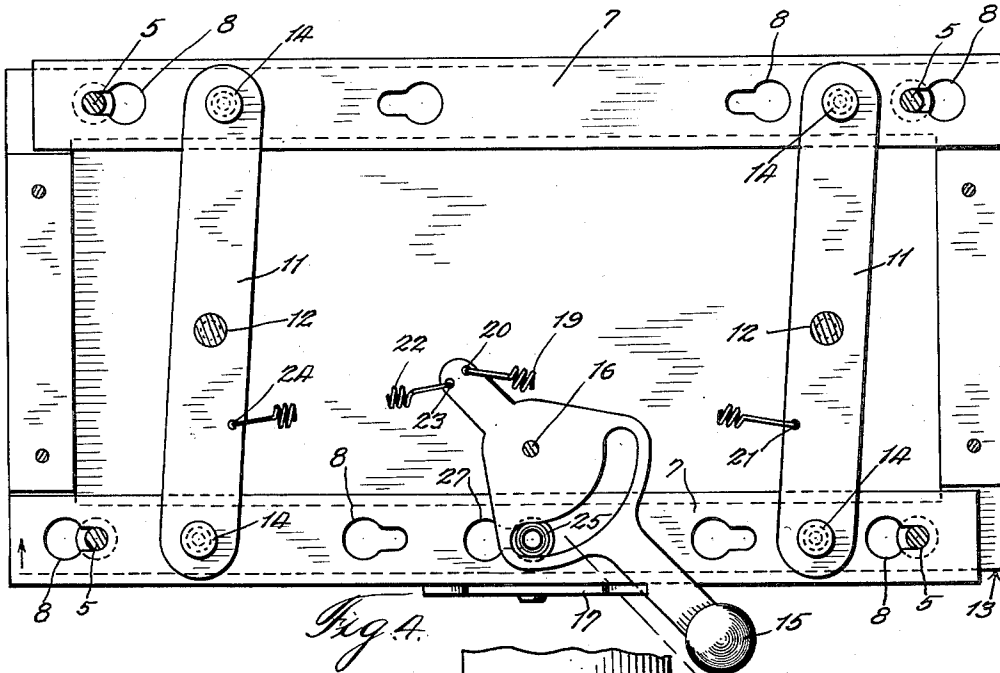


Fig. 4.

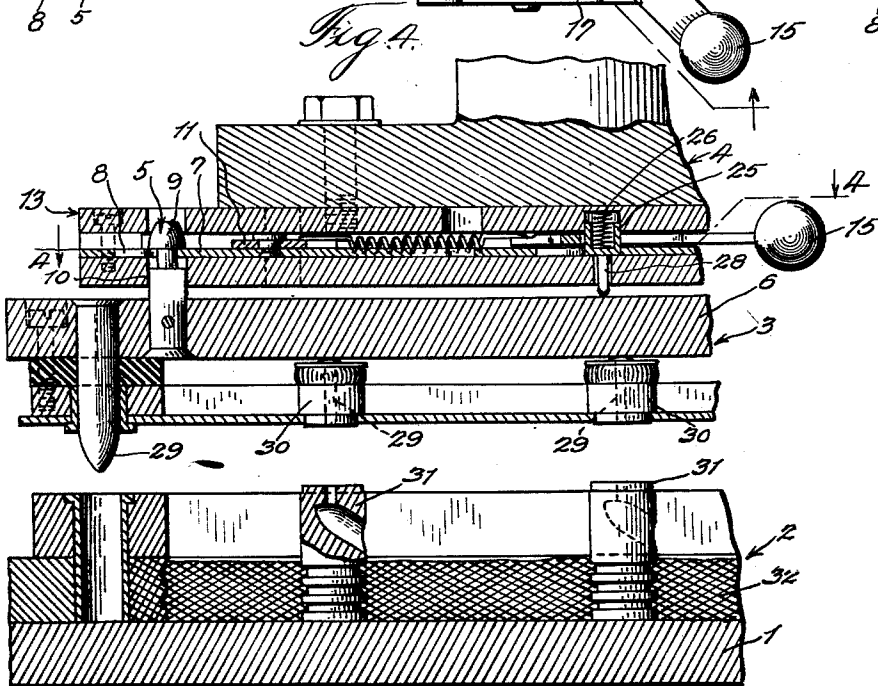


Fig. 5.

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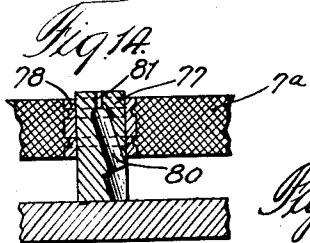
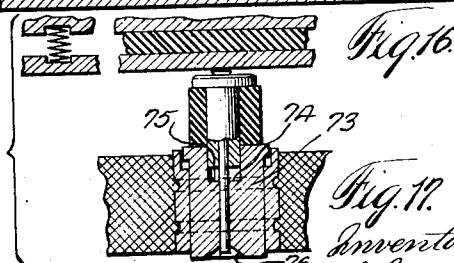
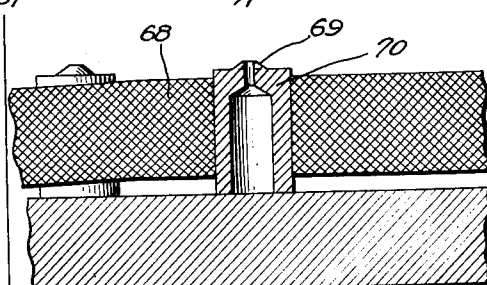
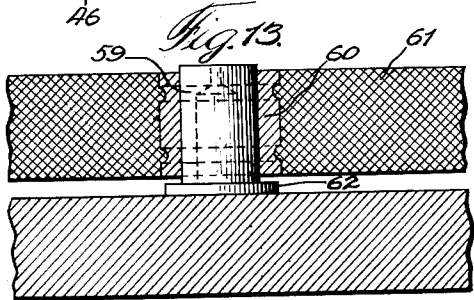
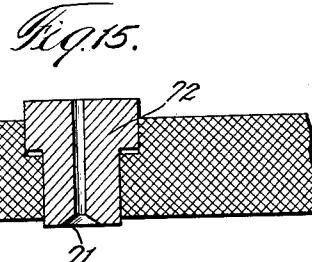
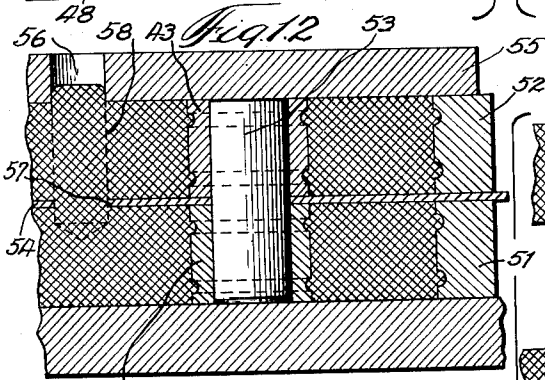
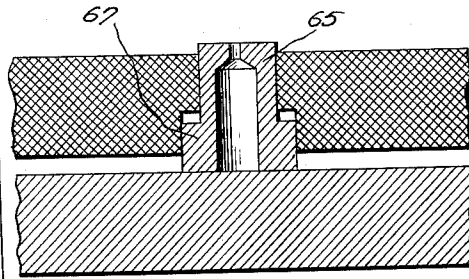
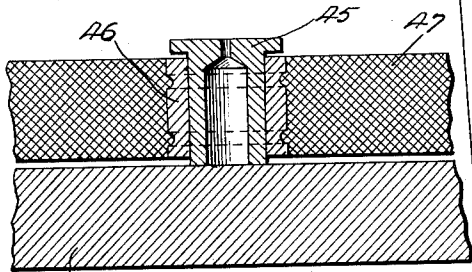
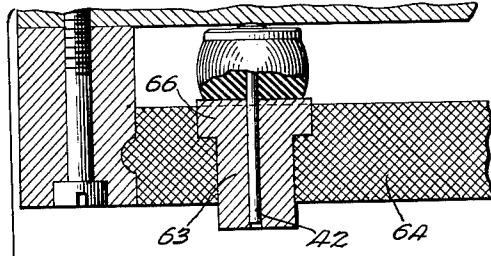
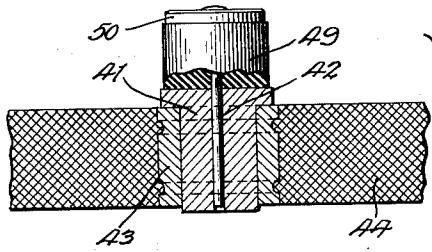


Fig. 10  
Fig. 11  
Fig. 12  
Fig. 13  
Fig. 14  
Fig. 15  
Fig. 16  
Fig. 17  
Fig. 18  
Fig. 19

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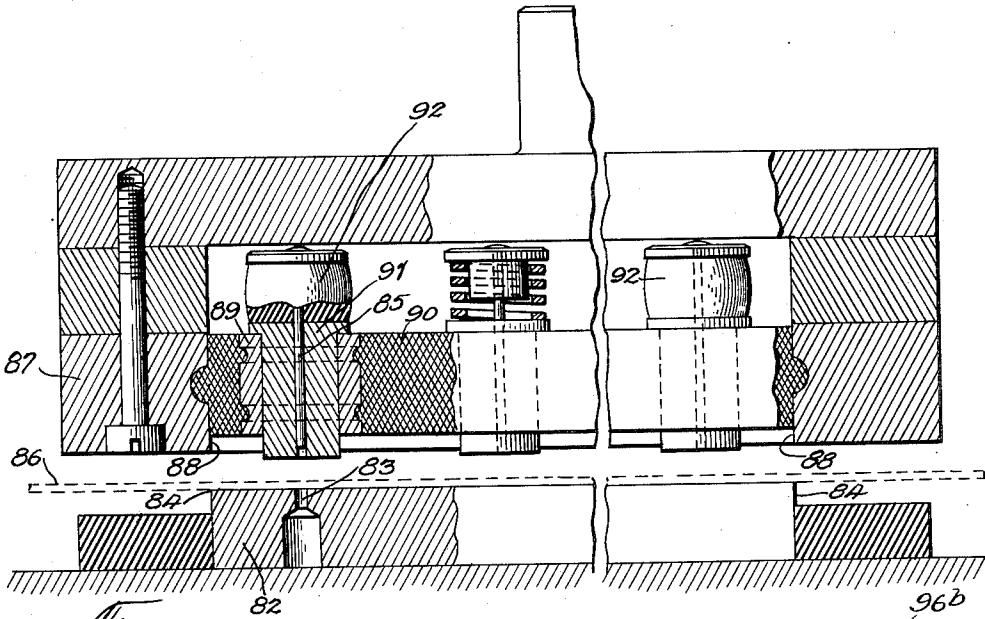


Fig. 18

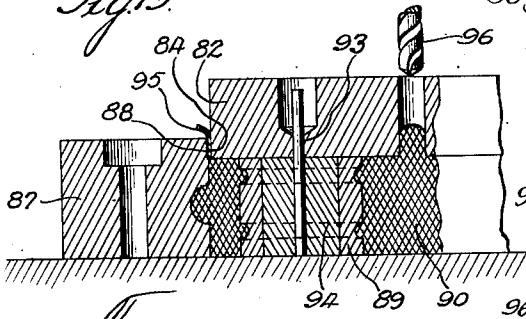


Fig. 19

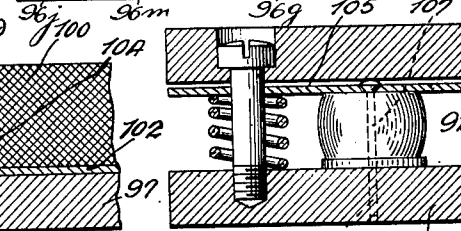
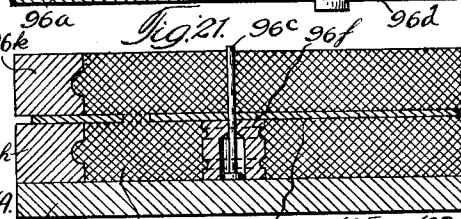
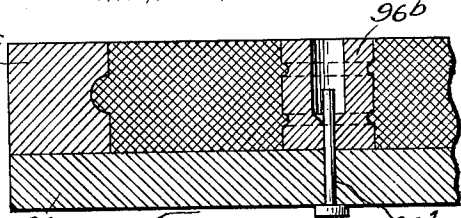


Fig. 20

Fig. 21

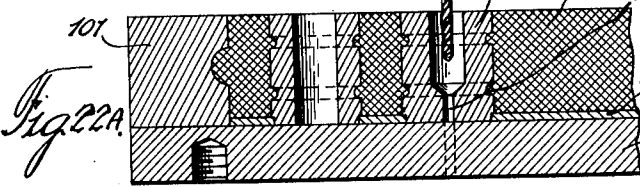


Fig. 22A

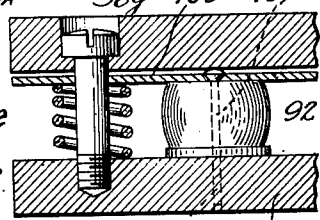


Fig. 22B

Fig. 23

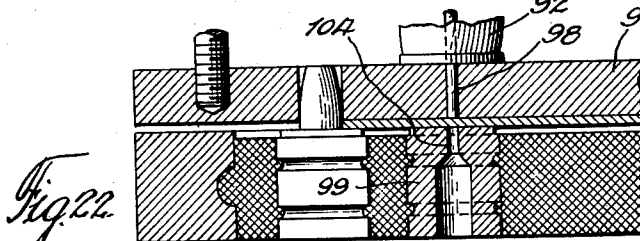


Fig. 24

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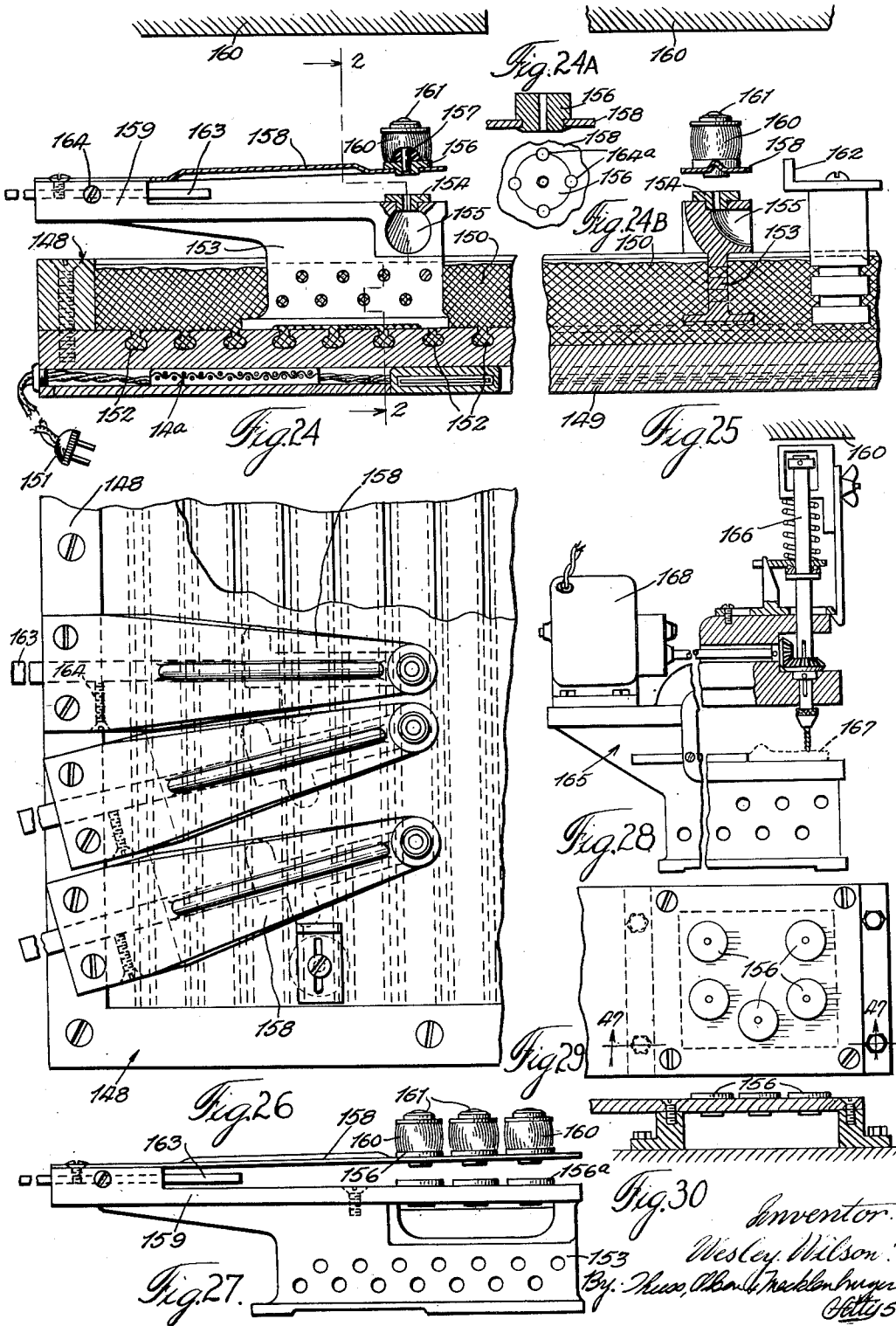
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5 Sheets-Sheet 5



Inventor:  
 Wesley Wilson:  
 By: *[Signature]*  
 Attys:

# UNITED STATES PATENT OFFICE

2,395,083

PRESS

Wesley Wilson, Chicago, Ill.

Application August 30, 1943, Serial No. 500,531

36 Claims. (Cl. 164—90)

My invention relates to presses, such as punch presses and the like.

One of the objects of my invention is to provide a punch set having a lower punch guide and stripper plate, individual resilient punch retractors and an upper punch positioning and lifting plate on which the individual retractors press, whereby an even stripping action of all of the punches is obtained and the upper ends of the punches are held against tipping and tilting action.

A further object is to provide improved means for mounting punch and die elements in matrix material in such a way that the end thrust on the elements will not cause stress on the matrix material.

A further object is to provide an improved method for aligning bearing elements in matrix material.

A further object is to provide improved means for connecting and disconnecting a punch assembly with respect to a ram.

A further object is to provide improved means for controlling the movement of a press to provide a relatively rapid approach to the work and a slower work stroke.

Another object is to provide a multiple punch and die assembly in which a slidable concentric sleeve surrounds each punch of a construction in which the sleeve acts to guide the punch and also acts to strip the perforated metal from the punch after the punch has produced the perforation.

Another object is to provide a multiple of individual punch and die assemblies, each assembly of which is complete within itself and so constructed that the punch and die are always maintained in alignment, in which a matrix material is made to solidify around each of the assemblies so as to maintain the relative position of one to the other.

Another object is to provide as a part of a punch and die device an electrical heating element for liquefying the matrix material used for maintaining the relative positions of each of the individual punch and die assemblies.

Another object in a multiple punch and die assembly in which a matrix material maintains the relative alignment of the various punches and the various dies is to provide a means for avoiding the necessity of grinding the surfaces of the various punches and dies resulting from any warping which might occur during the assembly of other devices.

Another object in a multiple punch and die assembly in which the punches are held in rela-

tive positions through the use of a matrix material is to provide individual slidable stripper sleeves around each punch so as to avoid the necessity of mounting the punch guide assembly with a lost motion linkage to the punch press proper.

Another object is to provide a multiple punch and die assembly construction incorporating a matrix material having substantially neutral expansion qualities or shrinkage qualities on its solidification and aging.

Another object in a multiple punch and die assembly using matrix material for maintaining the relative positions of the punches and dies is to provide a replaceable sleeve construction so that either the individual dies or the individual punch guides may be replaced at will.

Another object is to provide in a multiple punch and die construction a templet for maintaining the relative positions of the individual dies while a matrix material solidifies around the dies and then using this templet for permanently maintaining the relative positions of the punches so that the alignment between the punches and the dies will be maintained when the die assembly is in operation.

Further objects and advantages of the invention will be apparent from the description and claims.

In the drawings:

Figure 1 is a side elevational view of a punch and die set showing the punch set disconnected from the punch-carrying head or ram;

Fig. 2 is a side elevational view similar to Figure 1, showing the punch set connected to the punch-carrying head;

Fig. 3 is a plan view of the construction shown in Figs. 1 and 2, showing the punch set connected with the punch-carrying head;

Fig. 4 is a horizontal sectional view substantially on the line 4—4 of Fig. 5, showing the latching mechanism for connecting the punch set to the punch-carrying head;

Fig. 5 is a section substantially on the line 5—5 of Fig. 4;

Fig. 6 is a view similar to Fig. 2, but showing how the punch set can be connected to the punch-carrying head without the use of the latching mechanism;

Fig. 7 is a detail plan view showing a construction for locking a die element to a die sleeve embedded in the matrix material;

Fig. 8 is a section on the line 8—8 of Fig. 7;

Fig. 9 is a section on the line 9—9 of Fig. 7;

Fig. 10 is a perspective view of a hardened die

element used in the construction of Figs. 7, 8 and 9;

Fig. 11 is a detail view of the locking element for the hardened die element of Fig. 10;

Fig. 12 is an axial sectional view through a punch and die construction;

Fig. 13 is a vertical sectional view showing how the punch and die set of Fig. 12 may be made;

Fig. 14 is an axial sectional view showing a somewhat different form of die from that shown in Fig. 12;

Fig. 15 is an axial sectional view showing a further modification of the punch and die set;

Fig. 16 is a vertical sectional view showing still another form of slidably mounted punch and die elements;

Fig. 17 is an axial sectional view showing a combination punch and embossing element different from that shown in Fig. 16;

Fig. 18 is an axial section showing another form of die;

Fig. 19 is a side view, partly in section, showing a combination shearing and punching die;

Fig. 20 is a vertical sectional view showing how the punch and die sets of Fig. 19 may be made;

Fig. 21 is a vertical sectional view showing another embodiment of my invention;

Fig. 21a is a vertical sectional view showing another embodiment of my invention;

Fig. 22 shows another form of punch and die set;

Fig. 22a shows how the punch and die set of Fig. 22 may be made.

Fig. 23 is a side view, partly in section, showing another form of punch set;

Fig. 24 is an elevational view, partly in section, showing a complete punch and die unit embedded in matrix material;

Fig. 24a is a detail axial sectional view through the punch guide sleeve;

Fig. 24b is a bottom view of Fig. 24a;

Fig. 25 is a section on the line 42—42 of Fig. 24b;

Fig. 26 is a plan view of the construction shown in Fig. 24;

Fig. 27 is a side elevational view of a punch and die unit which might be used in the construction of Fig. 24;

Fig. 28 is a side elevational view, partly in section, showing a drill press assembly which could be used in the matrix-containing box shown in Figs. 24 and 25;

Fig. 29 is a plan view of a multiple punch and die assembly which might be used with the matrix-containing box of Fig. 24; and

Fig. 30 is a vertical sectional view substantially on the line 47—47 of Fig. 29.

Referring to the drawings in detail, and first to the construction shown in Figs. 1 to 10, inclusive, this comprises a die set support 1, a die set 2 supported thereon, a punch set 3 cooperating with said die set, and a reciprocable punch holder 4 to which the punch set is detachably secured. The construction is such that when the punch holder 4 is raised, the punch set 3 may be slipped in place over the die set 2 and lowered down thereon to align the punch set with the die set, and the latch mechanism on the punch holder 4 may then be releasably biased so that when the ram is brought down toward the punch set the punch set will be latched automatically to the punch holder and thereafter will operate as a unit with the ram, moving up and down therewith. The construction is also so designed that when the punch set has been attached to the punch

holder, the latch mechanism can be releasably biased so that when the punch holder is brought down, the punch set will be unlatched automatically so that it will be deposited on top of the die set and the ram will move away from the punch set. The latching mechanism comprises a plurality of headed pins 5 secured to the pressure plate 6 of the punch set and extending upwardly therefrom, and a pair of latch slides 7 having keyhole slots 8 therein for cooperation with the heads 9 and necks 10 of the pins 5 on the pressure plate. In order to insure that the slides work simultaneously, they are connected by a pair of levers 11 pivotally mounted at 12 on a latch-supporting head 13 secured to the punch holder, these levers having loose pivotal connections at 14 with the slides. Movement of the slides 7 back and forth will effect latching and unlatching of the punch set 3 with respect to the punch holder 4. The manually settable biasing construction comprises a manually operable lever 15 pivotally mounted at 16 on the latch block 13, which can be set to either one of two positions. In one position of the lever 15, the latch means are biased toward latching position and in the other position the latch-operating levers are biased toward the unlatching position. A manually operable rocking latch 17 is provided for holding the manually operable lever 15 in either of the two positions, this latching lever being pivotally mounted on the latch frame 13 at 18 and having a notch in one end engageable with the arm of the lever 15 to hold the arm in the position shown in Figs. 2 and 4, to bias the latch-operating levers 11 toward latching position and having a notch in the other end for holding the lever 15 in position to bias the latch-operating levers 11 to unlatching position, as shown in Fig. 1. The biasing means comprise a spring 19 connected with the end of the lever 15 at 20 and connected with the latch-operating lever at 21 and a spring 22 connected with the operating or setting lever 15 at 23 and connected with the latch-operating lever at 24. The releasable means for holding the latch bars 7 against the biasing action either of the spring 19 or of the spring 22 comprise a spring-pressed releasable retaining sleeve 25, urged by the spring 26 toward engagement with one or the other of the enlarged ends of the dumbbell slot 27 in one of the latch bars 7, the sleeve 25 having secured thereto a release pin 28 extending down through an opening in the latch-carrying head 13 and engaging the pressure plate 6 of the punch set 3. With this construction, in order to connect the punch set 3 with the ram 4, the ram is raised to provide clearance between the die set 2 and the ram, and the punch set is then placed between the ram and die set and lowered down onto the die set, the leader pins 29 effecting registration of the punch set with the die set. The manual lever 15 is then moved to the position shown in Fig. 4, which places tension on the spring 19, biasing the latch bars 7 toward latching position. The latch bars, however, have previously been placed in unlatching position, in which position they are held by the engagement of the releasable spring-pressed retainer sleeve 25, which springs down into one of the enlarged portions of the dumbbell slot when the latching slides are moved to unlatching position. With the parts thus set the ram is moved downwardly to cause the tapering heads 9 of the latch pins to enter into the enlarged portions of the keyhole slots 8. Toward the end of the downward movement of the ram, the re-

tainer releasing pin 28 engages the pressure plate 6 and is moved upwardly relative to the latch bar 7 to move the latch sleeve 25 out of the enlarged portion of the dumbbell slot. When this takes place, the retainer sleeve 25 no longer holds the latch bars against the biasing action of the spring 19 and the latch bars therefore snap into latching position. The punch press can then be operated in the usual manner, the lower face of the latch frame 13 engaging the pressure plate 6 of the punch set and forcing the punches 29 downwardly and causing their lower ends to project from the bearing sleeves 30 and to enter the openings in the hardened die inserts 31 set in the solidified matrix material 32 in the die set.

To release the punch set from the latch plate, it is only necessary to set the latch-controlling lever 15 to the position shown in Fig. 1, in which the spring 22 will be biased to move the latch bars 7 to unlatching position. With this setting in the final downward movement of the punch holder 4, the lower face of the latch-carrying head 13 will approach the upper face of the pressure plate 6, causing the pin 28 to move the retainer sleeve 25 to releasing position, whereupon the spring 22, which is then biasing the lever 11 and latch bars 7 to unlatching position, will effect unlatching movement to release the punch set from the ram and lay it in place on the die set.

Fig. 6 shows how the punch set may be directly connected to the ram 4 by means of cap screws 32a extending through the flange of the ram and threaded into the pressure plate 6 of the punch set 3.

In Figs. 6 to 11 is shown a method of detachably securing a hardened punch-receiving die piece 33 to a die sleeve 34 which is set in the matrix material 32 of the die set. This construction comprises a U-shaped piece 35 of hardened material lying in parallel side grooves 36 in the upper end of the die sleeve 34 and embedded in the matrix material, the grooves 36 opening into the central counterbore 37 so that the opposing arms of the piece 35 are exposed to provide a bayonet joint connection with the hardened punch-receiving piece 33. This punch-receiving piece 33 has a flange 38 at its lower end flattened on opposite sides at 39 so that it can pass between the side arms of the U-shaped retainer and be turned so as to bring the unflattened portions of the flange 38 underneath the arms of the U-shaped retainer. The punch-receiving die piece may then be secured against rotation as by peening the matrix material against the punch-receiving die piece 33 as shown at 40 in Fig. 8.

In Fig. 12 is shown a construction in which the punch guide sleeve 41 for the punch 42 is slidably mounted in a bearing sleeve 43 embedded in the matrix material 44 of the punch set, and the hardened punch-receiving sleeve 45 of the die set is slidably mounted in a bearing sleeve 46 embedded in the matrix material 47 of the die set. This construction has certain advantages in that the hardened die piece 45 does not depend for support against endwise movement on the matrix material 47 but has its lower end bearing against a metal die plate 48 which takes the main strain of the punching operation and in that the end thrust on the punch guide sleeve 41 is not transmitted to the matrix material 44 of the punch set but is taken by the engagement of the punch guide sleeve 41 with the upper end of the die set sleeve 45. The punch 42 is slidably mounted in the punch guide sleeve 41 and is bi-

ased toward retracted position by a resilient element such as a coil spring or a piece of rubber 49 engaging the enlarged driven end 50 of the punch and bearing on the sleeve 41.

Fig. 13 shows a method of making the punch and die set of Fig. 12. In making the punch and die set a matrix-holding die frame 51 and a matrix-holding punch frame 52 are used. Before pouring in the matrix material the die sleeves 46 are set in the die frame, and aligning pins 53, the outside diameter of which is a little less than the inside diameter of the die sleeves, and punch sleeves are inserted into each of the die sleeves. A properly laid-out templet 54 is then placed over the upper ends of the aligning pins. The punch frame 52 is then put in position above the templet 52. The punch sleeves 43 are then slipped over the upper ends of the aligning pins 53. The cover 55 is placed over the matrix receptacle thus formed, and the matrix material is poured into the cavity through the opening 56 in the cover. The templet 54 is provided with an opening 57 so that the matrix material will fill the entire space within the receptacle, both around the die sleeves 46 and the punch sleeves 43.

In order to separate the punch set from the die set, the matrix material is drilled out as indicated in dotted lines at 58, thus severing the only connection between the matrix material in the upper half of the mold and the matrix material in the lower half of the mold.

Fig. 14 shows another form of punch-receiving die sleeve 59 slidably mounted in a bearing sleeve 60 embedded in the matrix material 61. This hardened sleeve 59 has an enlarged base portion 62 which prevents it from being drawn upwardly too far in case the punch sticks in the die on the upstroke of the punch.

Fig. 15 shows a punch and die set construction in which the punch sleeves are slidably mounted in the matrix material 64 itself and in which the hardened punch-receiving die pieces 65 also are slidably mounted in the matrix material. The slidable engagement may be effected after the matrix is poured around the punch and die sleeves by tapping the sleeves endwise in order to loosen them up. In this form the punch guide sleeve 63 is provided with an enlarged upper end 66 providing a shoulder which will prevent the sleeve from being forced out of the matrix material. The hardened die piece 65 also is provided with an enlarged lower end 67 to provide a shoulder which will prevent the die piece from being drawn upwardly too far in case the punch 42 sticks in the die 65.

Fig. 16 shows another form of punch and die construction in which the punch and die sleeves are slidably mounted in the matrix material itself. It will be noted in this figure that the matrix material 68 of the die is shown somewhat warped so as to be slightly nonparallel with respect to the die shoe. This warping is rather common, but, by providing a well-polished punch and die guide, a certain amount of vertical movement of the die is permitted so that each die can be forced down to rest firmly upon the flat die shoe surface. As each die sleeve is of the same height, this results in the working surfaces of the dies lying in substantially the same plane. This eliminates the need of surface grinding of the entire die assembly which would otherwise be necessary in order to insure that the working surface of the dies should lie in a common plane. This construction also shows a forming projection 69 on the die sleeve 70 and a recess 71 on

the punch guide 72 which results in forming the edge of the material being perforated into a conical shape. This can be such as to permit the use of a flathead screw or rivet so that the head of the screw or rivet will be flush with the surface of the material perforated.

Fig. 17 shows another form in which the slidable punch guide sleeve 73 has a shoulder 74 which engages a shoulder 75 of the punch after the lower end of the punch has perforated the material, so that further movement of the punch will effect positive movement of the punch guide sleeve 73 to cause the conical depression 76 on the lower end of the hardened punch sleeve 73 to cooperate with a conical projection on the die sleeve to form a conical countersink in the material operated on.

Fig. 18 shows another form of hardened die piece 77 which may be used in the die sleeve 78 embedded in the matrix 79. In this form a kick-out hole 80 is provided which may be drilled in from the lower end of the die piece to meet the punch-receiving opening 81 at the upper end of the die piece. With this construction the punchings can readily pass out from the die piece and avoid clogging.

Fig. 19 shows a construction in which the die set comprises a hardened plate 82 having punch-receiving openings 83 therein and having a peripheral shearing edge 84 which cooperates with the punch set for shearing out the shape of the sheet desired at the same time that the punches 85 are making the perforations in the sheet 86. The punch set comprises a matrix frame 87 having a shearing edge 88 which cooperates with the shearing edge 84 on the die plate in shearing out the shape desired. The punch set comprises the guide sleeves 89 embedded in the matrix material 90, the punch guide sleeves 91 slidably mounted in the sleeves 89, the punches 85 slidably mounted in the punch guide sleeves 91 and the resilient retractors 92 for withdrawing the punches after the punching operation.

Fig. 20 shows a method of making the punch set and die set of Fig. 19. The hardened die plate 82 is accurately drilled to provide the punch-receiving openings 83; the plate is formed to the desired outline of the shearing edge 84; the matrix-retaining frame 87 of the punch set is formed to have the desired shearing edge 88; the guide sleeves 89 are placed in position within the matrix frame and positioned accurately with respect to the die plate by means of aligning pins 93 and aligning sleeves 94 of a suitable diameter, and the matrix material 90 is poured in through the opening in the die plate to cause the sleeves 89 to be embedded in the matrix material. It will be noted that the aligning pin 93 is of the same diameter throughout. This necessitates that the holes in the plate 82 and in the sleeves 94 be of the same diameter. As the punch 85 itself should be somewhat smaller in diameter than the punch-receiving opening 83, it may be necessary to substitute for the sleeve 94 used in the aligning operation a sleeve having a somewhat smaller diameter of punch-receiving opening. If desired, shims 95 may be provided to secure the proper clearance between the shearing edges 84 and 88. After the matrix material has been poured in place and has solidified, the excess of matrix material in the filling opening may be drilled out by means of a drill, as shown at 96, to separate the die plate 82 from the punch set.

It is obvious that in the embodiment of my invention shown in Figs. 12 and 13, the punch guide

sleeve 41 and sleeve 43 might be made integral and the die sleeve 45 and sleeve 46 might be made integral, and a positioning pin of smaller diameter than the aligning pin 53 might be used in cooperation with a suitably perforated templet for holding the die sleeves and punch sleeves in position for pouring, as shown in Fig. 13.

In the embodiment of my invention shown in Fig. 21, the punch guide and stripper plate 96a is provided with properly located punch guide openings, and this punch guide and stripper plate is used as a templet for positioning the hard die sleeves 96b in the matrix-holding frame 96c, a suitable aligning pin or punch 96d being inserted through the punch guide openings and through the punch-receiving opening in the dies to hold the die sleeves in position as the matrix material is poured around them.

In Fig. 21a is shown a vertical cross section of an embodiment of my invention in which aligning pins 96e are inserted through the die-receiving openings in the die sleeves 96f and through the positioning openings in the templet, the assembled dies and templet then placed in a matrix frame 96h in the position shown, with the sleeves resting on the bottom plate 96j of the matrix holder, an upper matrix frame 96k placed in position on top of the templet, and the matrix material 96m poured in around sleeves 96j and the upper portions of the aligning pins 96e. In this embodiment of my invention, the upper matrix material itself, held in the matrix frame, forms the punch guide and stripper plate. The positioning pins 96e are removed and in their place are inserted the individual punches, the diameter of which is the same as the diameter of the aligning pins which have been removed.

Fig. 22 shows a different construction in which the punch assembly plate 97 is accurately drilled to provide guide openings for the punches 98 and in which the die sleeves 99 are embedded in matrix material 100.

Fig. 22a shows a method of making the construction of Fig. 22. The hardened punch-receiving sleeves 99 of the die set are placed in a matrix-holding frame 101 and accurately positioned by means of a suitably laid-out templet 102, the templet 102, frame 101, and hardened die sleeves 99 resting on the hardened plate 97 which is to be drilled to form the punch guide plate. The parts are then securely fastened together; the matrix material is poured into the frame and allowed to harden, and the punch guide plate 97 is then drilled by means of a drill 103 of suitable size, using the punch-receiving openings 104 in the die sleeves 99 as templet means for positioning the drill 103 in the drilling operation.

Fig. 23 shows another form of punch guide construction which can be made by using the completed die assembly as a drill jig, as in Fig. 22a. In this case, two steel plates 105 and 106 are drilled, the lower plate 106 acting as a punch guide plate in a manner similar to that of Fig. 22, while the thinner plate 105 is used to maintain the relative position of the top parts of the punches 107 to take the place of the round washer-like plates used in other forms. One advantage of this construction is that where a number of holes are being punched, if one resilient stripper 92 does not supply sufficient power to withdraw the punch 107 from the work after it has made the perforation, the other adjacent strippers will assist in raising the punch, as they

all exert a force tending to raise the upper plate 105. This will result in an even stripper action of all of the punches, although a number of the resilient strippers 92 may have become quite weak. The upper plate 105 also tends to prevent any tipping or tilting action of the punches 107 as they operate in the punch guide holes 108, thus insuring a minimum amount of wear in the punch guide holes.

The construction shown in Figs. 24-30, inclusive, comprises a matrix holder 148 having an electric heating element 149 associated therewith in such a way that the matrix material 150 may be melted at any time desired, simply by plugging in the electrical connector 151 to supply current to the heating element. This enables the punch and die elements to be loosened up and shifted to any desired new position for new work. The bottom of the matrix frame may be provided with anchorage recesses 152 into which the matrix material may flow when solidified to anchor the material securely. The punch and die construction shown includes a unit having a base portion 153 to be embedded in the matrix material, a hardened die element 154 fitted in the base and provided with a kickout opening 155, and a spring mounted punch guide 156 and punch 157 also mounted on the base element. The punch guide 156 may be mounted on a leaf spring 158 secured to an arm 159 extending from the base. The punch is provided with a suitable type of resilient retractor 160 for withdrawing the punch 157 into the punch guide 156 when the pressure of the pressure plate 160 on the punch head 161 is relieved. Suitable adjustable gauges 162 may be provided to aid in positioning the work. If desired, the punch and die unit may be provided with an adjustable gauge bar 163 slidably mounted in a boss on the arm 159 and held in adjusted position by means of a set screw 164. With this construction, it will be seen that when a new setup of the punch and die units is desired, it is only necessary to plug in and melt the matrix material 150, shift the punch and die units to the desired position, and allow them to harden in position. The lower finished face of the base 153 rests snugly and smoothly on this finished upper face of the bottom of the matrix frame. The punch guide 156 may be secured to the spring 158 by a peening operation, as indicated at 164a in Fig. 24b.

Figs. 27, 29, 30 show a multiple punch and die assembly which can be used in the matrix-holding frame shown in Figs. 24 and 25. This is in general similar to the unit shown in Figs. 24 and 25, except that a plurality of hardened die elements 156 are provided and a plurality of individual punch guide sleeves 156 and punches 157 all mounted on a single leaf spring 158.

Fig. 28 shows a drill press assembly of a type which can be used in the matrix frame shown in Figs. 24 and 25. Here, instead of using multiple punch and die assemblies, a plurality of drill press assemblies 165 can be used, the matrix material acting to hold each drill press in accurate predetermined arrangement with respect to that of the other drill presses. The drill spindles 166 are forced down together to operate on the work 167 by means of the pressure plate 160. The drill spindle 166 is driven by its individual motor 168.

It is proposed that a matrix material of such specific gravity as to cause any steel or brass chips of metal to come to the surface, will be desirable as that will prevent any chips from ever

getting between the punch assemblies 153 and the non-wetting plate surface which supports said punch assemblies.

Further modifications will be apparent to those skilled in the art and it is desired, therefore, that the invention be limited only by the scope of the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A punch press apparatus comprising a die assembly, a punch assembly for cooperation with said die assembly, a reciprocable ram, and means for detachably securing said punch assembly to said ram comprising latch means, means for biasing said latch means toward latching position, and a releasable retainer for holding said latch means in unlatched position, automatically released by relative movement of the ram and punch assembly to enable the biasing means to cause the latch means to connect the ram with the punch assembly.

2. A punch press apparatus comprising a die assembly, a punch assembly for cooperation with said die assembly, a reciprocable ram, and means for detachably securing said punch assembly to said ram comprising latch means, means for biasing said latch means toward latching position, and a releasable retainer for holding said latch means in unlatched position, automatically released by movement of the ram to enable the biasing means to cause the latch means to connect the ram with the punch assembly.

3. A punch press apparatus comprising a die assembly, a punch assembly for cooperation with said die assembly, a reciprocable ram, and means for detachably securing said punch assembly to said ram comprising latch means, means for alternatively biasing said latch means either toward latching or unlatching position, and a releasable retainer for holding said latch means in unlatched position, automatically released by movement of the ram to enable the biasing means to cause the latch means to connect or disconnect the ram with respect to the punch assembly.

4. A punch press apparatus comprising a die assembly, a punch assembly for cooperation with said die assembly, a reciprocable ram, and means for detachably securing said punch assembly to said ram comprising latch means, means for alternatively biasing said latch means either toward latching or unlatching position, and releasable retainer means for alternatively holding said latch means either in unlatching or latching position, released by movement of the ram to enable the biasing means to cause the latch means either to latch or to unlatch the punch assembly with respect to the ram.

5. A punch press apparatus comprising a die assembly, a punch assembly for cooperation with said die assembly, a reciprocable ram, and means for detachably securing said punch assembly to said ram comprising latch means, means for biasing said latch means toward unlatching position, and a releasable retainer for holding said latch means in latched position, automatically released by movement of the ram to enable the biasing means to cause the latch means to disconnect the punch assembly from the ram.

6. A punch press apparatus comprising a die assembly, a punch assembly for cooperation with said die assembly, a reciprocable ram, and means for detachably securing said punch assembly to said ram comprising latch means, means for biasing said latch means toward latching position, and a releasable retainer for holding said latch

means in unlatched position, automatically released by relative movement of the ram and punch assembly to enable the biasing means to cause the latch means to connect the ram with the punch assembly, said punch assembly comprising punch guide means and punches slidably mounted in said guide means and said ram being provided with a pressure plate for effecting punching action of the punches by said relative movement.

7. A punch press apparatus comprising a die assembly, a punch assembly for cooperation with said die assembly, a reciprocable ram, and means for detachably securing said punch assembly to said ram comprising latch means, means for biasing said latch means toward unlatching position, and a releasable retainer for holding said latch means in latched position, automatically released by relative movement of the ram and punch assembly to enable the biasing means to cause the latch means to disconnect the punch assembly from the ram.

8. A punch press apparatus comprising a die assembly, a punch assembly for cooperation with said die assembly, a reciprocable ram, and means for detachably securing said punch assembly to said ram comprising latch means, means for biasing said latch means toward unlatching position, and a releasable retainer for holding said latch means in latched position, automatically released by relative movement of the ram and punch assembly to enable the biasing means to cause the latch means to disconnect the punch assembly from the ram, said punch assembly comprising punch guide means and punches slidably mounted in said guide means and said ram being provided with a pressure plate for effecting punching action of the punches by said relative movement.

9. A punch press apparatus comprising a die assembly, a punch assembly for cooperation with said die assembly, a reciprocable ram, and means for detachably securing said punch assembly to said ram comprising latch means, means for biasing said latch means toward latching position, and a releasable retainer for holding said latch means in unlatched position, automatically released by movement of the ram to enable the biasing means to cause the latch means to connect the ram with the punch assembly, said latch means comprising headed members mounted on the punch assembly and reciprocable bars mounted on the ram having keyhole slots for receiving said headed members.

10. A punch press apparatus comprising a die assembly, a punch assembly for cooperation with said die assembly, a reciprocable ram, and means for detachably securing said punch assembly to said ram comprising latch means, means for alternatively biasing said latch means either toward latching or unlatching position, and a releasable retainer for holding said latch means in unlatched position, automatically released by movement of the ram to enable the biasing means to cause the latch means to connect the ram with the punch assembly, said biasing means comprising a lever, and spring means acting between said lever and latch means.

11. A punch press apparatus comprising a die assembly, a punch assembly for cooperation with said die assembly, a reciprocable ram, and means for detachably securing said punch assembly to said ram comprising latch means, means for alternatively biasing said latch means either toward latching or unlatching position, a releasable

retainer for holding said latch means in unlatched position, automatically released by movement of the ram to enable the biasing means to cause the latch means to connect the ram with the punch assembly, said biasing means comprising a lever, and spring means acting between said lever and latch means, and means for latching said lever in position to bias the latching means to latching position.

12. A punch set comprising a first bearing sleeve embedded in solidified matrix material, a second bearing sleeve slidably mounted in said first sleeve, and a punch slidably mounted in said second bearing sleeve.

13. A die set comprising a bearing sleeve mounted in solidified matrix material, and a hardened die slidably mounted in said bearing sleeve.

14. A punch set comprising a first bearing sleeve embedded in solidified matrix material, a second bearing sleeve slidably mounted in said first sleeve, and a punch slidably mounted in said second bearing sleeve, said punch having a head for engagement by a driving element.

15. A die set comprising a bearing sleeve mounted in solidified matrix material, and a hardened die slidably mounted in said bearing sleeve, said die having a flat base portion for engagement with a flat support.

16. A die set comprising a bearing sleeve mounted in solidified matrix material, and a hardened die slidably mounted in said bearing sleeve, said die having an enlarged flat base portion for engagement with a flat support.

17. A punch set comprising a bearing sleeve embedded and slidably mounted in solidified matrix material, and a punch slidably mounted in said slidable bearing sleeve.

18. A die set comprising a hardened die having a slide portion of uniform cross section embedded and slidably mounted in solidified matrix material for movement longitudinally of the punch and having a base portion for engagement with a support.

19. A punch set comprising a first bearing sleeve embedded in solidified matrix material, a second bearing sleeve slidably mounted in said first sleeve, and a punch slidably mounted in said second bearing sleeve, said punch having a lost-motion engagement with said second sleeve, and said second sleeve having a forming face for forming the material after the punch has passed therethrough.

20. A punch and die set comprising a die block of hardened material having a peripheral shearing edge and having a plurality of punch receiving openings within its periphery having shearing edges for cooperation with the punches, and a punch block comprising a frame having a shearing edge for cooperation with the peripheral shearing edge of the die and punch elements embedded in solidified matrix material held within said frame and cooperating with said punch-receiving openings.

21. A punch set comprising a reciprocable ram, a combined punch guide and stripper plate resiliently mounted on said ram for lost-motion with respect thereto, a plurality of punches slidably mounted in guide holes in said punch guide plate, a punch lifting and positioning plate for retracting the punches into the punch guide plate when the ram pressure on the punches is released, and resilient means acting between the punch guide plate and the punch-lifting plate for causing retracting action of the lifting plate.

22. A punch set comprising a reciprocable ram, a combined punch guide and stripper plate resiliently mounted on said ram for lost-motion with respect thereto, a plurality of punches slidably mounted in guide holes in said punch guide plate, a punch-lifting and positioning plate for retracting the punches into the punch guide plate when the ram pressure on the punches is released, and resilient means acting between the punch guide plate and the punch-lifting plate for causing retracting action of the lifting plate comprising individual resilient means adjacent each punch.

23. A punch set comprising a reciprocable ram, a combined punch guide and stripper plate resiliently mounted on said ram for lost-motion with respect thereto, a plurality of punches slidably mounted in guide holes in said punch guide plate, a punch-lifting and positioning plate for retracting the punches into the punch guide plate when the ram pressure on the punches is released, and resilient means acting between the punch guide plate and the punch-lifting plate for causing retracting action of the lifting plate comprising individual resilient means surrounding each punch.

24. A punch or drill press set comprising a matrix receptacle for receiving matrix material and having provisions whereby it may be secured in position in a punch or drill press, and electric heater means carried by said receptacle, said receptacle having anchorage recesses into which the molten matrix material may flow.

25. A combined unitary punch and die set comprising a matrix receptacle having means whereby it may be secured in position in a punch press, and a punch and die unit embedded in the matrix material.

26. A punch and die set comprising a matrix receptacle having means whereby it may be secured in position in a punch press, and a punch and die unit embedded in the matrix material comprising a hardened die piece, a resiliently mounted punch guide sleeve, a punch slidably mounted in said sleeve, and resilient means acting to retract the end of the punch into the sleeve.

27. A templet for positioning hard die elements in a matrix mold comprising a sheet having positioning pins projecting therefrom shaped for interfitting engagement with the punch-receiving openings in the die elements for positioning the die elements as the matrix material is placed in the mold around said elements.

28. A punch and die construction comprising a plurality of punches, a plurality of punch-guide and stripper sleeves, one for each punch, in which the punch is slidably mounted, the working face of the punch being withdrawable into the sleeve for the stripping action, a plate having openings in which said sleeves are slidably mounted and through which said sleeves extend, the ends of the sleeves extending beyond the plate for engagement with the work in the punching action, the thickness of said plate being several times the diameter of the working end of the punch, a plurality of die sleeves, one for each punch, a plate having openings in which said sleeves are mounted, the thickness of said plate being several times the diameter of a punch, said sleeves extend beyond the plate for engagement with the work in the punching action, the driven ends of said punches extending from their mounting plate and being engageable by a press element in the punching

action, and individual spring elements, one for each punch surrounding the extended end of the punch and acting between the punch guide sleeve and the punch to withdraw the working end of the punch into the stripper sleeve.

29. A punch and die construction comprising a plurality of punches, a plurality of punch-guide and stripper sleeves, one for each punch, in which the punch is slidably mounted, the working face of the punch being withdrawable into the sleeve for the stripping action, a plate having openings in which said sleeves are slidably mounted and through which said sleeves extend, the ends of the sleeves extending beyond the plate for engagement with the work in the punching action, the thickness of said plate being several times the diameter of the working end of the punch, a plurality of die sleeves, one for each punch, a plate having openings in which said sleeves are mounted, the thickness of said plate being several times the diameter of a punch, said sleeves extending beyond the plate for engagement with the work in the punching action, the driven ends of said punches extending from their mounting plate and being engageable by a press element in the punching action, and spring means to withdraw the working end of the punch into the stripper sleeve.

30. A punch and die construction comprising a plurality of punches, a plurality of punch-guide and stripper sleeves, one for each punch, in which the punch is slidably mounted, the working face of the punch being withdrawable into the sleeve for the stripping action, a plate having openings in which said sleeves are slidably mounted and through which said sleeves extend, the ends of the sleeves extending beyond the plate for engagement with the work in the punching action, a plurality of die sleeves, one for each punch, a plate having openings in which said sleeves are mounted, said sleeves extending beyond the plate for engagement with the work in the punching action, the driven ends of said punches extending from their mounting plate and being engageable by a press element in the punching action, and spring means to withdraw the working end of the punch into the stripper sleeve.

31. A punch and die construction comprising a plurality of punches, a plurality of punch-guide and stripper sleeves, one for each punch, in which the punch is slidably mounted, the working face of the punch being withdrawable into the sleeve for the stripping action, a plate having openings in which said sleeves are slidably mounted and through which said sleeves extend, the ends of the sleeves extending beyond the plate for engagement with the work in the punching action, a plurality of die sleeves, one for each punch, a plate having openings in which said sleeves are mounted, said sleeves extending beyond the plate for engagement with the work in the punching action, the driven ends of said punches extending from their mounting plate and being engageable by one of said press elements in the punching action, and spring means to withdraw the working end of the punch into the stripper sleeve, said die sleeves extending beyond their mounting plate for engagement with a support.

32. A punch construction comprising a plurality of punches, a plurality of punch-guide and stripper sleeves, one for each punch, in which the punch is slidably mounted, the working face of the punch being withdrawable into the sleeve for the stripping action, a plate having openings in which said sleeves are slidably mounted and

through which said sleeves extend, the ends of the sleeves extending beyond the plate for engagement with the work in the punching action, the thickness of said plate being several times the diameter of the working end of the punch, the driven ends of said punches extending from their mounting plate and being engageable by a press element in the punching action, and individual spring elements, one for each punch surrounding the extended end of the punch and acting between the punch guide sleeve and the punch to withdraw the working end of the punch into the stripper sleeve, said punches being readily withdrawable from said punch guide sleeves when the mounting plate is removed from the press.

33. A punch construction comprising a plurality of punches, a plurality of punch-guide and stripper sleeves, one for each punch, in which the punch is slidably mounted, the working face of the punch being withdrawable into the sleeve for the stripping action, a plate having openings in which said sleeves are slidably mounted and through which said sleeves extend, the ends of the sleeves extending beyond the plate for engagement with the work in the punching action, the driven ends of said punches extending from their mounting plate and being engageable by a press element in the punching action, and individual spring elements, one for each punch surrounding the extended end of the punch and acting between the punch guide sleeve and the punch to withdraw the working end of the punch into the stripper sleeve.

34. A punch construction comprising a plurality of punches, a plurality of punch-guide and stripper sleeves, one for each punch, in which the punch is slidably mounted, the working face of the punch being withdrawable into the sleeve for the stripping action, a plate having openings

in which said sleeves are slidably mounted and through which said sleeves extend, the ends of the sleeves extending beyond the plate for engagement with the work in the punching action, the driven ends of said punches extending from their mounting plate and being engageable by a press element in the punching action, and spring means to withdraw the working end of the punch into the stripper sleeve.

35. A punch construction comprising a plurality of punches, a stripper plate element in which said punches are slidably mounted, the thickness of said stripper plate being several times the diameter of the working end of the punch, the working face of the punch being withdrawable into the stripper plate for the stripping action, the driven ends of said punches extending a substantial distance from the stripper plate and being engageable by a press element in the punching action, a withdrawing plate to which the upper end of the punches are secured for effecting said withdrawal of the punches enabling the upper ends of the punches to support each other laterally, and spring elements, one for each punch surrounding the extended end of the punch acting on the withdrawing plate to withdraw the working end of the punch into the stripper plate.

36. A die construction comprising a plurality of die sleeves, one for each punch, and a plate having openings in which said sleeves are mounted, the thickness of said plate being several times the diameter of a punch, said sleeves extending beyond the plate for engagement with the work in the punching action, said sleeves extending through and below said plate for engaging a support and having lateral slug ejection passages for ejecting the punchings from the sleeves above said plate.

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