April 16, 1963 T. K. ALLISON 3,085,275

DOCTOR BLADE AND HOLDER

Filed April 12, 1961 3 Sheets-Sheet 1

Fig. 1.

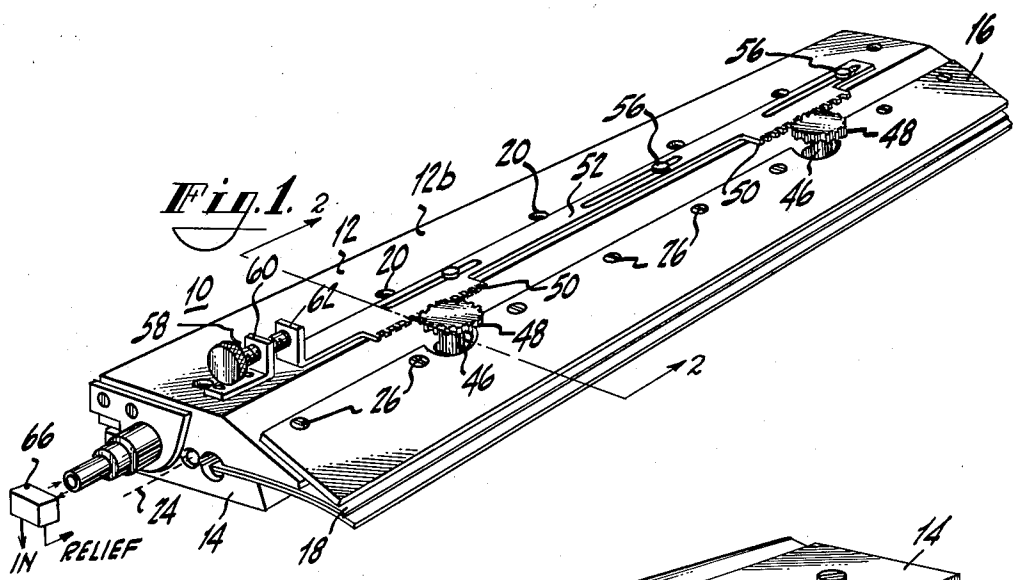
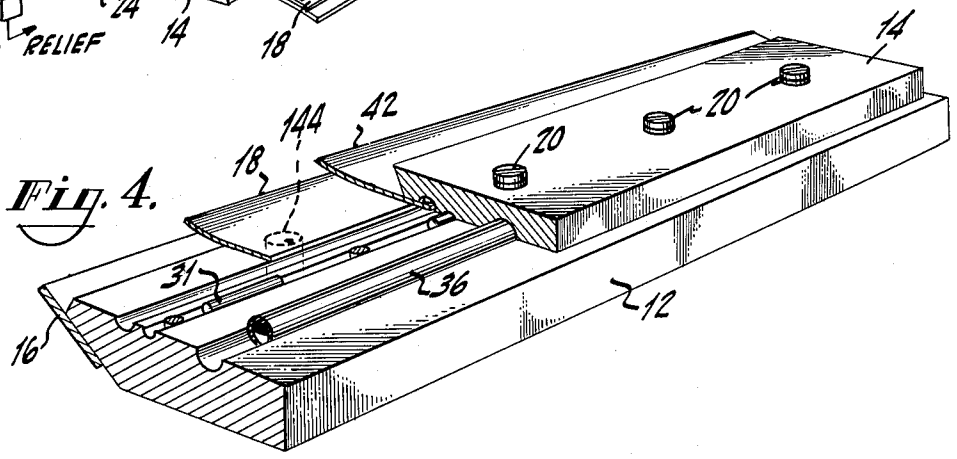


Fig. 4.



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DOCTOR BLADE AND HOLDER

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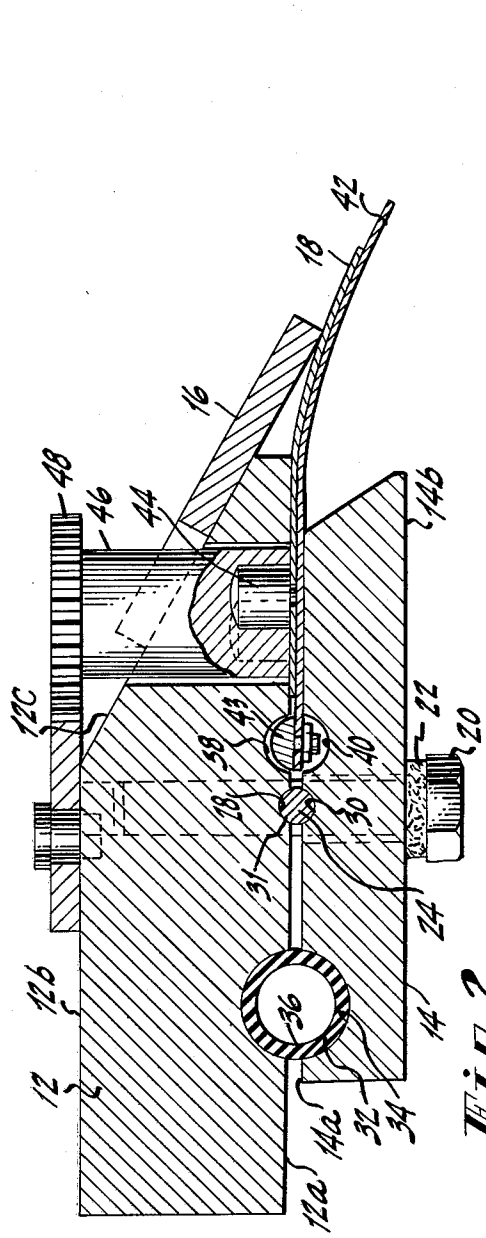

Fig. 2.

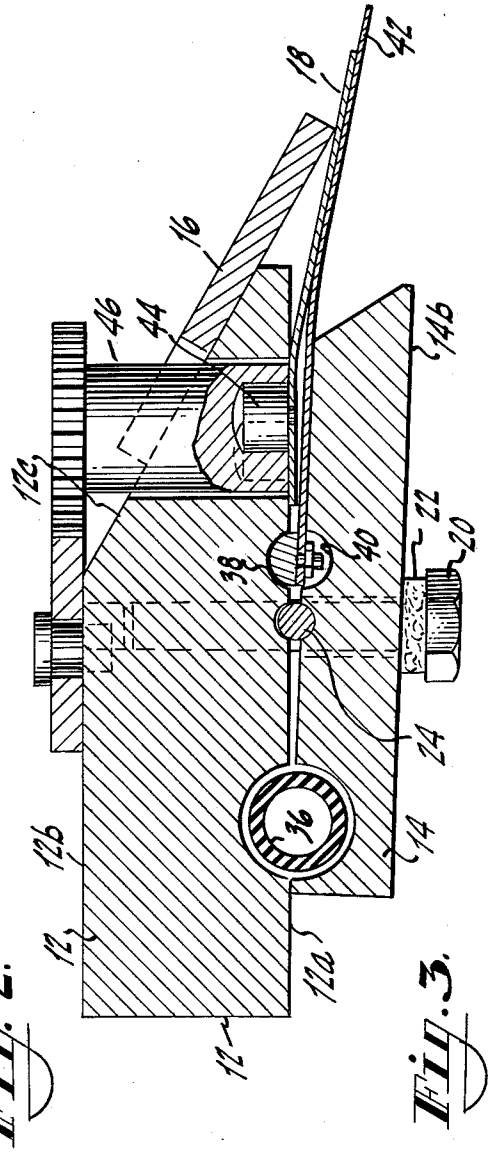

Fig. 3.

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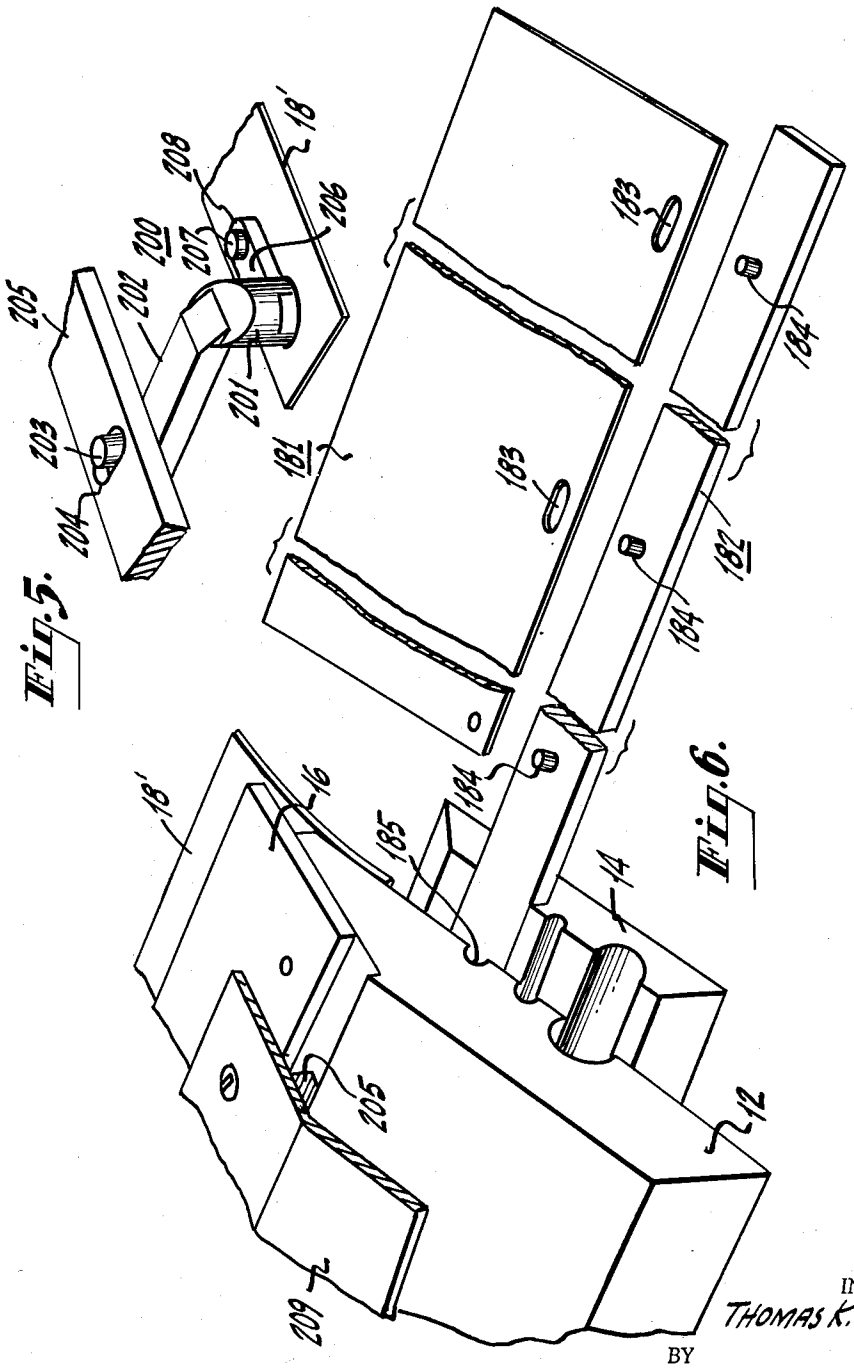

Fig. 5.

Fig. 6.

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3,085,275

DOCTOR BLADE AND HOLDER

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Filed Apr. 12, 1961, Ser. No. 102,525
9 Claims. (Cl. 15—236)

The present invention is related to doctor blades and holders therefor.

Although sometimes used elsewhere, doctor blades are often used in gravure or intaglio printing for wiping excess fluid from the surface of an engraved roll. To obtain good impressions, the sharp, true edge of the blade is brought into good registry and tight contact with the cylindrical surface of the roll. As the roll rotates against the fixed blade, the blade wipes off any excess ink. The doctor blade may be made of a high quality steel, for example, Swedish steel .95 carbon, 50–55 Rockwell C, 0.006" to 0.010", often purchased as a coiled ribbon of steel. Other materials, such as nylon, brass and bronze are also used. In use, a sufficient length is cut off of the ribbon, the edge trued, and the blade inserted in a doctor blade holder. The blade may be trued in the holder, either the working holder or a grinding fixture of the same geometry, to maintain in this case parallelism between the working edge and an indexing edge in the holder. The doctor blade holder maintains the blade against the roll at the desired angle and with the desired pressure and flexure to secure a desired wiping action on the roll. Eventually, the blade wears, and the worn blade is replaced by either a new or re-sharpened blade. In replacing the blade, the blade holder is removed, which usually requires stopping the press. Then the holder is reinserted at the appropriate angle to provide a desired "wipe," the desired pressure is applied, and the press started again.

It is an object of the invention to provide a novel combination of doctor blade and holder therefor which has advantages in ease of blade replacement.

Further objects are to provide the blade and to provide the blade holder which may be combined in the novel combination.

A further object of the invention is to provide a doctor blade holder having advantages in adjustment of the flexibility of the blade as it wipes which advantages are not available in presently proposed apparatus. In particular, my blade holder affords an adjustment means for advancing or retracting a back-up blade, which controls the flexure of the doctor blade. The adjustment may, if desired, be performed while the press is in operation.

In accordance with the invention, the novel doctor blade holder includes a main bar, a secondary bar, a back-up bar, and a back-up blade. The doctor blade is held releasably between the main and secondary bars, at least one of which has an axial key way slot for guiding a cooperating key or the like on the doctor blade itself. The main and secondary bars are attached for a rocking action along an axial line to the rear of the doctor blade keyway but forward of the rear-most part of the secondary bar. In operation, when the two bars are released so that their forward portions (forward of the fulcrum line) may be separated, or at least are not stressed together, the doctor blade may be withdrawn or inserted from one axial end of the holder, guided by the key in the keyway. When the back portions of the bars are pushed apart, forward portions of the bars rock together grasping the inserted doctor blade firmly in operative position, and holding the back-up blade in place against it. Further features of the invention involve the preferred use of inflatable tubing so that compressed air may be used to exert the rocking force or leverage for locking the

doctor blade in place, and also an arrangement for adjustably positioning the back-up blade fore or aft for firmer or less firm back-up, respectively, of the doctor blade, thereby affecting the wiping action.

The foregoing and other objects, advantages and novel features of the invention will be more fully explained in the following description, which should be read in connection with the accompanying drawing. In the drawing, like reference characters refer to like parts and:

FIGURE 1 is a perspective view of the doctor blade holder according to the invention with the doctor blade in place;

FIGURES 2 and 3 are transverse cross-sectional views of the holder of FIGURE 1 along the lines 2—2 in FIG. 1 illustrating, in FIG. 2, the position of the parts with the doctor blade locked in place; and in FIG. 3, the parts with the doctor blade released ready for withdrawal, or after insertion but prior to locking in place;

FIGURE 4 is a perspective view of the holder of FIG. 1 inverted from the view of FIG. 1 and partly in section;

FIGURE 5 is a partial view in perspective illustrating an alternative mechanism for adjusting a back-up blade; and

FIGURE 6 is a view in perspective of still another embodiment of the invention which may employ the mechanism of FIG. 5.

With reference to FIGURES 1 to 4, the doctor blade holder **10** includes a main bar **12**, a secondary bar **14**, a back-up bar **16**, and a back-up blade **18**. The main and secondary bars are held together by a series of axially spaced bolts **20** which are inserted through holes in the secondary bar **14** centered along an axial line **24** and threaded into the main bar **12**. Between the enlarged heads of the bolts **20** and the secondary bar **14** are felt or rubber washers **22**. These washers have a certain resiliency. The holes in the secondary bar **14** for the bolts **20** are slightly oversize to allow the rocking action more fully described hereinafter. The axes of the bolts **20** are at right angles to the adjacent, facing, substantially planar surfaces **12***a* and **14***a* of the two bars **12** and **14**, respectively.

The opposite, lower surface **14***b* of the secondary bar **14** is also planar and parallel to the surface **14***a*. However, the upper surface of the main bar has two portions, a rearward portion **12***b* parallel to the lower, planar surface **12***a* and a forward portion **12***c*, also planar but chamfered toward the facing surfaces **12***a*, **14***a*. Against the chamfered surface **12***c* is held the back-up bar **16**, which is fastened to the main bar **12** by any suitable means, such as machine screws **26**, and has its front part extending forward and down toward the back-up blade **18**.

A pair of slots **28** and **30** each a little less than semicircular in cross-sectional shape are milled axially in the main and secondary bars **12** and **14**, respectively. These slots **28** and **30** may be centered approximately on the axial line **24** when the bars are assembled. In substantially circular space afforded by slots **28** and **30** rest lengths of solid, cylindrical rods **31** interspersed between the bolts **20**.

A rear pair of slots **32** and **34** each of which may be semicircular in cross-sectional shape, are milled axially in the main and secondary bars **12** and **14**, respectively. When the bars are assembled, an air hose **36**, which may be of synthetic rubber, vinyl, polyethylene or fluted steel or the like (a synthetic rubber or rubberized cloth not affected by ink solvents is preferred) is nested in the circular space afforded by their rear pair of slots **32**, **34**. To one end of the main bar **12** is attached a fixture **66** for connecting to the air hose **36** any suitable air source and relief valve. The fixture **66** is only indicated schematically. Any type of commercially available quick-connect and release fixture may be used, although a more

permanent connection may be made. The inlet and relief valves are indicated by legend and these may be of any suitable, known type. The inlet valve may lead from any suitable pressurized air or gas pressure supply. I have found a pressure of 40 to 60 p.s.i. suitable.

A forward pair of slots 38 and 40 are milled axially in the main and secondary bars 12 and 14, respectively. The slot 38 in the upper bar serves as the key-way for the keyed doctor blade.

The doctor blade 42 is keyed by means of the round heads of machine screws 43 inserted through the doctor blade 42 in alignment along the rear edge of the blade. Rivets, dimpling of the blade material, moulded plastic buttons, beads, spiral wound wire (like a spiral notebook binding) may also be used as guiding devices. The main bar lower slot 40 of the forward pair affords access for the nut which holds the screws on the doctor blade 42 and the screw heads 43 in place.

The back-up blade 18 has riveted equidistantly from its rear edge and axially widely spaced, a pair of pins 44. The pins 44 are journalled eccentrically into a pair of posts 46, and the posts 46 in turn are journalled in the main bar 12 in the forward, bevelled or chamfered portion. Each post 46 bears at its top a pinion 48. A pair of racks 50 cooperate respectively with the pinions 48. The racks 50 are carried on a plate 52. Guide pins 54 ride in longitudinal slots 56 in the plate 52 restricting the plate to axial displacement. A screw 58 having a knurled knob for easy manual manipulation is threaded into a stud 60 attached to one end of the main bar 12 on the upper, planar surface 12*a* near where the chamfer begins. When the screw is turned, it advances or retracts along its axis parallel to the axis of the doctor blade holder 10. The end of the screw 58 is journalled in a turned up tab 62 of the plate 52 in such a manner that as the screw 58 rotates in one direction, it advances and the tab 62 and the plate 52 advance with it; and as the screw 58 rotates in the other direction, it retracts, and the tab 62 and the plate 52 retract with it. For example, a reduced diameter end portion of the screw 58 may pass through a hole in the tab leaving a shoulder of the screw 58 riding on one side of the tab 62, and the end of the screw 58 may be peened over on the other side of the tab 62 to prevent its withdrawal from the tab 62.

In operation, the doctor blade holder 10 is fixed in place in the gravure press or the like, with or without the blade in position. The relief valve is opened, and air is released from the air hose 36. The hose collapses, or loses rigidity. The parts are now in a relatively loose condition, as illustrated in FIG. 2. The doctor blade 42 is relatively or completely in an unstressed condition. A blade within the holder may now be withdrawn easily from one axial end of the holder 10 and a new or resharpened blade inserted using the screw heads 43 as keys to fit the key-way to guide the blade into position. The withdrawal or insertion of a doctor blade 42 is thus accomplished without removing the holder 10 from the press, and without disassembling the holder.

In order to tighten the grip of the holder 10 on the doctor blade 42, after the blade 42 is in proper position longitudinally in the holder, the relief valve is closed and the inlet valve is opened, so that compressed air or gas flows into the air hose 36. The hose now is inflated, as illustrated in FIG. 2. Inflation of the hose rocks the rear part of the secondary bar 14 away from the main bar 12 about the heads of the bolts 20 and washers 22 as a fulcrum and also rocks the forward part of the secondary bar 14 toward the main bar 12 to grip or hold the doctor blade between the main bar 12, the back-up bar 16, and the back-up blade 18 on one side and the secondary bar 14 on the other side. As understood by those skilled in the art, an unsupported doctor blade, or one not fully stressed or grasped, has a wavy, not straight line, edge. Such a wavy edge is in evidence after insertion of the doctor blade 42 before the air hose is fed compressed air. However, when the air hose 36 is expanded by the compressed air, the grip on the doctor blade is astonishingly strong. The blade becomes well straightened. The wiping action is excellent.

Moreover, also with the holder 10 in place in the press, and in fact with the press running, the wiping action secured may be varied or adjusted. Thus with the air released from the air hose 36, the adjustment screw 58 may be advanced or retracted to advance or retract axially the plate 52. When the plate 52 is advanced or retracted, the racks 50 turn the pinions 48 correspondingly clockwise or counter-clockwise as viewed in FIG. 1. Both posts 46 also turn clockwise or counter-clockwise correspondingly. Because the pins 44 are eccentrically journalled in the posts, the rotation of the posts 46 advances the pins 44 toward the front, or retracts the pins toward the rear, of the blade holder 10, and the back-up blade 18 correspondingly advances or retracts. The pins 44 are spaced a distance equal to the separation of the centers of the posts 46, and the posts are so turned when the pins 44 are initially inserted into the posts 46 that the pins are at the same angles from the centers of rotation of the posts. Then the pins 44 maintain their same distance of separation and are advanced toward the front, or retracted toward the rear of the holder 10 together. When this adjustment is completed, the air hose may be again expanded with compressed air, and the degree of wipe examined. In this fashion, the "overhang," or flexure or "bend" of the doctor blade may be increased, by advancing the back-up blade 18 toward the front edge of the doctor blade 42, thus increasing the flexure of the blade 42 against the gravure cylinder; or the flexure of the wipe may be decreased, by retracting back-up blade 18 from the front edge of the doctor blade. This adjustment is made with some little change in the angle of wipe, and is a type of adjustment not heretofore readily available, if at all.

When the air hose 36 expands, it applies a constant force of separation per unit of axial length along the holder of the main and secondary bars 14, 16. Moreover, it is economical. Other fluids, than air, either gas or liquid, could be used. Solely mechanical arrangements are possible for exerting the releasable force of separation. However, for economy of parts, and because a compressed air source is available in nearly all commercial printing establishments, I presently prefer the arrangement illustrated.

The rods 31, which may be ordinary drill rod, are employed to assure correct alignment of the primary and secondary bars. They admit of the rocking action and assure that the bolts 20 do not in the first instance engage the plates so tightly that there shall be no room for the effective rocking of the parts to perform the release and grasping functions. For this same purpose, I engage the bolts 20 only lightly, finger tight, and find this quite sufficient to keep the parts in desired assembled relationship. It would appear that the rocking action occurs actually against the head of the bolts 20 and on the washers 22. The compressibility or resilience of the washers thus serves to smooth the action and ease the rocking of the main and secondary bars 12 and 14 with respect to each other. The holes drilled for the bolts 20 in the secondary bar 14 should be oversized to avoid obstructing the desired rocking action.

An alternative arrangement with respect to the bolts is as follows: Here the bolts 20 have their heads drawn into the top of a countersunk bore in secondary bar 14. Resilient washers 22', which may be, for example, of polyethylene, felt, rubber, neoprene or vinyl, may be inserted in the oversize portions of the countersunk bores between the heads of bolts 20' and the smaller diameter part of the bore. The bolts 20' bear a shoulder 20*a* which bears against the main bar 12 around the threaded holes which receive the threaded portions of the bolts 20'. The bolts 20' may now be drawn up fully and

tightly with this shoulder engaged to prevent the bolts 20' working loose due to vibration or the like. Further to assure that the bolts 20 or 20' may not withdraw accidentally, a locking device such as a nylon button (not illustrated), sunk in a small cavity in the threaded portion may be used. When this button is used and the button forced in, withdrawal of the bolt 20' is resisted. A like button may be used with the bolts 20 for a like purpose. Bolts with such an arrangement are sold under the trademark "Nylock," hence known as "Nylock" button. Since the spacing required between main and secondary bars 12 and 14 is assured, the pieces of rod 31 may be omitted, as well as the channels for receiving them. The bolts 20' may be inserted in a similar manner from the main bar 12 and threaded into the secondary bar 14. Since this is only an inversion of parts, it is not separately illustrated.

Still another embodiment of the invention is illustrated in FIGS. 5 and 6. This embodiment employs a doctor blade assembly 18' which comprises a doctor blade 181 and a doctor blade guide element 182 which may be a suitably shaped bar. The doctor blade 181 is slotted at 183, somewhat ahead of its rear edge at equal intervals. The guide element 182 has posts or the like 184 which engage the slots 183. The slots 183 are accurately spaced from the rear edge so that the front edge of the doctor blade 181 is accurately aligned relative to the guide bar or element 182 which acts as a key for the blade. This assembly may be guided into its matching key way like the assembly of doctor blade 42 of FIGS. 1 to 4 with its round head screws, except that the bar 182 is received in the mating slot in bar 14, and pins 184 are received in the slot 185, as is apparent from the drawing. The blade 181 and bar 182 assembled together act as a keyed blade.

The arrangement for moving the back-up blade 18' is also different in this embodiment being moved back and forth by two or more bell-crank arrangements. As the pinions 48 are turned, bell-crank posts 201 journalled in the main bar 12 are actuated to turn and move the back-up blade 18' forward and back.

One arm 202 of each bell crank 200 has a pin 203 received in a slot 204 of an actuating bar or plate 205. The plate 205 may be moved, and otherwise arranged similarly to the plate 52, but is recessed in a groove or ledge, cut for it at the top of the main bar 12, and has no racks. It may have guide slots and guide pins, such as pins 56 of FIG. 1, but it may be guided by the groove cut therefor. It may be moved back and forth parallel to the axis of the doctor blade holder by means similar to those provided for the plate 52.

As the plate 205 moves in one direction or the other, it moves the arm 202, and hence the other arm 206 of the bell crank, thereby moving the back-up blade 18' by pins 207 on the back-up blade 18' journalled in holes 208 in the arms 206, back and forth.

The bell crank arrangement affords a better mechanical advantage for the back-up blade motion. With the recessed arrangement, as illustrated, a dust cover 209 may also be provided to substantially cover the bell crank mechanism. With the guide element 182, the doctor blade itself is readily disposable, since machining or punching the slots 183 is simple and easily performed with accuracy and economy.

In other respects, the embodiment of FIGS. 5 and 6 may be similar to that of FIGS. 1 to 4.

One of the advantages of the invention is that the blade with the key-way may be disposable. After use, because of the ease of replacement, they may be thrown away or returned to a central facility, for machine sharpening. The cost of sharpening, which is thus much more efficiently accomplished, either initially or for resharpening, is reduced by use of a mass production facility. The cost of waiting a substantial period of time while the press is stopped for replacement of the blade is avoided.

If desired a further pair of matching half round grooves may be added just back of the front edge where the doctor blade is grasped and a sleeve of Teflon or other somewhat resilient ink resistant material inserted therein. The purpose of this sleeve is to seal the space between the main bar and secondary bar from the entry of ink splashed from the doctor blade.

What is claimed is:

1. A doctor blade holder comprising a main bar, a secondary bar, each of said bars having a longitudinal axis and a front portion and a rear portion, said axes being parallel, one of said bars having a key-way to receive a keyed doctor blade assembly including a doctor blade and with the blade edge in front of the front portions of said bars, said key-way extending substantially the entire length of said one bar for the insertion of said doctor blade from one end of said key-way and said bars, means for holding said bars so that one may rock with respect to the other against a fulcrum between the front and rear portions of said bars, means selectively for exerting a force of separation between said rear portions and for releasing said force, whereby when said force is exerted a doctor blade keyed in place is grasped between the front portions of said bars for doctor blade operation in said holder, and whereby when said force is released, the doctor blade may be freely slidably withdrawn or inserted in place from said one end.

2. A doctor blade holder as claimed in claim 1, the doctor blade having slots spaced longitudinally along the doctor blade, said key of said doctor blade assembly including a guide bar having longitudinally spaced pins received in said slots.

3. A doctor blade holder comprising a main bar, a secondary bar, each of said bars having a longitudinal axis, a front portion, and a rear portion, means for holding said bars with axes substantially parallel so that one may rock with respect to the other about a fulcrum along an axial line between the front and rear portions, one of said bars having a key-way extending axially from one end of said one bar substantially the entire length thereof for receiving from said one end and between said bars a keyed doctor blade assembly including a doctor blade with the blade edge in front of said front portions, means selectively for exerting a force of separation between said rear portions to force the front portions together whereby a blade thus received in place is grasped between said front portions for doctor blade operation, and for releasing said force whereby a blade assembly may freely slide for withdrawal or insertion guided along said key-way from said one end.

4. A doctor blade holder as claimed in claim 3, the doctor blade having longitudinally spaced slots, said key of said doctor blade assembly including a guide bar having longitudinally spaced posts received in said slots.

5. A doctor blade holder comprising a main bar, a secondary bar, each of said bars having a longitudinal axis, a front portion, and a rear portion, means for holding said bars with axes substantially parallel so that one may rock with respect to the other about a fulcrum along an axial line between the front and rear portions, one of said bars having a key-way extending axially from one end of said one bar substantially the entire length thereof for receiving from said one end and between said bars a keyed doctor blade assembly including a doctor blade with the blade edge in front of said front portions, means selectively for exerting a force of separation between said rear portions to force the front portions together whereby a blade thus received in place is grasped along the entire length of said blade parallel to said axis between said front portions for doctor blade operation, and for releasing said force whereby a blade assembly may freely slide for withdrawal or insertion guided along said key-way from said one end, said force exerting and releasing means comprising a fluid-tight hose extending lengthwise axially between said bar rear portions.

6. A doctor blade holder comprising a main bar, a secondary bar, each of said bars having a longitudinal

axis, a front portion, and a rear portion, means for holding said bars with axes substantially parallel so that one may rock with respect to the other about a fulcrum along an axial line between the front and rear portions, one of said bars having a key-way extending axially from one end of said one bar substantially the entire length thereof for receiving from said one end and between said bars a keyed doctor blade assembly including a doctor blade with the blade edge in front of said front portions, means selectively for exerting a force of separation between said rear portions to force the front portions together whereby a blade thus received in place is grasped along the entire length of said blade parallel to said axis between said front portions for doctor blade operation, and for releasing said force whereby a blade assembly may freely slide for withdrawal or insertion guided along said key-way from said one end, said holding means comprising a plurality of longitudinally axially aligned bolts passing through one of said bars and threaded into the other, said bolts having bolt heads establishing said fulcrum line.

7. A doctor blade holder as claimed in claim 6, further comprising at least one aligning rod interfitting both of said bars along an axial line between said front and rear portions.

8. A doctor blade holder comprising a main bar, a secondary bar, each of said bars having a longitudinal axis, a front portion, and a rear portion, means for holding said bars with axes substantially parallel so that one may rock with respect to the other about a fulcrum along an axial line between the front and rear portions, one of said bars having a key-way extending axially from one end of said one bar substantially the entire length thereof for receiving from said one end and between said bars a keyed doctor blade assembly including a doctor blade with the blade edge in front of said front portions, means selectively for exerting a force of separation between said rear portions to force the front portions together whereby a blade thus received in place is grasped along the entire length of said blade parallel to said axis between said front portions for doctor blade operation, and for releasing said force whereby a blade assembly may freely slide for withdrawal or insertion guided along said key-way from said one end, said holder further comprising at least one aligning rod having an axis parallel to said longitudinal axes and interfitting both of said bars along a line between said front and rear portions to aid in aligning said bars.

9. In combination, a doctor blade holder comprising a main bar, a secondary bar, said bars each having a longitudinal axis parallel to that of the other, means for joining said bars for rocking motion one with respect to the other along an intermediate axial line between front and rear portions of said bars, a back-up bar having an axis parallel to said axes and having a forward edge extending forwardly beyond said main and secondary bar front portions, a back-up blade having a rear portion and a front portion, said back-up blade rear portion being between said main and secondary bar front portions and said back-up blade front portion extending forwardly of said back-up bar, means for moving said back-up blade selectively forward or backward, and means selectively applying force tending to separate said main and secondary bar rear portions or for releasing them from said force, one of said main and secodary bars being arranged to receive therebetween a doctor blade having an axis and a front edge parallel thereto, one of said bars having a key-way extending from one end thereof substantially the entire length of said one bar, said doctor blade being keyed to fit said key-way with a portion of said doctor blade between said main and secondary bar front portions and with a front edge in working position in advance of said back-up blade front edge and backed up by the front portion of said back-up blade, whereby when said force is applied, said blade is locked in operative position backed-up by said back-up blade which is also locked in position and by said back-up bar, and when said force is released, said back-up bar is released for adjustment and said doctor blade is released for free slidable withdrawal or replacement from said one end.

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