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C. H. TAUSER

3,112,666

PUNCHING APPARATUS

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2 Sheets-Sheet 2

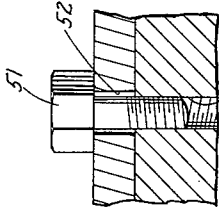


FIG. 7

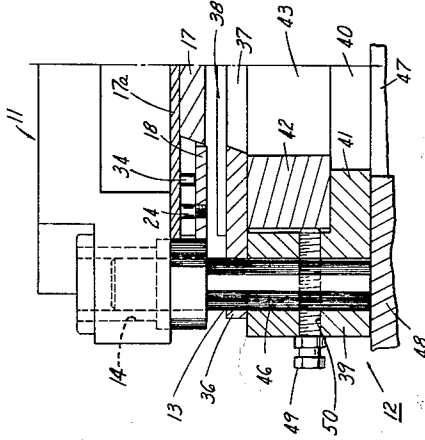


FIG. 6

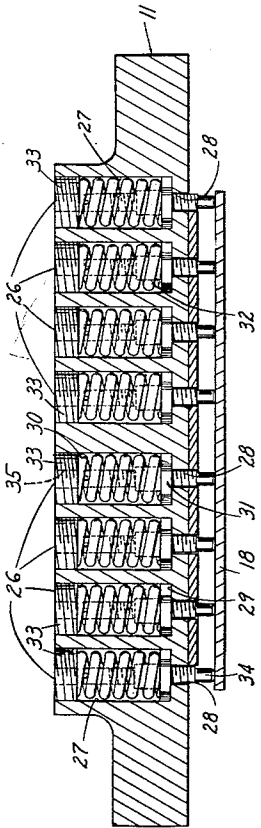


FIG. 5

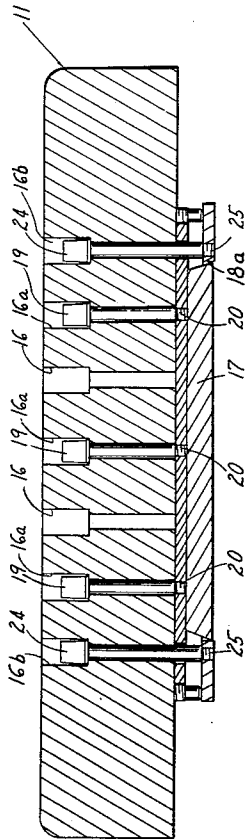


FIG. 4

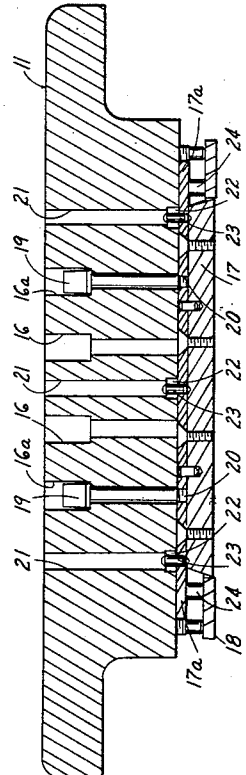


FIG. 3

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PUNCHING APPARATUS

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The present invention relates to a punching apparatus and more particularly to die set for accommodating male and female dies for punching sheet material.

A general object of the present invention is to provide an improved punching apparatus which is especially economical and simple to use and which is reliable in operation.

Another object is to provide an improved die set capable of accommodating an unlimited number of different blanking dies of various configurations, and wherein the dies may be relatively quickly and easily attached to and removed from the die set.

Another object is to provide an improved die set for the successive accommodation of different stripper means and sets of blanking dies of substantially any configuration and wherein the parts are maintained in accurate alignment during blanking operations.

Another object is to provide a die set having a punch holder provided with mounting means for the successive accommodation of complementary punch and stripper means of various configurations wherein the punch and stripper means may be installed therein without the necessity of performing machine operations, such as drilling, on the punch holder itself.

Another object is to provide an improved punch holder for use in a die set wherein punch mounting means, and stripper plate mounting and biasing elements may be repeatedly used for successive sets of punch and stripper means of different configurations.

Another object is to provide a die set having improved stripper biasing means readily adapted for use with stripper means of substantially any configuration.

Another object is to provide an improved die set wherein relatively simple and inexpensive all-metal stripper means of substantially any configuration may be used in the die set.

Another object is to provide an improved punch holder adapted to accommodate successive metal stripper means of substantially any configuration wherein the necessity of using compressible materials such as rubber pads and the like for stripping purposes is avoided.

Still another object is to provide a punch holder for the successive accommodation of different stripper plates wherein only the preparation of a new stripper plate is required when a new configuration thereof is to be used with the punch holder, the necessity of special spring biasing and mounting elements for each new stripper plate being obviated.

In accordance with one aspect of the present invention, a punching apparatus is provided which includes a punch holder adapted to carry complementary punch and stripper means, the punch holder being provided with a plurality of openings in which are positioned resilient means for biasing the stripper means.

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

These and other objects and advantages of the present invention will be apparent from the following detailed description and accompanying drawings wherein like numerals refer to like parts wherever they occur.

In the drawings:

FIG. 1 is an upper plan view of the punch apparatus embodying the present invention,

FIG. 2 is a front end plan view of the apparatus of FIG. 1,

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FIGS. 3, 4 and 5 are sectional views taken along lines 3-3, 4-4 and 5-5 respectively, of the punch holder shown in FIG. 1,

FIG. 6 is a partial side view with certain parts in section of the apparatus of FIG. 1,

FIG. 7 is a fragmentary sectional view taken along line 7-7 of FIG. 2.

Referring now to the drawings and particularly to FIGS. 1 and 2, a die set 10 is shown including an upper portion or punch holder 11 guided for movement relative to a lower portion or die holder 12 by means of four leader or guide pins 13 secured to the die holder. The die holder is adapted to be secured to the bed of a power press in the usual manner, such as by clamping means (not shown), while the punch holder is adapted to be connected to the ram (not shown) of the press by which it is raised and lowered during blanking operations.

The punch holder 11 is in the form of a relatively heavy metal plate provided with a hole 14 at each corner for receiving a bushing 15 to provide slidable bearing surfaces with the leader pins 13. Each bushing has a lower collar and an upper nut for fixing the bushing within the hole.

Referring now also to FIGS. 3 and 4, the punch holder 11 is provided with a plurality of parallel mounting bores 16 extending vertically through the main body portion of the punch holder and, as seen in FIG. 1, the bores are distributed over the major surface area thereof. The bores 16 are arranged and distributed such that a sufficient number of them will be in alignment with substantially any configuration of punch and stripper plate.

In the drawings, the numeral 17 represents a male die or punch and the numeral 18 represents a complementary metal stripper plate. The punch 17 may include a foundation or backing plate, such as indicated at 17a, secured by means of screws and dowel pins. The punch is usually made of hardened steel and where a backing plate is used, the backing plate is usually made of softer metal than the punch to prevent marring of the lower face of the punch holder during punching or blanking operations. Stripper plate 18 may be made from any suitable metal such as sheet steel. The stripper plate has an opening 18a which is formed in accordance with the shape of the punch.

The punch 17 is secured to the lower side of holder 11 by a plurality of fastening screws 19 in certain of the mounting bores, these particular bores being indicated as bores 16a. Threaded holes 20 which are provided in the punch 17 during its fabrication are aligned with bores 16a to threadedly receive the fastening screws 19. The screws 19 are tightened down so that the heads of the screws are in abutment with shoulders provided within the bores and the punch unit is abutting the lower face of the holder. Dowel pins, in addition to the above described fastening means, are shown in the drawings for maintaining the punch in fixed relation to the holder. One or more dowel pins may be provided in the punch in the usual manner. As seen in FIGS. 1 and 3, several bores 21 in the holder 11 are provided with bushings 22 for the reception of dowel pins 23 which fit in holes that may be provided in the punch 17 during its fabrication or installation in the die set.

In the illustrated embodiment, the holder supports the stripper plate 18 by means of a plurality of fastening screws 24 in certain of the mounting bores, these being indicated as bores 16b. The screws 24 are threadedly received in threaded holes 25 provided in the plate during its fabrication. As shown, four fastening screws 24 are used, one adjacent each corner of the punch holder, the screws passing through openings in the backing plate. Fastening screws 24 are slidable in their bores but limit the downward travel of the stripper plate. The stripper

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plate is installed in the die set with its inner edge surrounding the cutting edge of the punch 17.

As shown in FIG. 5, the stripper plate is resiliently biased from the punch holder by a plurality of stripper biasing units 26 in a plurality of parallel bores or openings 27 formed in the punch holder. In the illustrated embodiment, the bores 27 extend vertically through the body of the holder and, as seen in FIG. 1, are distributed over a major portion of the holder so that a sufficient number of them will be in alignment with a stripper plate of substantially any configuration. The bores 27 are formed with a portion 28 of reduced diameter to provide a shoulder 29. The bores 27 are shown by way of illustration as having cylindrical walls.

The biasing unit 26, as shown, each include resilient means in the form of a coil spring 30 within the bore 27, a slidable internally threaded pin retaining member 31 having an integral collar 32 normally biased by the spring 30 into abutment with the shoulder 29, a screw 33 at the upper end of the bore retaining the spring in the bore, and a threaded bias pin 34 threadedly received in the retaining member 31 and extending through bore portion 28 and below the lower face of the punch holder. The bias pins 34 are adjusted so that the lower ends thereof abut the upper surface of the stripper plate 18 thereby urging the plate downwardly. In this manner, the stripper plate is spring biased away from the lower surface of the holder 11, the stripper plate normally being positioned slightly in advance of the punch 17. The spring retaining screws 33, which are in abutment with the upper ends of the biasing springs 30 and preload the biasing springs, are provided with openings such as hexagonal tool openings 35 therethrough for not only providing means for turning the screws 33 but also to provide an opening through which a tool such as a screwdriver may be inserted for turning and adjusting the bias pins 34. During the installation of a stripper plate, the end of a screwdriver, for example, may be inserted in the slot provided in the upper end of each bias pin, as seen in FIG. 1, and each of the bias pins, in this manner, turned until they abut the upper surface of the stripper plate. In this way, the bias pins may be adjusted to suit a stripper plate of substantially any thickness and configuration.

As shown in FIG. 6, the die holder 12 supports a complementary female die 36 which is installed in the die set in aligned relation with the male die 17. The die 36 has an opening 37 which receives the male die upon the closing of the die set by the power press to produce a blanked out piece from sheet material, for example, a sheet of metal 38. The die holder includes a rectangularly shaped base member or die shoe 39 provided with an opening 40. The die shoe is provided with an inwardly extending flange portion, indicated at 41, on which is positioned a die supporting bolster 42 for backing the die plate 36. The bolster is provided with an opening 43 adjacent the opening 37 in the die 36. As previously mentioned, the leader pins 13 are secured to the die holder 12, and this may be accomplished, for example, by press fitting them in holes 46 in the die shoe, which holes are in aligned relation with holes 14 in the punch holder.

The opening 43 in the bolster 42 is shown slightly larger than die opening 37, and the opening 40 in the die shoe is shown slightly larger than opening 43. With this arrangement, blanked out pieces from sheet 38 are permitted to fall through these aligned openings and through an opening 47 in the bed, indicated at 48, of the press (FIG. 6) and into any suitable container (not shown).

The bolster 42 is adjustably positioned between the die 36 and flange 41 by a plurality of lock screws 49 which extend laterally through threaded bores 50 in the sides of the base member 39, the ends of the lock screws being in abutment with the sides of the bolster. The

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lock screws thus provide means for adjusting the bolster 42 laterally relative to the die 36.

The die 36 is rigidly but detachably secured to the die shoe by means of a plurality of cap screws 51. As seen in FIG. 7, each cap screw is inserted in an aperture 52 in the die and received in a threaded bore 53 in the die shoe. A dowel pin bushing 54 (FIG. 2), is positioned in the die shoe at the center of the side shown to permit use of a dowel pin 55 that extends into a hole 56 formed in the die, the hole being in aligned relation with the bushing. The die plate 36 may be accurately located in position by two such dowel pins, the other dowel pin (not shown) being used in the same manner at the side of the die shoe opposite that viewed in FIG. 2. The apertures 52 in the die shoe are shown oversize, as seen in FIG. 7, to permit easy insertion of the cap screws after the dowel pins have been inserted.

Where the same blanking dies are to be re-used and dowel pins have been previously employed to accurately locate the dies in the die set, the dies are inherently aligned when dowel pins in the punch and female die are again located in the punch holder and the die shoe, respectively.

In the operation, with the die set open, which is the position shown in FIGS. 2 and 6, the sheet 38 that is to be punched is placed between the punch 17 and die 36. During the downward stroke of the ram of the press, the punch holder 11 is lowered on leader pins 13 toward the die holder 12. The stripper plate 18, being normally positioned in advance of the punch, is first to abut the sheet 38. This abutment compresses the coil springs 30 within the holder resulting in a force being exerted on the stripper plate and sheet metal 38 through biasing pins 34 in retainers 31 to maintain the sheet in a fixed position between the punch 17 and die 36. Further downward movement of the punch holder causes the punch to shear or cut through the sheet 38 and to be received in the die opening 37. During this action, the coil springs 30 are further compressed thereby resulting in increased pressures being applied to the sheet metal by the stripper plate. The piece blanked out from sheet 38 then falls through the aligned openings 37, 43, 49 and 47 (FIG. 6) into any suitable container. The press is again opened and ready for the next blanking operation.

During the downward movement of the punch holder, the pins 34 and retaining members 31 are moved upwardly, relative to the bores 27, against the compression forces of the springs 30, the collars 32 of the pin retaining members sliding upwardly in the bores away from the shoulders 29. The stripper plate fastening screws 24, of course, also slide upwardly in their bores 16 when the stripper plate is urged upwardly during a blanking operation. When the press is opened, retaining members 31 are again biased into abutment with shoulders 29 in bores 27, and the stripper plate again biased outwardly of the holder 11 and toward the die holder 12, as shown in the drawings.

The punch holder shown is preformed, that is, formed with bores 16 and bores 27 during its fabrication. Also, the holder may be pre-assembled with a plurality of biasing units 26 and fastening elements 19 and 24. A plurality of holes 21 and dowel bushings 22 may also be provided in the punch holder during its fabrication. The punch holder, as viewed in FIG. 1, is preformed with a plurality of parallel rows of bores 27 which extend from one side to the other side of the holder between the leader pin bushings. The bores 16 which receive fastening elements 19 and 24 are formed in spaced parallel rows which alternate with the rows of bores 27. In this way, a suitable number of fastening elements and biasing elements may be selectively used in the punch holder for the installation of a punch and stripper plate of substantially any configuration.

The various mounting holes in the punch and stripper

plates may be located, for example, by use of a simple template having openings corresponding to the openings in the punch holder. Such a template may be stored with the die set and conveniently used for each set of punch and stripper plates to be used in the die set.

The punch 17 is easily detached from the punch holder by removing fastening screws 24 and dowel pins 23. The stripper 18 is detached by simply removing the fastening screws 19. The die 36 is also easily removed from the die holder 12 by removing cap screws 51 and dowel pins 55. The bolster 42 may be removed by loosening lock screws 49 and sliding the bolster upwardly out of the die shoe.

Where one or more of the biasing units 26 is not to be used due to the particular configuration of stripper plate to be installed in the die set, such biasing units may nevertheless be retained in the punch holder. Any bias pins not to be used may be turned and backed into their openings in the holder, where desired, or, such pins may be removed from the holder. Each of the biasing units may be removed from any location and relocated by removing the screw 33, and sliding the spring 30, bias pin 34, and retainer 31 out of one bore, and re-assembling the bias unit in another bore.

The biasing force of each biasing unit may be independently adjusted by varying the compression of each spring by means of screws 33. By adjusting screws 33, the desired biasing forces may be distributed over a given stripper as required or desired.

If desired, several of the biasing pins may be provided with threaded end portions (not shown) for threading the pins into threaded holes which may be provided in the stripper plate. In this way, such bias pins engage and yieldingly urge the stripper outwardly of the punch holder as well as limit the downward movement thereof. Such biasing pins of this nature may be used in place of fastening screws 24, if desired.

It will be apparent that a punch and stripper of substantially any configuration and size may be attached to the punch holder, the size being limited only by the size of the die set. Since the fastening means and spring biasing means may be provided by the described punch holder, no special mounting and biasing means are required for each new stripper plate other than threaded mounting holes such as indicated at 25. This means that a very simple and economical metal stripper plate may be used with the punch holder. As seen in the drawings, the stripper plate 18 is a relatively thin, flat metal sheet member. Also, the punch requires only properly located mounting holes for its installation. Considerable savings may be realized since the mounting and spring biasing units provided by the die set of the present invention, may be repeatedly used for different punches and stripper plates.

The use of resilient pads such as rubber pads and the like, for stripping purposes and their inherent disadvantages are obviated by the practice of the present invention. As is well known to those skilled in the art, such pads of resilient material must be cemented or vulcanized to the die set, and such pads usually have a very limited useful life.

It will be apparent that, while successive punch and stripper plates of substantially any configuration can be installed in the die set of the present invention, no machining or drilling of the parts of the die set itself is required when each new set of punch and stripper means is installed therein. This results in a reduced die installation time and greatly increases the life of the die set. Also, since the coil springs 30 are positioned within openings in the punch holder, economical punches made from relatively thin metal stock may be used in the die set of the present invention, where desired, since external springs which require considerable space are not required between the stripper plate and lower surface

of the punch holder, as is usually the case in conventional die sets.

Because an unlimited number of different sets of blanking or punching dies and stripper plates may be used in the hereinbefore described die set, considerable savings in material and labor costs may be realized. This is especially true where a limited number of parts are to be produced by a given set of dies. In contradistinction, when conventional die sets are used in making a relatively small number of parts, the tool cost per unit part may be exceedingly high because of the high cost of the conventional die set.

In the illustrated embodiment, the punch holder is guided for movement relative to the die holder on the four guide pins 13 which accurately maintain the punch and die holders in alignment. The number of guide pins used in any given design is determined generally by the size of the die set.

While the die set shown for illustration in the drawings contains a single punch 17, it will be apparent that more than one punch may be installed together in the die set for simultaneous operation. For example, where more than one punch is to be attached, a single stripper plate may be installed having an opening for each of the punches. The female die in such case, will, of course, be provided with openings complementary to the punches. On the other hand, it may be desired in some cases to use more than one stripper plate, one for each of the punches to be installed.

It is to be understood that the foregoing description and accompanying drawings have been given only by way of illustration and example, and that alterations and changes in the present disclosure, which will be readily apparent to one skilled in the art, are contemplated as within the scope of the present invention, which is limited only by the claims which follow.

What is claimed is:

1. In a punching apparatus, a punch holder, a punch member secured to one side of said punch holder, a stripper member secured to said punch holder, fastening elements secured to said stripper member and slidable in openings in said punch holder for supporting said stripper member for movement toward and away from said one side of said holder, each of said fastening elements having abutment means thereon normally engaged with said holder to limit the extent of movement of said stripper member from said one side of said holder, said punch holder having a plurality of bores therein, each of said spring means having an opening therethrough, spring means in each of said bores, spring retaining means at one end of each of said bores engaged by one end of the spring means therein, abutment means at the other end of each of said bores, a slidable member in each of said bores engaged by the other end of the spring means therein and normally urged by the spring means into engagement with the abutment means in each bore, each of said slidable members having a threaded opening therethrough, and a plurality of threaded pin members each received in one of said threaded openings, one end of each of said pin members being in only abutting engagement with one side of said stripper member to bias said stripper member from said punch holder, each of said retaining means having an opening therethrough in aligned relation with each respective pin member and the opening through respective spring means to permit access to the other end of said pin members for varying the position of the pin members relative to their associated slidable members, each of said pin members being movable relative to the slidable member associated therewith without varying the force and position of the spring means associated therewith.

2. In a punching apparatus, a punch holder, a punch member, removable fastening elements securing said punch member to one side of said holder, a stripper plate having a plurality of threaded apertures therein, movable fastening elements slidable in openings in said holder and

having threaded end portions respectively received in said apertures to support said stripper plate adjacent the outer periphery of said punch member for movement toward and away from said one side, said elements having abutment means thereon normally engaged with said holder for limiting the extent of movement of said stripper plate from said one side, said holder having a plurality of bores therein, a plurality of spring means one in each of said bores, each of said spring means having an opening therethrough, a plurality of threaded spring retaining members one in each of said bores engaging one end of the spring means therein, means forming a shoulder in each of said bores adjacent said one side of said holder, a reciprocal member in each of said bores between the other end of the spring means and the shoulder therein and normally urged by the spring means into abutment with the shoulder, each of said reciprocal members having a threaded opening therein, a plurality of threaded pin members respectively received in said threaded openings in said reciprocal members, each of said pin members being movable relative to its associated reciprocal member without varying the force and position of the spring means associated therewith, each of said pin members having one end in only abutting engagement with one side of said stripper plate to bias said stripper plate from said one side of said punch holder, each of said retaining members being movable relative to the bore in which it is disposed for varying the force of the spring means therein, each of said retaining members having an opening therethrough in aligned relation with each respective pin member and the opening through each respective spring means to permit access to the other end of each of said pin members for varying the position of each pin member relative to its associated slidable member.

3. A punch holder for use in a die set and adapted to have connected to one side thereof punches and stripper members of various configurations comprising a main body portion having a first plurality of spaced bores, a plurality of fastening elements for insertion in selected ones of said first plurality of bores for securing one of said punches to said one side of the punch holder, said body portion having a second plurality of bores therein, a plurality of bolts for insertion in selected ones of said second plurality of bores for supporting a stripper member having threaded openings and which is complementary to said one punch, adjacent the outer periphery of said one punch for movement toward and away from said one side of the punch holder, said bolts having threaded end portions to be respectively received in the threaded openings in said stripper member, each of said bolts having abutment means thereon engageable with the punch holder to limit the movement of each of said bolts and the extent of movement of said stripper member from said one side of the punch holder, said body portion having a third plurality of bores therein, a movable threaded

member disposed in each of said third plurality of bores, each bore of said third plurality of bores having abutment means therein spaced from the threaded member therein, a plurality of spring means one in each of said third plurality of bores between the threaded member and abutment means therein with one end of the spring means engaging the threaded member therein, each of said spring means having an opening therethrough, a plurality of reciprocal members one in each of said third plurality of bores between the other end of the spring means and the abutment means therein and normally urged by the spring means into engagement with the abutment means therein, each of said reciprocal members having a threaded opening therein, and a plurality of threaded pin members one received in each of said threaded openings in said reciprocal members, each of said pin members being movable relative to its reciprocal member without varying the force and position of the spring means associated therewith, each of said threaded members having an opening therethrough in aligned relation with each respective pin member and the opening through each respective spring means to permit access to one end of each of said pin members for turning each pin member to adjust the position thereof relative to its associated reciprocal member, each of said pin members being adjustable between a first position wherein said other end of each pin member is substantially coextensive with said one side of the punch holder and a second position wherein said other end of each pin member is at a substantial distance from said one side of the punch holder, selected ones of said pin members being adjustable so that said other end of each of said selected ones of said pin members only abuts one side of the stripper member to bias the stripper member from said one side of the punch holder.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,112,666

December 3, 1963

Charles H. Tauser

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 8, for "set" read -- sets ---; column 6, lines 48 and 49, strike out "bores therein, each of said spring means having an opening therethrough, spring means in each of said bores, spring" and insert instead --- bores therein, spring means in each of said bores, each of said spring means having an opening therethrough, spring ---; line 64, before "respective" insert -- each ---; column 7, line 34, for "slidable" read --- reciprocal ---; column 8, line 26, for "said" read --- the --.

Signed and sealed this 19th day of May 1964.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents