

June 12, 1945.

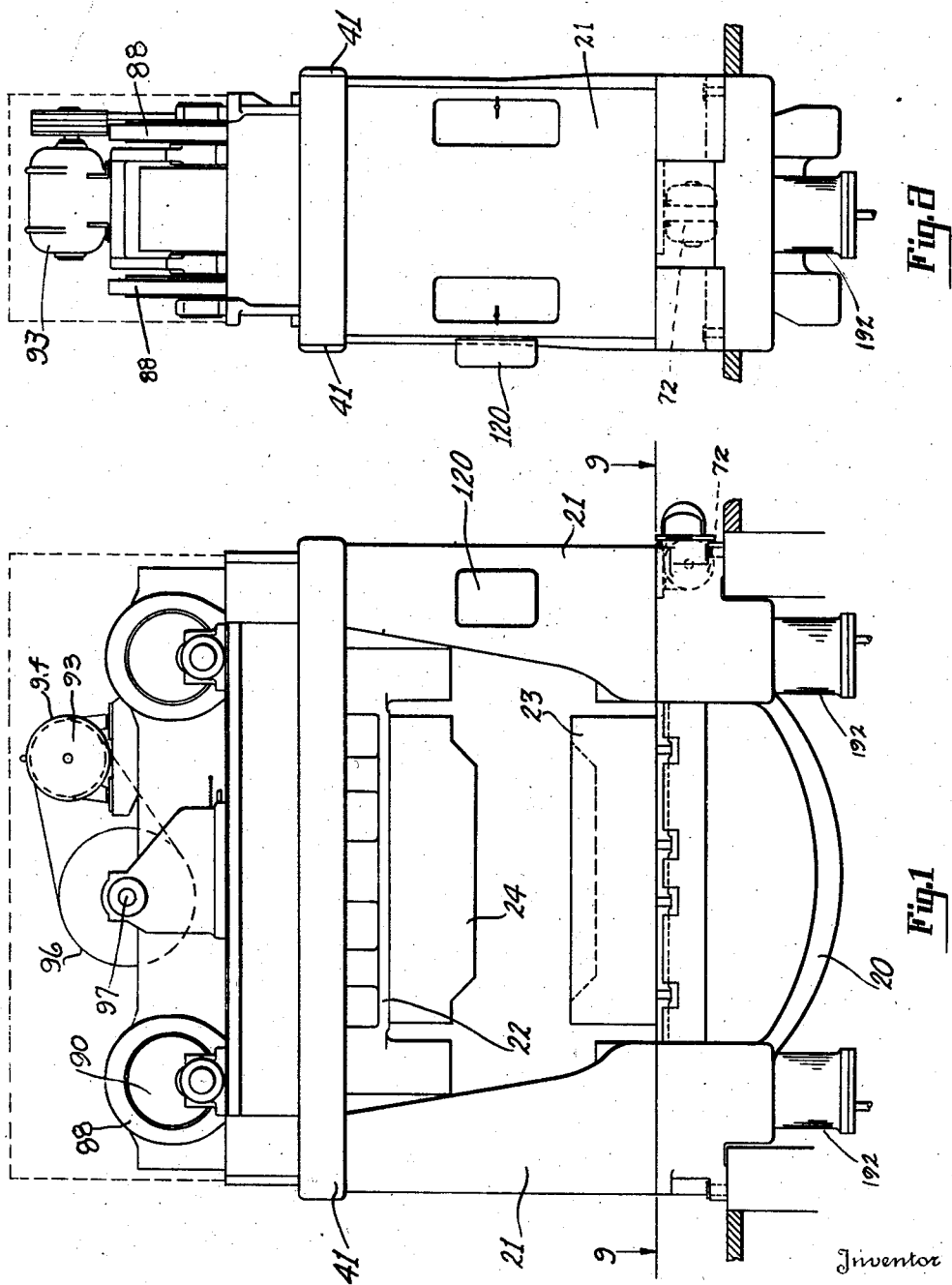
A. A. BYERLEIN

2,378,062

PRESS

Filed Sept. 17, 1942

5 Sheets-Sheet 1



Arthur A. Byerlein

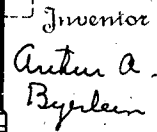
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Attorneys

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June 12, 1945.

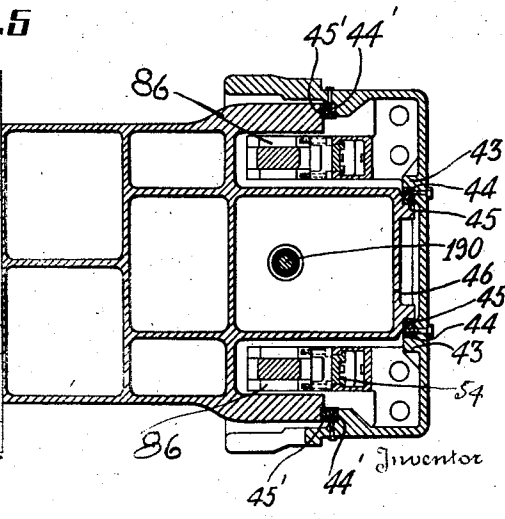
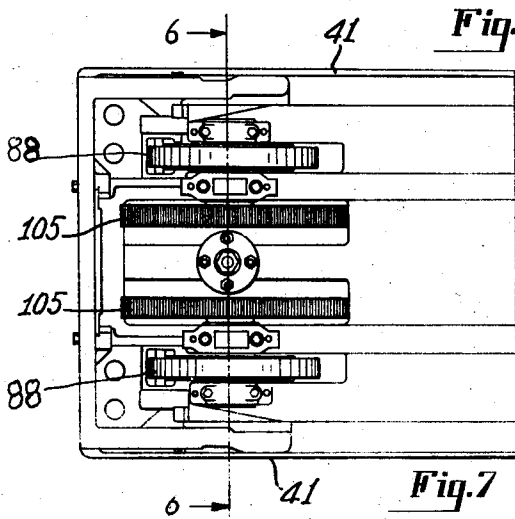
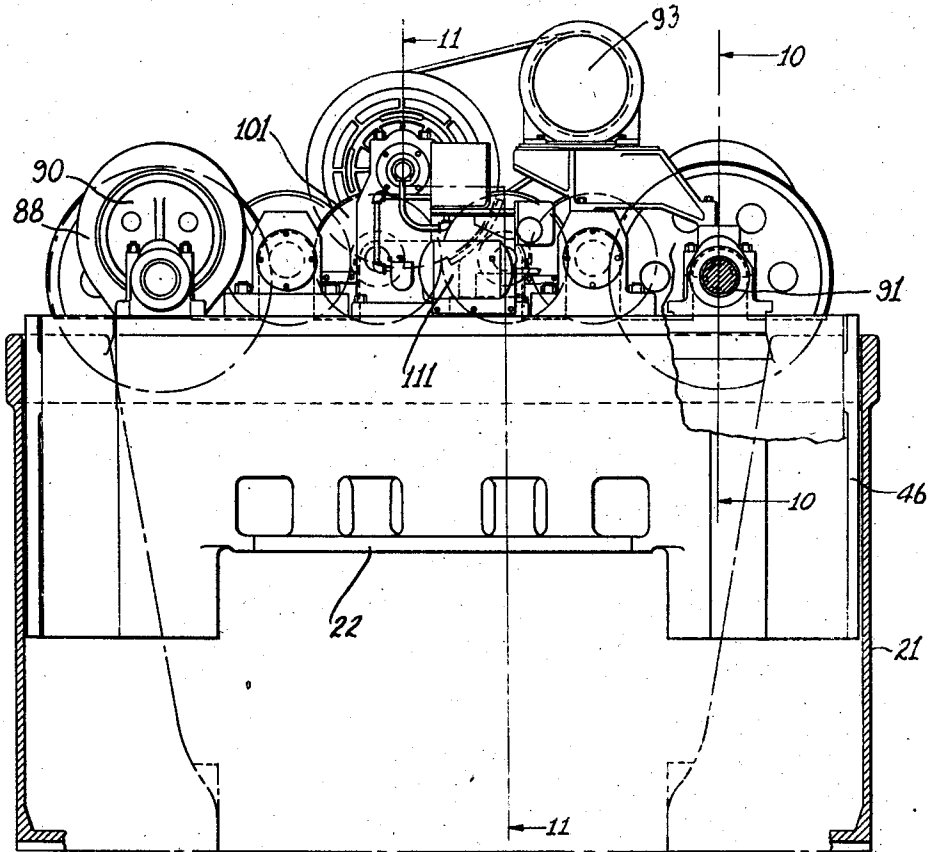
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PRESS

Filed Sept. 17, 1942

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June 12, 1945.

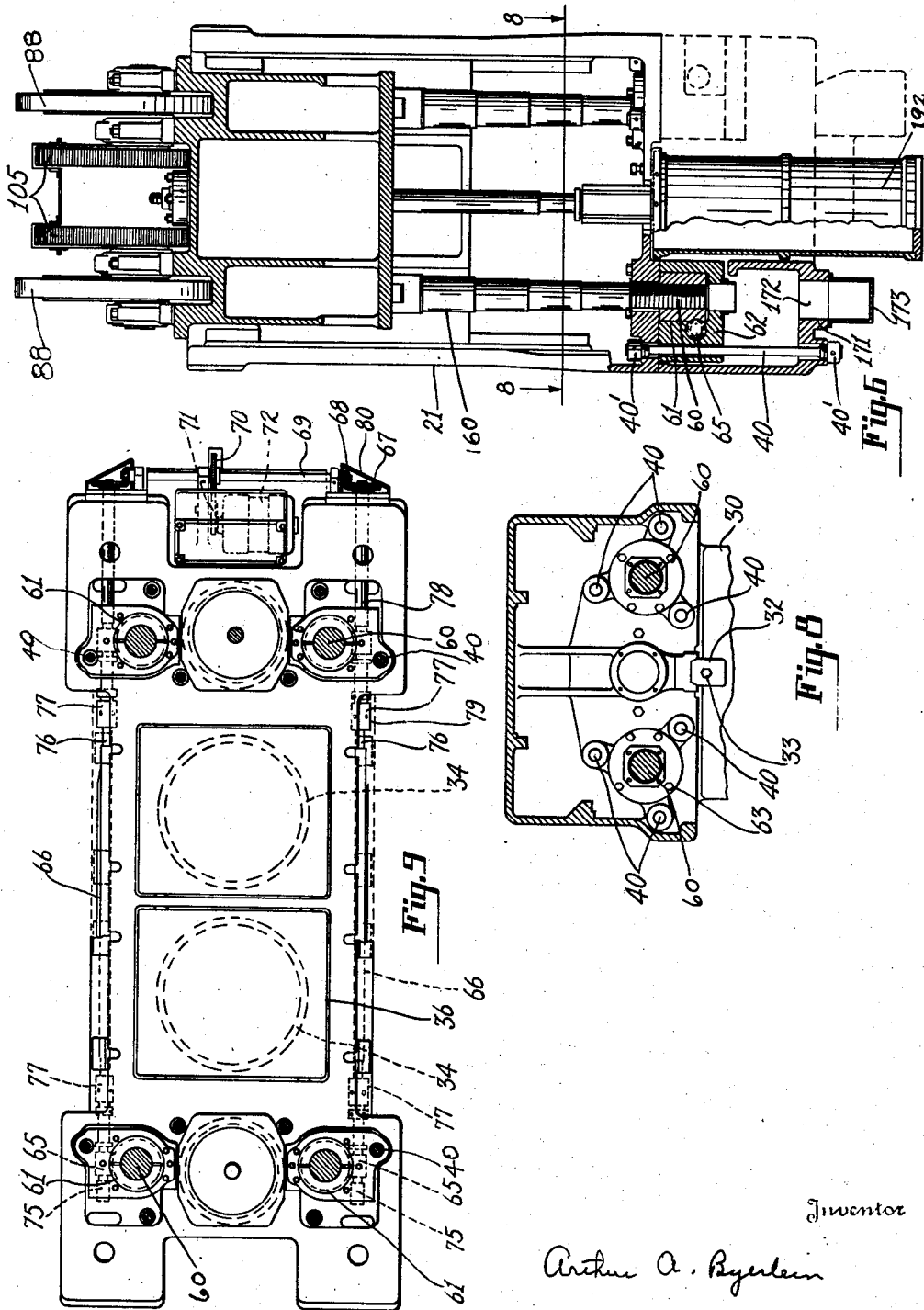
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2,378,062

PRESS

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5 Sheets-Sheet 4



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June 12, 1945.

A. A. BYERLEIN

2,378,062

PRESS

Filed Sept. 17, 1942

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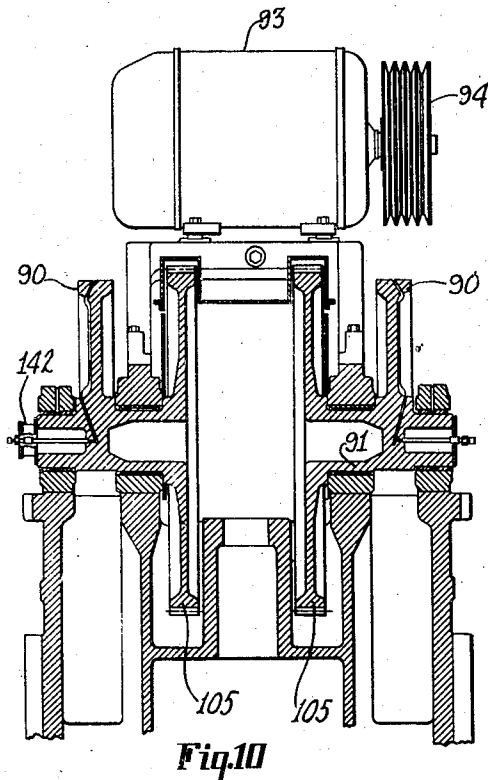


Fig. 10

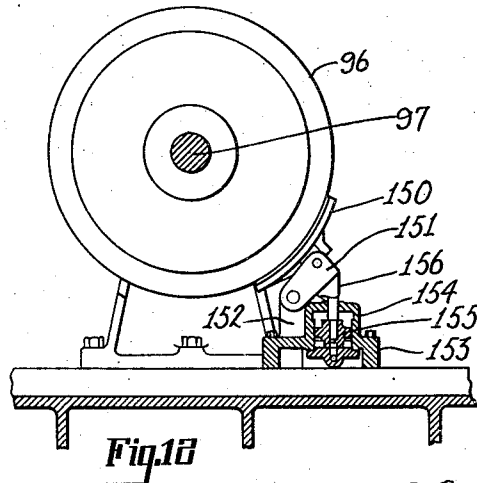


Fig. 12

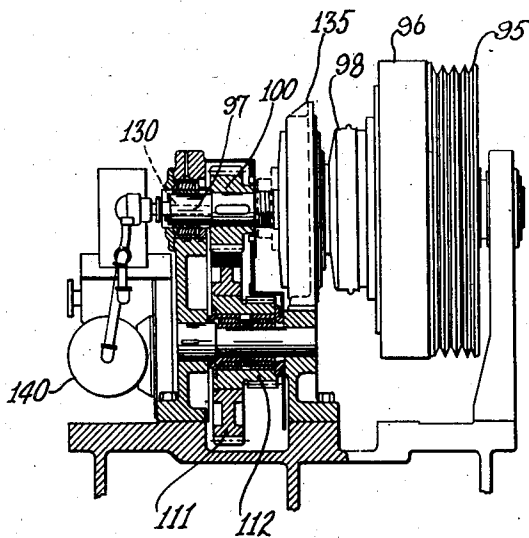


Fig. 11

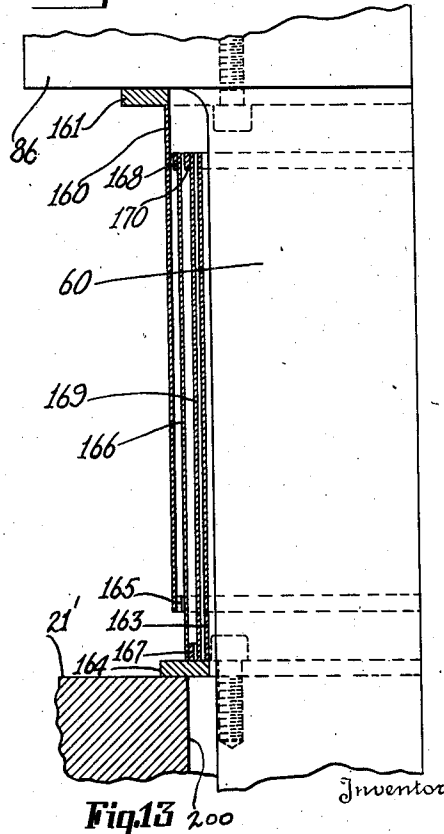


Fig. 13

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UNITED STATES PATENT OFFICE

2,378,062

PRESS

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Application September 17, 1942, Serial No. 458,686

15 Claims. (Cl. 113—38)

This invention relates to presses, and more particularly to stamping and drawing presses such as are used for forming metal sheets in the manufacture of automobile bodies, and parts thereof, and the like.

Presses for stamping or forming operations have been used widely in industry, ranging from the small size and simple stamping or punching presses for small objects up to quite enormous and involved mechanisms used for stamping or forming large and intricate products.

As illustrative of the latter are the mechanically operating presses for use in the making of products such as automobile bodies. In such presses thin sheets of metal, which are of considerable size, are formed in the presses into the desired shape—the forming of such sheets requiring either so-called stamping operations or drawing operations, or both. In the former type of operation the sheet is formed by stamping, while in the latter the sheet is held so that as the forming dies operate upon it it is caused to draw over the edges of the dies and to flow from between the holding members so as to give substantially uniform flowing of the sheet under the operation of the press mechanism. With most automobiles, for example, the bodies are formed from sheets of steel approximating 20 gauge in thickness (i. e., approximately one twenty-fifth of an inch thick) and it has heretofore been common practice to have very large presses capable of handling a sheet of such dimensions that at least a whole "quarter panel"—i. e., one-half of the whole rear of an automobile body—could be formed in one cycle of operation of the press, usually involving several drawing operations however. And in such operations the press mechanism must be such that the metal sheet could be caused to flow and formed into shapes requiring drawing operations of a depth 10 or 12 inches or even more. This required quite large presses with very intricate operating mechanisms, capable of exerting enormous pressures and also capable of operating within the very narrow limits required to cause flowing of the thin sheet of metal into the intricate forms required without appreciably varying the thickness of the sheet and without leaving any wrinkles or rough spots which would immediately show up as defacing highlights when the automobile body is painted; and, of course, other forming problems are involved in the automobile and other industries in which equally large presses, capable of exerting tremendous forces of many tons are likewise used.

In order to provide presses of the size required for these operations such as the handling of these very large sheets for automobile bodies, and the deep draws needed, and to contain the intricate and accurate operating mechanisms of great strength and power, presses of this character have been of the order of 30 to 40 feet high in over-all dimensions and with a bed 15 to 18 feet between uprights and as much as 7 or 8 feet deep. And the operating mechanisms provided have been such as to carry out the operations necessary, for example such as the forming of a complete quarter panel with several drawing operations in the same direction and also reverse drawing operations, all performed in one cycle of the press, and under pressures of many hundreds of tons, and with the mechanism nevertheless acting with such precision that the pieces would be so formed that only a very small percentage would be so marred in formation as to require any substantial amount of hand finishing.

Presses of the character referred to are capable of forming operations over a very wide range as to depth and complication of the forms produced, from the simplest shallow stamping operation to intricate involved reverse drawing operations. And of course the difficulties in constructing such presses for satisfactory operation are greatly increased over those encountered in simple small stamping or forming presses, even though some of the latter are provided for exerting high pressures or somewhat complicated formings when using comparatively small dies.

Also, in these very large presses, with many operating parts required to exert enormous pressures and to produce products within close tolerances, the great size of the presses and the complexity of the mechanisms has made assembly of the presses a substantial job; and also repairs and maintenance is a somewhat difficult and dangerous job as the operating mechanism, including the drive motor and clutch and gears and links and the like, have been normally affixed to and carried by the press frame at the bottom with the power transmitted upwardly to an upper die slide, slidably guided between side uprights and constrained to reciprocate by the guiding movement of the uprights; or this operating mechanism has been in large part mounted upon the top of the press frame or crown which bridged across the top of the press and consisted of heavy members for tying the top of the press together and also for supporting all of these operating parts, with the upper die

slide movably guided or reciprocally sliding upon the upright guides and with interconnecting links for transmitting the power to this movable die slide. And in maintenance and repair it was necessary for the workmen to endeavor to effect the repairs while perilously working on top of this mechanism or to disassemble the necessary parts and lower them to the floor thus leaving the press inoperative until repairs could be effected. And in these presses the forces were normally transmitted in compression, as the operating mechanism exerted its forces against the crown and thence through linkage to the upper die slide which would thus be forced against the lower stationary die slide, and also to absorb these great forces exerted between the two slides enormous bolts or tie rods were required for holding the crown in properly spaced position with respect to the bed which was accomplished by drawing the two parts together against opposite ends of the side and guide members.

The present invention relates particularly to such larger presses for stamping and forming, and one of the principal objects of the invention is to provide such a press in which the extremely difficult operating conditions referred to can be satisfactorily handled with a press having an over-all height very much less than that heretofore used, and this object is obtained by providing a press in which all of the mechanism for operating a movable die slide is carried upon the die slide itself, and in which therefore the heavy crown or arch members which have heretofore been used can be entirely dispensed with, and in which also the construction is such that the entire movable slide member, with the operating mechanism, may be lifted bodily out of the press as by a crane and deposited on the floor when repair or adjustment work, or assembly or disassembly of any of the parts, is required.

Another object of the invention is to provide such a press in which the members which force one die member into forming relation with the other are at all times in tension during operation, thus preventing certain adverse or destructive tendencies, such as the tendency to bend, which are encountered where the pressure is exerted under compression which in turn would frequently be sufficient to derange the mechanism for adjusting the effective stroke of the movable die and which in turn would require replacement of the adjusting screws forming part of the slide actuating members. In the present invention if the adjusting screws should be stretched somewhat under unusually heavy load they will resume their regular length when relieved from the excessive tension, and unless so overloaded as to cause permanent elongation or deformation such stretching during operation has no effect upon the adjustment mechanism.

It is another object of the invention to provide such a press mechanism in which these tension members may be enclosed and protected from dirt to minimize or avoid freezing of the adjusting nuts; it having been heretofore a not unusual occurrence for operating screws and adjusting nuts therefor in presses to become so affected as to freeze in which event the nuts frequently would have to be cut in two to be removed and replaced, or the entire nut and screw lost.

It is another object of the invention to provide such a press having a self-contained movable upper slide mechanism, containing all of the operating mechanisms for moving one slide with respect to the other, so arranged that by

simple removal of certain pins the entire top slide and the mechanism carried by it can be removed for repair or replacement of parts at a convenient time and place; and so that thus an extra top slide and operating mechanism unit may be provided which can be put into position within a short time to thus provide a minimum of interruption in the operation of the press. This is an extremely important consideration inasmuch as in large quantity production the presses are usually arranged in line so that predetermined sequential operations are performed, beginning with the original sheet of metal and having each press perform its own special operation until the final product is completed in the last press of the line, so that stopping the operation of any one of the presses stops the whole production line, and any reduction in the time of stopping this whole production line is accompanied by very large advantages as to manufacturing costs and quantity of production.

It is another object of this invention to provide such a construction in which the movable die slide and its operating mechanism and the tension members which cause its movement with respect to the other die, may be assembled substantially as a unit in proper relation with each other, and extreme nicety of adjustment and assembly of each individual element with respect to the other portions of the press is not required.

It is another object of the invention to provide adjusting mechanism for the tension members of the movable slide in which the adjusting gears and the operating shafts therefor may be driven from one end without the torsion in the shaft being objectionable and without the necessity of providing such positioning and mounting of the operating motor and the gears as to give substantially balanced drive to the several sets of gears which cause the adjustment.

Other objects and advantages of the invention will be apparent from the description and drawings and the appended claims.

In the drawings, in which like characters of reference designate like parts throughout the several views thereof, is illustrated a preferred embodiment of the invention, in which drawings:

Fig. 1 is a side elevational view of such a construction;

Fig. 2 is an end view in elevation of the construction shown in Fig. 1;

Fig. 3 is a plan view of the press construction;

Fig. 4 is a sectional view along the line 4-4 of Fig. 3, looking in the direction of the arrows, and with certain parts shown in dotted lines;

Fig. 5 is a detail side elevational view of the movable die slide member with operating mechanism mounted thereon, and of the upright guides therefor, with certain parts broken away to more clearly show the details of construction;

Fig. 6 is a vertical sectional view, along the line 6-6 of Figs. 4 and 7, and with certain parts in elevation for clearer disclosure;

Fig. 7 is a view looking down upon the press with certain parts shown in elevation and others shown in section along the line 7-7 of Fig. 4;

Fig. 8 is a detail sectional view along the line 8-8 of Fig. 6;

Fig. 9 is a sectional view through the press structure looking down upon the bed of the press, the section being taken substantially along the line 9-9 of Fig. 1;

Fig. 10 is a detail vertical sectional view along the line 10-10 of Fig. 5;

Fig. 11 is a detail vertical sectional view, with

parts in elevation, along the line 11-11 of Fig. 5;

Fig. 12 is a view partly in elevation and partly in section of the brake mechanism for the fly wheel; and

Fig. 13 is a detail view, partly in section, of one of the telescoping covers for the adjustable screws.

In the preferred embodiment illustrated in the drawings, the press is shown as comprising a bed member 20 which is suitably supported upon a concrete floor or upon other suitable foundation members; this bed having affixed thereto, and extending upwardly, two upright members designated generally by the numeral 21, and a movable die slide member which is constructed properly to reciprocate up and down in operation, within the upright members 21 which serve to resist or guide against tendency of the slide to sidewise movement, such upper slide member being designated generally by the numeral 22, and having suitable bolt receiving, or other means, whereby the die may be secured to the lower face thereof.

The bed member 20 is shown as a hollow casting, which is adapted to receive a bolster plate designated by the numeral 30, this plate extending over the bed and being provided with suitable means, such as the usual bolt receivers, whereby the lower die member may be fastened thereto for operation. This lower die is illustrated in very simple, diagrammatic form, in Fig. 1 and designated by the numeral 23, the upper female die being correspondingly illustrated and designated by the numeral 24. This bolster plate has the center portion of its end walls inclined to cooperate with correspondingly inclined holding members 32, each of which in turn is pulled into tight wedging engagement with the bolster plate by means of bolts 33 which are suitably threaded into the bed. If the press is desired to be used to effect drawing operations pressure cushions, such as the air cushions 34, are mounted and suitably supported within the bed and below the bolster plate. Since these air cushions may be of any suitable conventional character, they are shown diagrammatically, as in Fig. 4, and each of these air cushions is circumferentially illustrated by dotted lines in Fig. 9. The bolster plate has the usual large number of holes through it (several being indicated diagrammatically at 35, by dotted lines, in Fig. 4) for accommodating pins which in turn rest upon plates 36 each of which is in turn supported upon a movable portion of its corresponding pressure cushion so that suitable air pressure can be transmitted through these pins onto a proper draw ring or blank holder, or pressure control portion of the die members, or knock-out member, associated with the die parts. The pressure air may be supplied to these air cushions from a storage or surge tank, in the usual way, through pipes 37 having the proper control mechanisms associated therewith.

Each of the uprights 21, as shown, consists of a metal member generally U-shape in cross section, shown as a casting, and which is provided at the bottom and at opposite side thereof with bolt holes through which the bolts 40 pass, which bolts serve to hold the uprights connected to the bed structure of the press. As shown in Fig. 8 there are 3 of these bolts at each corner of each of the upright guides 21. The operating mechanism for the movable slide member 22 is such that the mechanism itself tends to impart to the slide straight line reciprocation during operation, with

only moderate side thrusts, resulting principally from the power transmitting members; and these members 21 therefore need not assume considerable side thrust or guiding forces in connection with the reciprocation of the movable die slide and the exerting of the required tremendous pressures between the die members as the forming operation is completed. And, as shown, these upright slide members can be connected at the lower end thereof to the bed by bolts which are of a length which is quite small when compared with the ponderous tie rods and bolts which have heretofore been used in former presses of the character referred to to connect the bed with the crown or arch member at the top and with the side frame members which space them. And because of this short length, and also because of using a plurality of bolts, the over-all cross-section may be substantially less without any loss in resistance of the bolts to the operating forces exerted upon them. The tie bolts as heretofore used were required to absorb the entire working pressure of the press since the operating mechanism was such that in completing a press cycle the reacting forces would be exerted respectively against the bed and the crown or arch and it has not been unusual in large presses of the character referred to to have such tie rods each of which is as much as 20 feet in length and 8 or more inches in diameter (with correspondingly large nuts), either shrunk into place, or with the tie rods pre-tensioned under pressure of many hundreds of tons in the manner described in patent to A. A. Byerlein No. 1,872,115 dated August 16, 1932. But by using these much shorter bolts and a plurality of them as shown herein the working forces may be as adequately taken care of with the use of much smaller and less expensive bolts and nuts, which also may be much more easily handled in assembly, pre-tensioning, etc.

As shown clearly in Figs. 4, 6, 8 and 9 each upright 21 has an inwardly extending portion at the bottom, which is designated by the numeral 21' and which is formed to rest upon the top of the bed. At each side of this bottom portion 21' (fore and aft of the press), three bolt holes are formed to receive the bolts 40, each of these bolts being threaded at its opposite ends to receive nuts 40'. As will be clear, from Fig. 6 for example, when the nuts 40' are tightened in place the upper one rests against the upper surface of the inwardly extending bottom 21' and the lower is pulled tight against the bottom of the bed; these several bolts, at the four corners of the press, thus serving to hold the uprights 21 firmly affixed to the bed of the press. And it is these bolts which bear the working load during reciprocation of the upper die slide 22; but since the construction of this press is such that the working forces during a forming operation of the slide are transmitted in tension through the connecting mechanisms which cause movement of the upper die slide with respect to the bed, it is unnecessary to have the tremendous crown or arch members and large tie rods, and the bolts 40 need be only sufficient to hold the uprights 21 properly in position, to withstand the comparatively small side thrusts which are encountered during operation, and to withstand the operating forces during the drawing or stamping operation, as described. However, the upper ends of these uprights are preferably connected by means of cross bars or rods, shown as flat steel bars 41 each of which is suitably connected at its opposite ends to the upper ends of the two uprights 21. These cross bars may

be easily connected and disconnected and when in place will be entirely out of the way of the operating mechanisms and will provide resistance and tension to any side thrust exerted upon the uprights.

To absorb this operating side thrust and also to give some guiding and support to the movable die slide, each of the uprights 21 includes suitable guide portions. As shown, each upright 21 is provided with two inwardly extending flanges 43, located at the upper part of the member, and carrying a guide surface 44 each of which cooperates with a guide surface 45 carried by the cooperating end of the upper slide member, which end is designated by the numeral 46, there being likewise guide surfaces 44' and 45' at each side of the slide and members 21 the cooperating faces of which are at right angles to the corresponding faces of parts 44 and 45—this mechanism serving to give some guiding crossways and fore and aft to the slide in its reciprocation and to hold it within its proper path with respect to forces which might tend to move it from its normal path of reciprocation.

The intermediate part of each member 21 at each side thereof also carries an inwardly extending portion 50 which has connected to it, by bolts, a guide member 51 which provides a bearing surface for the upper end of its associated adjusting screw 60, to take the side thrust which arises during operation. As shown, the upper end of each adjusting screw 60 carries a block 52, which is held in place by bolts 53. This block 52 also has attached to it a guide member 54, attached to the block 52 by bolts 55, and this member in turn cooperates with the guiding surface upon the guide member 51, which is of sufficient extent to receive the block 52 and guide member 54 throughout the entire range of adjustment of the adjusting screw 60.

As shown, there are four of these adjusting screws 60, each of which is threaded throughout a substantial portion thereof, and the lower threaded end of each of which extends through an opening in the portion 21' and carries adjusting nut 61, which nut in turn is rotatably mounted within a member 62, which member in turn is connected to the bottom of an upright by means of a plurality of bolts 63.

Since the inwardly extending portions 21' of the uprights 21 are held affixed to the bed of the press by means of the bolts 40, and the adjusting screws which carry the operating forces in tension are supported in the nuts 61 which in turn are supported in the members 62, so that the nuts 61 when under operating tension bear against the lower face of the inwardly extending portions 21', as a result the operating loads are thus transmitted to and carried by the plurality of bolts 40, which in the aggregate must necessarily be sufficiently strong to withstand these entire tension operating loads but which nevertheless because of the construction described will be of quite short length and comparatively small diameter as compared with the large tie rods heretofore used in presses intended to perform similar operations. In assembling the press it is desirable that these bolts 40 be pretensioned in the manner described in patent to A. A. Byerlein No. 1,872,115 above referred to.

In effecting such pretensioning in the construction described, the uprights are first fastened in place by means of the bolts 40 and the nuts 40' are then tightened in the usual manner. The preloading or pretensioning of the bolts 40 can

then be satisfactorily accomplished by placing hydraulic jacks on the bed and exerting pressure on the upper slide 22. When the predetermined maximum limiting pressure is exerted the uprights will be slightly lifted due to the stretching of the bolts 40 thus providing a small space between the bottom portion 21' of the uprights and the top of the bed. Suitable shims are then inserted to fill this space, and when the pressure on the slide is then released the parts of the mechanism will be tightly and rigidly held together, with the bolts so pretensioned that no further lengthenings will occur during operation of the press and therefore the adjustment of the parts when once properly attained will remain substantially constant. Of course if the press should be subjected to an extraordinary and undesirable pressure, exceeding the maximum pressure under which the bolts 40 are preloaded, this construction permits of the bolts extending an additional amount thus preventing destruction of the slide, or the bed or the other major portions of the press which would be comparatively costly to replace.

The outer side of each nut 61 is provided with threads which mesh with a worm 65, there being one of these worms for driving connection with each of the nuts 61 and each of these worms being connected upon one end of a shaft designated generally 66. There are two of these shafts 66 each of which extends along one side of the bed. As shown in Fig. 9, one end of each of these shafts has proper bearing in the cooperating member 62 and the other end likewise has proper bearing in its supporting member 62 but extends therethrough and carries at its free end and at one end of the press a bevel gear 67 which meshes with a corresponding bevel gear 68 which in turn is mounted upon a shaft 69 rotatably supported within suitable brackets at one end of the press and having intermediate of its length a gear 70 which in turn meshes with a suitable reduction gearing, indicate generally by the numeral 71, and driven by the adjusting motor 72. Since each of the worms 65 meshes with the corresponding thread of the worm gear upon the outside of the nut 61 a single motor, located at one end of the press, and a single adjusting shaft 69 at one end of the press for completing actuation of these adjusting nuts may be satisfactorily used. That is, by using worms meshing with correspondingly cut threads, the effect of torsion in the shafts 66, during operation of adjustment, is effectively minimized and in this way such torsion as will produce angular movement of the order of 10% of one end of the shaft with respect to the other will have no objectionable or adverse effect upon nut adjustment. Great care has been exercised in the past, using other gear arrangements, so as to locate the adjusting motor substantially adjacent the center of the actuating shaft, and to provide such driving mechanism as to evenly divide the torsional effects so as to secure the desired accuracy in operations. But by using the construction above described, with a worm gear and cooperating threads, the effect of torsion can be so overcome that the very substantial degree of torsion referred to can be encountered without adverse effect on nut adjustment and therefore the construction of the press can be greatly simplified and cheapened by providing a single drive motor at one end of the shaft, with a single cross shaft having bevelled gears at its ends to drive one end of each of the adjusting shafts and without the necessity of the expensive equalized drives heretofore used (e. g., see patent A. A. Byerlein

No. 1,827,558 dated October 13, 1931) and with the use of considerably smaller shafts than heretofore utilized and without effecting its satisfactory operating characteristics.

Each of the shafts, indicated generally by the numeral 66, consists of two pieces of shafting, one designated by the numeral 75 and the other by the numeral 76. At each end of the portion 76, which is shown as of slightly reduced diameter, is mounted a coupling 77, one of which serves to effect driving connection between one end of the shaft section 76 and the gear carrying shaft 78, and the other of which serves to connect the other end of the shaft portion 76 to the portion 75. This construction is such that by loosening each set screw 79 each coupling may be slid to one side to lie completely within the extent of the shaft portion 76, and thus permit ready insertion and withdrawal of that shaft portion.

Also, as illustrated in Fig. 9, the nut 61 is split and the two portions of the nut are so formed that when in operative position the two edges do not touch and space is thus provided at each side to contain lubricant. Because the nut is split it can be readily removed from the screw and repaired in case any of the threads should seize or become damaged; whereas if the nut were of one piece and should seize it might become necessary to destroy the nut to remove it from the screw, and perhaps to damage the adjusting screw also—a condition which has frequently arisen in the past in connection with large adjusting nuts and screws carrying heavy loads, as used in large machinery of this character.

The beveled driving gears 67 and 68 are enclosed within a metallic cover indicated by the numeral 80, which protects them from injury, from the accumulation of dirt, etc., and which may be readily removed for access to these gears.

The upper end of each adjusting screw 60 carries a pivot pin 85, the opposite ends of which are mounted in the bifurcated yoke portion which constitutes the upper end 86 of each adjusting screw 60. Also pivotally mounted upon this pin 85 is the lower end of a connecting rod member 87, the upper end of which carries an eccentric strap 88—in the embodiment shown in the drawings there being four adjusting screws and four of these eccentrically operated connecting rods. Each of these connecting rods 87 is actuated by an eccentric 90, mounted within its associated eccentric strap, and each carried by a cross shaft 91, which is suitably journaled at its opposite ends upon the upper face of the slide 22.

Referring to Fig. 1, in which the construction is shown somewhat generally, the slide 22 is given proper reciprocating motion from the power transmitting mechanism which comprises a motor 93 which drives a pulley 94, shown as of the grooved type to receive V-belts, and which pulley, in turn is in driving connection with the fly wheel through the V-belt grooves 95 formed in the surface of the fly wheel member 96, the fly wheel in turn being mounted upon a drive shaft, from which shaft, by means of suitable clutch mechanism and gear trains, rotary motion is transmitted to the eccentric shafts 91 to thus cause reciprocatory motion of the slide 22.

As shown the fly wheel runs freely on shaft 97 and carries one portion of the clutch mechanism designated generally by the numeral 98 and which is not illustrated in detail as it may be of suitable type, such as the usual disk type used in transmitting heavy loads. It is believed un-

necessary to show the details of construction of this clutch and its operating mechanism. When it is desired to cause movement of the slide 22, and the die carried thereby, toward the bed and the die carried thereby, the clutch is actuated into engaged position and the rotary motion of the fly wheel 96 is thereby transmitted to the shaft 97. This shaft, as shown more particularly in Figs. 3, 4, 5 and 11, carries a gear 100 which drives two sets of gear trains, in synchronism, one for each side of the press. (For purposes of clearer illustration the motor 93 and its supports are omitted from Figs. 3, 4 and 7.) For actuating the eccentrics and connecting rods at the left hand side of the press, as shown in the drawings, the gear 100 drives a second gear 101 upon the shaft of which is mounted a gear 102 which in turn meshes with a gear 103, the shaft of which carries two gears each designated 104, and each of which in turn meshes with a larger gear 105. Each of the gears 105 is mounted upon one end of one of the shafts 91, each of which shafts also carries thereon at one end one of the eccentrics 90. A very satisfactory construction is attained when the gear 105, shaft 91 and eccentric 90 are integral as shown in detail in Fig. 10. Rotation of the gear 100, therefore, transmits power through the chain of gears as described to the shafts 91, located at the left hand side of the slide 22 and as these shafts rotate the eccentrics 90 cause the slide 22 to move up and down in substantially straight line motion, the connecting rod 87, oscillating about the pivot or wrist pin 85. As thus constructed the slide normally has straight line motion and any deviations in operation are readily resisted by the several pairs of guides 44—45 and 44'—45', and there is comparatively small side thrust at the upper end of the adjusting screws 60 which are affixed to the bed, and such side thrust as there is is readily taken care of by the guide members 54 and 51 as heretofore described.

Likewise, the two eccentrics and associated connecting rods at the right hand side of the press are correspondingly actuated by means of a chain of gears—the power being transmitted from the gear 100 to a cooperating gear 110 and thence through the gear 111 to the gear 112 which is carried upon the same shaft as the gear 111 and in turn to the gear 113 the shaft of which carries at each end a gear 114 each of which meshes with a gear 105' which in turn actuates an eccentric 90 and thus causes reciprocating actuation of the right hand end of the slide in the manner heretofore described, the two ends of the slide being thus actuated in timing to give proper and substantially straight line motion with the side thrust at all four wrist pin connections being taken care of in the manner described.

As is usual in presses of this character the clutch may be caused to engage by the actuation of suitable hand operated mechanism such as the electrical switch illustrated diagrammatically and indicated by the numeral 120. Upon actuation of this switch, which may be merely a manually operated button, a solenoid is energized which operates a valve to admit air through the passage 130 in the center of the shaft 97 which admits air to suitable pressure cylinder mechanism to cause engagement of the disks or plates of the clutch. These clutch plates which are located in the clutch mechanism designated generally by the numeral 98, are connected to other disks within the portion generally designated 135

which forms the brake mechanism for the unitary movable die slide and power transmitting mechanism and as the clutch disks move into engagement the disks of the brake are thus disengaged. Conversely when the action is reversed to disengage the clutch disks, the brake disks are caused to engage to bring the slide and its associated mechanism to a stop. In this way the brake is always positively engaged until such time as the clutch is engaged, and consequently safety in operation of the press is insured. Also in order to provide for more definite and certain actuation of the parts in operation of the press, a pressure air tank 140 is provided which supplies an excess of pressure air over that required to cause actuation of the clutch so that immediately upon opening of the valve air will rush into the pressure cylinders of the clutch to cause prompt and positive actuation of the clutch and disengagement of the brake. By utilization of this tank air may be stored, and supplied to the clutch from time to time as required, to give the necessary volume of pressure air for satisfactory operation of the clutch and brake mechanisms.

In order to insure satisfactory, and also completely safe, operation of the press it is preferable that a limit switch be provided, indicated generally by the numeral 141 which switch is shown as driven from a suitable sprocket wheel through the chain 142, which also is operatively engaged with a sprocket wheel upon one of the shafts 91, as indicated by the numeral 143. By means of this construction, as the press slide 22 moves back to its upper dead center position the rotation of the shaft 91, through the sprocket wheels and chain, causes actuation of the limit switch to move the solenoid operated control valve to relieve air pressure from the clutch operating mechanism and to disengage the clutch disks and cause engagement of the brake disks to bring the slide to rest at substantially upper dead center.

As stated the fly wheel normally turns freely on its shaft. At times it is desired to stop this fly wheel, as when a new die is used which requires reversal of the fly wheel rotation. For this a brake mechanism is provided, as shown in detail in Fig. 12, whereby a braking member may be applied and held firmly against the fly wheel to prevent actuation thereof during such time. As shown in Fig. 10 a brake shoe 150 is provided, having a suitable braking surface for contact with the face of the fly wheel 96. This brake shoe is pivotally connected to one end of a rock member 151 the other end of which is pivotally connected to a supporting member 152, which is shown as a supporting lug formed upon a pressure operating cylinder mechanism 153, and which in turn is supported upon the slide member and in rigid relationship with respect to the other associated operating parts. This member 153 comprises a cylinder 154 having a brake operating piston 155 therein, which carries a piston rod extending upwardly through the cylinder head and into contact with a projection 156 carried by the pivoted link 151 so that as the piston moves up under pressure the link 151 is rocked to force the brake shoe 150 against the fly wheel and hold it against rotation. The cylinder 155, below the piston, is connected to a suitable source of pressure fluid, such as pressure air. This pressure air is supplied to and exhausted from beneath the piston through suitable pipe and operating valve mechanism which may be manually operated, and which may be of

any suitable construction and is therefore thought unnecessary to illustrate. When it is desired to restore the press to operating conditions the valve mechanism is actuated to exhaust the pressure fluid and allow the brake shoe to move away from the fly wheel so that the press may thereafter be operated according to its proper cycle of operation.

The adjusting screws 60 are preferably provided with enclosing and protecting members which are shown (in detail in Fig. 13) as comprising a set of nesting sleeves, the upper of which, designated by the numeral 160 is of the largest diameter and is provided with a flange 161 whereby it may be connected by bolts to the bottom of the enlarged yoke member 86. As shown four of these telescoping guards are provided, which are of progressively decreasing diameter and the bottom one of which is designated by the numeral 163 and is likewise provided with a flange 164 which is connected by suitable bolts to the lower part 21 of the upright guides. The upper guard member 160 is provided with an in-turned flange in its lower end 165, and the intermediate guard member 166 is provided with an internal flange 167 at its lower end and an external flange 168 at its upper end, the next intermediate guard member 169 being provided with an external flange 170 at its upper end. By means of this arrangement the guard members are permitted to telescope freely on down movement of the slide 22, and are caused to extend, through the inter-action of the flanges referred to, on up movement. Thus dirt is prevented from clogging or gumming the threads on the adjusting screw, and the threads are likewise prevented from being damaged as a result of accidental blows during operation of the mechanism. Also the bed structure is provided with an inwardly turned portion 171, located beneath each of the adjusting screws each of which has an opening 172, in line with the adjusting screws, and of sufficient diameter to freely pass the end of the adjustment screw when it is adjusted toward lower position. Attached to the bottom of this portion 171, by suitable bolts, and in alignment with the opening 172 is a cup shaped cover 173 which serves to permit the desired lowering of the end of the screw, in the operation of the press, and also serves to protect the screw from accumulating dirt, grease, etc.

As shown, for example in Fig. 4, the upper slide, at each end, has attached thereto a rod 190, the lower end of which carries a piston 191 which is slidable in the cylinder 192, the lower end of which is connected by the pipe 193 to a suitable source of air supply, as to a surge tank, this mechanism serving as a counterbalance for the slide and to assist in upward movement thereof.

By means of the construction above described, which eliminates the usual crown and side members of the press frame and the large tie rods referred to, and providing a unitary slide with power transmitting mechanism with links for connection to adjusting screws which are affixed to the bed all the interference which is encountered in the older construction of presses referred to as between tie rods and gearing and other operating parts of the mechanism is eliminated. In other words the construction described is such that the entire power transmitting mechanism and the mechanism associated therewith which supports the movable slide and said slide are self-contained and do not require connection or attachment to any of the other parts of the press

above the bed and this gives substantially 100% freedom in designing and arranging the power transmission and driving mechanism and the supporting linkage connected therewith. And as a result it is unnecessary to have that nicety of adjustment and relative arrangement of parts which was formerly required in order to secure satisfactory operations. For example, the present invention permits of assembling the movable slide and the power transmitting mechanism including the eccentric strap connecting rods and the adjustable screw connecting members as a unitary assembly and fitting it as such into place upon the press bed, the passages 200 through which the adjusting screws extend and move during adjustment being larger than the screws so that the parts may be readily put in place and without any extreme nicety of adjustment or accurate fitting with respect to the bed. By this arrangement this unitary assembly can be connected in generally correct place upon the bed and affixed there by tightening the several bolts 40 to hold the adjusting nuts for the adjusting connecting screws properly affixed to the uprights 21 and the bed. And likewise by providing openings with substantial tolerance the upright members 21 with the connecting cross bars 41 thus can be assembled as a unit and put into place and brought into proper relationship so that the several guide portions will be in proper operative positioning with respect to the guides upon the movable slide and with the side thrust plates 54 at the upper end of the adjustable rods or screws 60. To illustrate the practical effect, the centers of the pivot or wrist pins 85 could be out of line with the centers of the corresponding driving pins 91 of the eccentrics as much as an eighth or one quarter of an inch and the mechanism still would function satisfactorily.

Furthermore, this construction permits of a ready modification in the power transmitting and operating mechanism, and permits of a wide range of sizes in the press, both across the press and fore and aft. Also the power transmitting mechanism can readily be so arranged that the eccentrics for the connecting links are arranged transversely to the arrangement of the preferred embodiment illustrated in the drawings, and in this way a press with a narrow slide, but nevertheless adequately supported at each end, and with the forces applied under tension rather than compression as above described, can be provided and the difficulties heretofore encountered in narrow slide presses using a single center drive for the slide, such as a crank shaft and connecting rod, can be avoided.

For clearer illustration the power transmitting mechanism and associated parts mounted on top of the movable slide are shown as exposed; but, as indicated diagrammatically by dotted lines in Figs. 1 and 2 a suitable cover may be provided and affixed to the movable slide member to completely enclose the operating mechanism carried thereby. Or the uprights 21 may be made to extend higher and the cross bars 41 may be made so wide as to completely enclose and conceal the upper slide and the mechanism thereon, and the cover dispensed with. And the bed may be provided with interned projections or lugs having passages therethrough to receive the lower ends of the adjusting screws 80, the nuts 81 thus bearing against the lower faces of these projections or lugs so that the work forces in tension will be borne directly by the bed, instead of being transmitted against the portions 21' of the uprights

and thence through the bolts 40 to the bed. Such a construction permits of using ever smaller bolts to hold the uprights in place. In such arrangement the nuts would be within housings attached to the bed to support the weight of the upper slide and its associated parts.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A power press of the character described having a stationary die carrying bed, connecting rods affixed to said bed and extending upwardly therefrom, a movable die carrying slide member, power supplying mechanism mounted upon and movable with said slide member, and power transmitting oscillatable links each connected at one end to one of said connecting rods and at the other end to said power supplying mechanism.

2. A power press of the character described having a stationary die carrying bed, adjustable connecting rods affixed to said bed and extending upwardly therefrom, means for effecting adjustment of said connecting rods, a movable die carrying slide member, power supplying mechanism mounted upon and movable with said slide member, and power transmitting oscillatable links each connected at one end to one of said connecting rods and at the other end to said power supplying mechanism.

3. A power press of the character described comprising a stationary die carrying bed, connecting rods affixed to said bed and extending upwardly therefrom, members extending upwardly from said bed, a movable die carrying slide member movable within said upwardly extending members, power supplying mechanism mounted upon and movable with said slide member, and transmitting links each pivotally connected at one end of said connecting rods and at the other end to said power supplying mechanism by means converting rotary motion to reciprocatory motion.

4. A power press of the character described comprising a stationary die carrying bed, adjustable connecting rods affixed to said bed, a movable die carrying slide, power supplying mechanism mounted upon and movable with said slide member and including a power source and eccentrics and means for operatively connecting said power source to said eccentrics, and power transmitting links each pivotally connected at one end to one of said connecting rods and at its other end provided with an eccentric strap mounted upon one of said eccentrics.

5. A power press of the character described comprising a stationary die carrying bed, adjustable connecting rods affixed to said bed and extending upwardly therefrom, a movable die carrying slide, power supplying mechanism mounted upon and movable with said slide and including a power source and eccentrics and means for operatively connecting said power source to said eccentrics, power transmitting links each pivotally connected at one end to one of said connecting rods and at its other end provided with an eccentric strap mounted upon one of said eccentrics, and members extending upwardly from said bed and cooperating with the upper pivotally connected ends of said connecting rods to counteract the side thrusts thereof during operation of the press.

6. A power press of the character described having a stationary die carrying bed, adjustable connecting rods affixed to said bed, a movable die carrying slide, power supplying mechanism including oscillatable links mounted upon and movable with said slide member to travel therewith during operation and operable to cause movement of said members toward and away from each other, and means cooperating with said adjustable connecting rods for causing adjustment of said rods with respect to the bed to adjust the setting of said movable die carrying slide.

7. A power press of the character described having a stationary die carrying bed, adjustable connecting rods affixed to said bed, a movable die carrying slide, power supplying mechanism mounted upon and movable with said slide member to travel therewith during operation and operable to cause movement of said members toward and away from each other, and means cooperating with said adjustable connecting rods for causing adjustment of said rods with respect to the bed to adjust the setting of said movable die carrying slide, said means comprising a split adjusting nut internally threaded to receive said adjustable connecting rods and externally threaded for driving connection with an adjusting gear.

8. A power press of the character described having a stationary die carrying bed, adjustable connecting rods affixed to said bed, a movable die carrying slide, power supplying mechanism mounted upon and movable with said slide member to travel therewith during operation and operable to cause movement of said members toward and away from each other, means cooperating with said adjustable connecting rods for causing adjustment of said rods with respect to the bed to adjust the setting of said movable die carrying slide, and telescopic sleeves surrounding said adjustable rods and expansible and retractable with movement of said movable die carrying slide, whereby extraneous dirt and the like is prevented from collecting in the adjusting means to cause injury to or disabling of said means.

9. A power press of the character described having a stationary die carrying bed, adjustable connecting rods affixed to said bed, a movable die carrying slide, power supplying mechanism mounted upon and movable with said slide member to travel therewith during operation and operable to cause movement of said members toward and away from each other, means cooperating with said adjustable connecting rods for causing adjustment of said rods with respect to the bed to adjust the setting of said movable die carrying slide, and telescopic members surrounding said adjustable rods and comprising a plurality of telescopic sleeves one of which is affixed to the movable die carrying slide and another of which is affixed to the stationary die carrying bed whereby upon movement of said movable die carrying slide said sleeves are caused to expand and retract, whereby extraneous dirt and the like is prevented from collecting in the adjusting means to cause injury to or disabling of said means.

10. A power press of the character described comprising a stationary die carrying bed, power transmitting members affixed to and extending upwardly from said bed, members extending upwardly from said bed and located outwardly of said power transmitting members and cross supporting members connecting the upper ends of said upwardly extending members and means for

connecting the cross supporting members and associated upwardly extending outward members into a unitary structure, means to affix said unitary structure to the stationary die carrying bed, a movable die carrying slide member, power supplying mechanism mounted upon and movable with said slide member, and members connecting said power supplying mechanism to said power transmitting members to support and cause reciprocatory movement of the die slide member to and from the bed upon operation of the power supplying mechanism, said unitary upwardly extending member and means for affixing it to said bed being constructed to affix said unitary member to surround the upper slide and supporting and operating mechanism, and means carried by said upwardly extending unitary member and constructed to cooperate with the supporting and operating mechanism for the slide member to counteract side thrust thereof.

11. A power press of the character described comprising a stationary die carrying bed, adjustable connecting rods affixed to said bed, a movable die carrying slide, power supply mechanism mounted upon and movable with said slide member and including a power source and oscillatable power transmitting links and means for converting rotary motion into reciprocatory motion and including means connected to said power transmitting links, each power transmitting link being pivotally connected at one end to one of said adjustable connecting rods and at its other end to said pivotal link connecting means forming part of the power supplying mechanism.

12. A stamping or drawing press of the character described comprising a die carrying bed member, adjustable power transmitting members affixed to said bed, and a movable die carrying slide member, power supply mechanism mounted upon and movable with said slide and including a power source and power transmitting links each pivotally connected at one end to one of said power transmitting members and at the other end to said power supplying mechanism by means converting rotary motion to reciprocatory motion, said links being so connected as to support and cause substantially straight line reciprocal motion of said slide member.

13. A forming press of the character described comprising a stationary die carrying bed member, adjustable connecting rods affixed to said bed, a removable die carrying slide, power supplying mechanism mounted upon and movable with said slide and including a power source, power transmitting links each pivotally connected at one end to one of said connecting rods and at the other end to said power supplying mechanism by means converting rotary motion to reciprocatory motion, members extending upwardly from said bed and cooperating with said connecting rods and linkage to counteract side thrust at their pivotal connections during operation of the press.

14. A forming press of the character described comprising a bed, a unitary movable die slide and power supplying mechanism, and linkage affixed to said bed and movably connected to said power supplying mechanism, said linkage comprising oscillatable link members and being constructed to support said unitary slide member in all operative positions and also to cause substantially straight line reciprocation of said slide member when the operating power is supplied to said linkage from said power supplying mechanism, and members extending upwardly from said bed and cooperat-

ing with said linkage to counteract side thrust of the linkage during operation of the press.

15. For use in a power press of the character described, a unitary movable die slide and power supplying mechanism comprising a slide member for receiving a die, a source of power and power transmitting mechanism all mounted on and movable with said slide and including a clutch and power transmitting connecting and oscillatable links, each said link being movably connected at one end to an element of the power transmitting

mechanism carried by the slide by means for translating rotary into reciprocatory motion and at the other end having a pivotal connecting means constructed to receive a fixed power transmitting and supporting member, whereby said unitary die slide and power supplying mechanism may be operatively supported in and removed from said press as a unit by effecting connection or disconnection at said pivotal connecting means.

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