

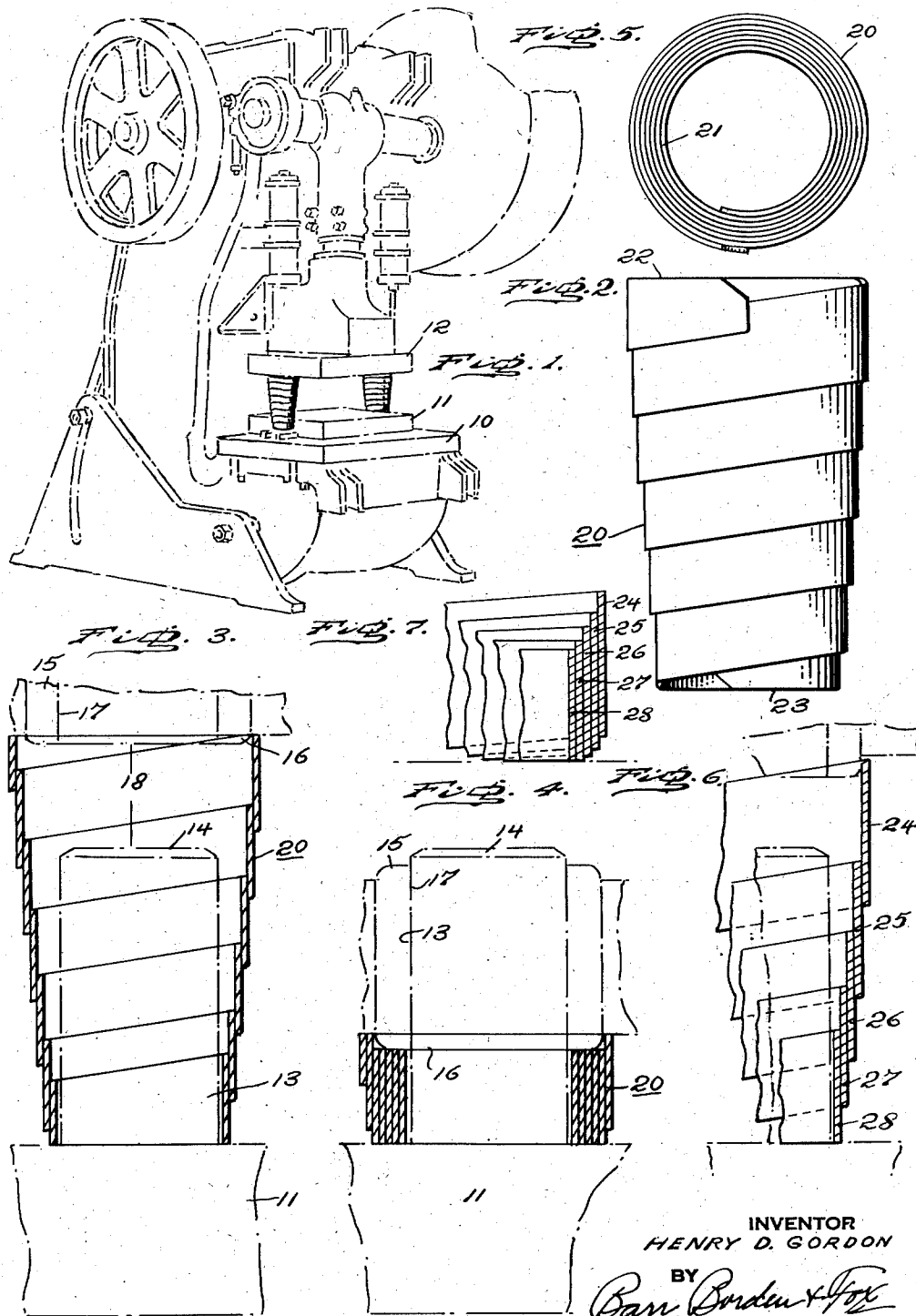
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GUIDE PIN COVER FOR PUNCH PRESSES

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GUIDE PIN COVER FOR PUNCH PRESSES

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This invention relates to guide pin covers for punch presses.

Punch and die presses as devised for heavy dieing and punching operations usually comprise a fixed bed or anvil, carrying one die or punch member, and a movable bed or platen carrying the complementary die or punch member. The movable platen is arranged for vertical movements between a position raised vertically away from the generally horizontal anvil to provide clearance for the insertion and removal of work, and a lowered position juxtaposed to the anvil, at which latter the punching or dieing pressure is transmitted by the complementary dies to the work. The pressure is applied to the platen by suitable mechanical or hydraulic transmitting means from a source of power, and is usually of a high order of magnitude. Punch presses have varying capacities as to size and pressures used, but all, except possibly some very small presses, require the use of guide rods to maintain the parallelism of the platen and anvil during operations on the work. The guide rods are of such numbers as to accomplish the aligning function despite stresses and torques developed during contact of the platen with the work. The guide pins, which are usually cylindrical with more or less rounded free ends, are mounted on one of the relatively movable press members and extend perpendicularly therefrom toward the complementary press member, and the latter is apertured in alignment with the respective guide pins to receive the pins, and the apertures are usually provided with bushings, which in many cases extend partially from the surface of said complementary press member toward the pins. In some cases the clearance between the punch members at a maximum is coordinated with the lengths of the guide pins so that the pins remain in the bushings at all times. In other cases, owing to the requirements of the press, the guide rods have a clearance from the bushing entrance during the greatest separation of the relatively movable punch members. It is recognized that the guide pins must retain their exact alignment at all times, normal to the pressing thrust of the movable member, must retain a coating of lubricant, must be continuously free from rust and friction-creating surface conditions, such as nicks, scratches, and gouges, etc. These several necessary attributes render the guide rods and bushings comparatively delicate, so that they must be housed and protected against impacts, and must also be so protected that in the event of clearance between the ends of the guide pins and the ends

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of the aligned bushings, entry into such clearance of any portions of the operator's body, or of the work, is prevented. This necessitates guards having multiple functions, i. e. protection of the pins from impacts and also from the removal of lubricant therefrom, unobtrusiveness and small size so as not unduly to minimize the space necessary to manipulate the work, positive prevention of the entry of any object over the ends of the pins between the pins and the bushings, while at the same time possessed of "follow-up" functions for maintaining guarding at all times and in all relative positions of the press, without imposing much appreciable load on the press power. Finally, the guards must be simple in construction and attachment to the press.

Many attempts have been made in the past to provide guards having certain of these desired characteristics, but so far as known there has never before been provided any guard which successfully provides or effects all of them. Prior art guards have taken many forms, such as sleeves of canvas or the like supported by helical wire springs, telescoping cup assemblies, etc., and each has failed to furnish actual continuous guarding under adverse conditions, and thus each has been no more than a mere temporary palliative, or simulation of a true guard. This is because each of the prior art devices, so far as known, has possessed one or more inherent and fundamental undesirable features militating against universal satisfactory use.

It is among the objects of this invention: to provide a guard which is capable of absorbing lateral shocks and impacts without interfering with or disturbing its continuous guarding functions; to provide a guard which is readily interchangeable from one pin to another pin, and from one die set to another die set; to provide a guard having predeterminedly the ability to establish and maintain all of the guarding functions recited above as essential; to provide a guard which obviates the disadvantages of prior guards; to provide a guard of extremely long life; to provide a guard of simplicity and ease of formation; to provide a guard which resists bends or distortions, and which even if dented will continue to function for guarding purposes; to provide a guard formed of a single integral element; to provide a guard of such simplicity and universality of application as to be readily carried in a few stock sizes and with a great reduction in measuring and fitting as required by prior art devices; to provide a guard which is constantly self-centering so that despite tem-

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porary conditions of asymmetry during use, as from impacts from the work, it finds its own center automatically; to provide a guard having automatic adjustments to establish both open and shut heights automatically; to provide a guard for guide pins and bushings which can be attached or removed without drilling or tapping, without threaded connectors, and which does not require installation tools nor engineering layouts for installation; to provide a guard for guide pins which conduces toward retention of the lubricant on said pins and the prevention of rust and surface interruptions such as nicks, scratches, and the like, on the guide pins; and to provide other objects and advantages as will become more evident as the description proceeds.

In the accompanying drawings:

Fig. 1 represents a skeleton perspective of a typical punch-press assembly, showing the location of the guards of this invention in guarding relation to guide pins extending between the movable platen and the fixed bed of the press;

Fig. 2 represents a side elevation of the guard of this invention in a preferred but illustrative embodiment;

Fig. 3 represents a fragmentary enlarged section through the guard in guarding relation between the press elements and relative to an illustrative pin and bushing assembly, with the latter shown in dotted lines;

Fig. 4 shows a guard in an illustrative compressed shortened condition at the bottom of the stroke of the movable platen toward the fixed bed, with the telescoped relation of the pin and bushing indicated in dotted lines;

Fig. 5 represents a top plan of the guard;

Fig. 6 represents a fragmentary section of a modified form of spring guard in which the initial yield in response to axial compression is from the small end of the guard;

Fig. 7 represents a similar view with the guard under compression.

The punch press to which the invention is to be attached comprises a lower fixed bed or anvil portion 10, upon which illustratively a die 11 is mounted. The movable platen 12 is disposed parallel to bed 10, and is arranged in any desired manner for powered vertical movements between an upper position, as illustrated in Fig. 1, and a lower punching or pressing position on work, (not shown) disposed between the press or die members 10 and 11 on one side and the movable platen 12 on the other. Platen 12, of course, may also carry a die member, but in the interests of clarity this has been omitted from the showing of Fig. 1.

Illustratively, the rigid guide pin 13 is mounted on the fixed anvil or bed member 10, and extends perpendicularly therefrom toward the movable platen 12 as the guide pin to be guarded. The upper end of the pin 13 is chamfered or slightly rounded in a guiding free end or terminus 14, and the platen 12 carries a bushing 15 having a concentric bore 17 in alignment with the pin. The guide pin has sliding guided engagement in and relative to the bore of the bushing. Usually the bushing 15 has a lower extension 16 extending out of the plane of the platen toward the fixed bed. Usually, also, in the initial open disposition of the press with the platen 12 in its raised position away from the bed 10 there is a vertical clearance 18 between the end 14 of the pin 13 and the lower end 16 of the bushing. Many serious mishaps have been occasioned by the inadvertent interposition of an operator's hand, or a heavy and rigid piece of work, in said

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clearance 18, maintained as the platen 12 starts downward on its punching or dieing stroke.

The guard 20 for the pin and bushing assembly thus described in accordance with an illustrative but presently preferred embodiment, comprises a ribbon of metal 21 wound upon itself in the form of a spiral either of actually contacting walls, or of slightly spaced walls to minimize friction, drawn out axially to form a helix comprising in profile a substantial truncated hollow cone, having a relatively large end 22 and a relatively small end 23. The walls of the cone comprise at any point a ribbon lying generally and preferably almost exactly parallel to the axis of the cone, and each portion of the ribbon overlaps a portion of the adjacent ribbon in the extended helix, so that each portion of the ribbon is backed-up, so to speak, by the next adjacent turn of ribbon. Illustratively, the ribbon may have but a few thousandths of thickness but transversely may be of the order of $1\frac{1}{2}$ inches, which, of course, may be greater or smaller than this illustrative form, depending upon the differentials between the maximum and minimum clearances 25 between the press members and the thickness of the ribbon, and the overlap is preferably, although merely illustratively, of the order of something less than one-half of the lateral width of the ribbon. As the ribbon in top plan is a spiral, all of the turns at any intersecting axial radial plane are substantially parallel to each other. In the preferred form the turns are in lightly touching contact, although for the elimination of friction each turn, as noted, can be spaced a slight distance from each adjacent turn, if this should be preferred.

The guard as described is preferably made of tool steel alloy in the illustrative embodiment, and not of so-called spring steel, and when properly formed it is tempered to have the desired resilience. The advantage of the tool steel is in its seeming immunity to crystallization under repeated deforming stresses, as contrasted with spring steel, although the latter material, of course, may be used, especially for certain small sizes of guards.

The truncated cone formed of the overlapping substantially parallel turns, each generally parallel to the axis of the cone, has the large end 22 of such diameter as to fit fairly freely about the extended end 16 of the bushing, to generally center the upper or large end of the guard. The smaller end 23 is preferably of such size as to have a fairly free fit over and about the pin 13 at the base thereof. In order to assemble the guard and the pin and bushing assembly, the guard is compressed axially into a small compass, which usually can be effected with mere manual manipulations, and inserted laterally into the space 18 and permitted to expand in both directions so that the large end surrounds the bushing and the small end expands axially of and surrounds the pin 13. The initial loading of the spring is such that when installed and with the press open to its fullest extent, the ends 22 and 23 of the guard axially abut the respective parallel surfaces of the press elements adjacent to the bushing and pin respectively. There is no necessity for greater loading than this.

It will be observed that the light resilient abutment of the ends 22 and 23 against the respective parallel surfaces of the press elements adjacent to the pin and bushing respectively is the only attachment of the guard to the press and this attachment is floating. This is the major factor in

the self-alignment of the guard. Even the slight transverse clearance of the respective ends of the guard relative to the aligned complementary pin and bushing elements shown, which is illustrative of a preferred wider clearance, is adequate to secure two important functions in self-alignment pursuant to any transverse impact or stress against the guard, at any angle of the 360° periphery of the guard, and regardless of the location of the focal point or focal area of the deforming impact or stress axially of the guard.

To assist in understanding this functioning, it will be seen that as the bushing 16 is larger in diameter than the pin 13, an imaginary truncated cone exists between the outer terminal end of the bushing and the pin adjacent to the surface in which it is mounted, the angle of the sides of which to the axis become more obtuse as the press members move from fully separated to fully closed. There is therefore at any instant an imaginary line between the bushing and the pin having an angle with the axis of the assembly.

The first result of the application of lateral force to a side of the guard is to cause the entire guard to move transversely, in yielding to the force in the line of the force, by transverse sliding or floating of the respective ends on the respective parallel flat faces of the press, until the large end internally engages and stops against the external periphery of the bushing in a generally axial line, area, or point of mutual contact, and the small end slides or floats transversely on the flat surface upon which it abuts until it internally engages and stops against the external surface of the pin in a generally axial line or area of mutual contact, which respective areas of mutual contact are in general axial alignment with each other and with the resultant force being exerted against the guard. This causes the guard to move initially into a position with its axis generally asymmetrical or eccentric of the axis of the pin and bushing assembly, bringing the impact side of the conical guard into such close general parallelism with the contiguous side of the imaginary cone as to be practically coincident therewith. At the same time, of course, the side diametrically opposite to the impact will have moved further away from the opposite side of the imaginary cone. Continuation of the lateral thrust causes the impact side of the cone guard to yield generally concavely in bridging relation between the points or areas of mutual contact. This increases the degree of overlap of adjacent turns on the impact side, to increase the strength of the cone, and as the impact side is then closer to the axis of the pin than is the opposite side, the distortion into concavity is stopped by the impingement of the inner surface of the guard against the closely adjacent side of the pin, with a merely shallow concavity. The thrust or force is then absorbed by the pin and bushing and the closely overlapping turns of the guard.

As a secondary and essential function of the floating abutment of the ends of the guard, it will be recognized that as the impact side is distorted into a general concavity, limited by the bridging engagement of the guard with the bushing and the pin, the diametrically opposite side of the guard is distorted into a general convexity. As the ends of the guard at this point are unrestrained except by the internal mutual contacts on the impact side, and as the sides of the ends opposite to the areas of mutual contact thereof are free and laterally unrestrained and are, therefore, free to float transversely away from the pin

and bushing respectively, the convex distortion is spread over the entire length of the guard, and although the turns on this side are thus pulled unequally out of their initial overlapping relation, they are not separated, and each retains the same general peripheral curvature as the adjacent turns and is free to distribute the distortion in accordance with the inherent properties of the unit. It will be seen that under certain conditions the disturbing transverse force may be so applied that the generally planar ends of the unit may tilt slightly on the respective faces which they abut, about the edges of the ends opposite to the areas of mutual contact mentioned as pivots, and this temporary situation is permitted by the floating abutment provided, during which the impact sides of the end turns may slide slightly axially of the unit on the respective bushing and pin.

When the press comes together during the application of the transverse stress the distorted but relatively aligned turns are forced together in self-alignment. As a corollary thereto, the successively wider turns, in descending, engage the object, causing the distortion, or producing the disturbing force, and convert the lateral or radial force into a generally axial resultant force passing harmlessly down along the side of the guard. The ability of the open ends to float in abutment against the parallel surfaces as the only attachment of the guard not only provides the self-alignment and return to general concentricity of the guard to the pin and bushing assembly, but also permits free rotation of either or both ends thereof without grooving the faces as torque is developed on the turns of the coiled device by reason of the closing and opening of the press, and further without unlapping of the turns as would follow anchored attachment of either or both ends.

The width of the ribbon is preferably predetermined to be slightly less than the minimum clearance of the bushing extension 16 relative to the surface of the fixed bed surrounding the pin 13, so that when the press is actuated to compress the guard axially, the approach of the bushing relatively to the fixed bed will be ineffectual to crush any turns of the guard that may be axially disposed between said end and said fixed bed.

It will be observed that the resilient metal guard forms a substantially complete enclosure for the pin and bushing for which purpose both open ends engage the press surfaces which they abut under the light loading necessary to self sustain the unit with the peripheral rims or edges of the end turn or turns of both ends in substantial planes for at least the major periphery of said ends, as shown in Figs. 2 and 3, has such reinforced strength by the overlapping areas of the respective turns as to be able to withstand lateral shocks and impacts, is always self-centering, protects the pins from removal of lubricant, and is a simple, efficient device of a lateral displacement just enough for the job it has to perform, without interfering with the free use of the press.

It will be seen that with equal overlap and equal widths of ribbon throughout the spring, because of the differential radii of the turns, the application of axial pressure to the guard will cause the collapse of the guard from the large end first. In most cases this is satisfactory as the clearances will be such that it may not make any difference. However, from time to time there are situations in which, because of small clearances or

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related problems, it is highly desirable that the collapse under axial pressure be from the small end first, or even be simultaneously from both ends for a limited travel of the platen relative to the anvil, with the mid-portion the last portion of the spring to be compressed. It is a feature of this invention to provide selective guard telescoping or collapse under stress against the resilience of the whole, whereby as desired the large end, or the small end respectively is compressed or collapsed first, according to the predetermination thereof. If it is desired to have the device yield substantially similarly from both ends, the spacing or relative overlap of the guard turns is changed, from the substantially similar overlap described, into one in which, starting with the smaller end of the guard, the turns have progressively different degrees of overlap, by becoming smaller in overlap and greater in depth of un-overlapped turns as the helix is wound toward the top turn, or end of the guard, while still retaining the same width or thickness of ribbon throughout the length. If it is desired to have the small end collapse toward the larger end, this is accomplished by having the turns of ribbon from which the helix is formed contain progressively more material in turn as the ribbon moves from the small end toward the large end. This may be accomplished in an expensive way according to present production methods by having the ribbon of the same width but possessed of progressively changing thickness, increasing from the small end toward the large end. It is preferred, however, to secure the desired small end initial collapse or yield by providing a ribbon of varying width, say, in an illustrative case, one and one-quarter inch for the top large turns, progressing downwardly in width to one inch at the small end. This is accompanied in the winding of the helix by progressively changing the proportion of overlap of the adjacent turns.

As shown in Fig. 6, for instance, the upper turn 24 is of the maximum ribbon width, and it has a small overlap on and about the next adjacent turn 25, which is, of course, of slightly smaller width. In turn this turn 25 has a slightly greater percentage of overlap on and about the third turn 26, but this latter turn is of still smaller width. The final small turns 27 and 28 of the narrowest ribbon have the largest percentage of overlap, i. e. the smallest depth of exposed turn. By such structure, axial pressure finds the upper larger turns most resistant to distortion, and the smallest turns most easily distorted in forming the helix into a compressed substantial spiral. The advantage of such selectability will be clear.

Having thus described my invention, I claim:

1. In combination, a first and a second press member, means mounting the respective members for relative movement between open and closed position, a bushing mounted in a smooth surface of the first member, a guide pin mounted in a smooth surface of the second member complementary to said bushing, a guard unit for the bushing and pin comprising in its entirety a lightly loaded ribbon of resilient metal coiled upon itself to define a hollow truncated cone with adjacent turns in overlapping relation and having respectively large and small open ends, the unit in expansion abutting said respective smooth surfaces and being self-sustaining whereby the large end surrounds said bushing in a limited floating on said surface of the first member, and the small end surrounds the pin in a limited floating on said surface of the second member, whereby in

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response to generally radial lateral pressure on the unit the large end internally abuts the bushing and the small end abuts the pin in generally axially aligned single areas peripherally of the respective ends, and whereby the remaining portions of the end turns float away from the bushing and pin respectively in distributing the pressure-induced distortion unequally along the entire length of the unit with maintenance of overlap and a conformation of each turn to the same general peripheral contour of adjacent turns of the unit, whereby the unit is self-aligning on the power stroke of the press.

2. In presses, cooperating complementary separable press members, a leader pin mounted on one member, a bushing complementary to the pin mounted on the other member, each member having a surface immediately adjacent to the respective mounted pin or bushing which is smooth and otherwise uninterrupted, a guard comprising in its entirety a ribbon of metal wound into coiled form defining a truncated hollow open-ended cone with adjacent turns in at least partial overlapping relation, and having such light loading in resiliency as merely to self-sustain the guard in limited floating abutment of the open ends thereof against the respective smooth surfaces as the only attachment of the guard, without consuming appreciable press power, the said open ends being of such diameter as to surround respectively the pin and bushing with a clearance, said guard being disposed for lateral yielding in response to lateral force thereon to engage small areas internally of the end turns against the pin and bushing and to bridge the pin and bushing on the thrust side with increase of overlap of some turns accompanied by distortion on the other side of the guard in which the overlap decreases unequally without separation of adjacent turns as the thrust-induced distortion is spread along the length of the guard with maintenance of substantially the same general peripheral contour of adjacent turns as the end turns float on said surfaces with relation to the respective pin and bushing and to said respective small areas.

3. A guard for operative association with a leader pin and complementary bushing of known diameters of a press of known clearance having substantially smooth and otherwise uninterrupted surfaces immediately adjacent to the respective bushing and pin, comprising in its entirety a single piece of metal in ribbon form wound upon itself to define a hollow open-ended truncated cone of light loading such that when freely expanded it is slightly longer than such clearance, the respective end turns of said cone being predeterminedly of a diameter greater than such respective pin and bushing and the edges thereof being relatively smooth such as to abuttingly engage such smooth surfaces with a relatively small lateral clearance from the respective bushing and pin so that part at least of said end turns float relative to such bushing and pin on said surfaces as the sole attachment of said guard, whereby in response to lateral forces against said guard and internal abutment thereof against such respective bushing and pin the guard opposite to the force can distribute the distortion throughout the length of the guard with maintenance of overlap of and the same general peripheral contours of adjacent turns whereby the guard is always self-aligning.

4. A guard as recited in claim 3, characterized by a progressive change in lead per turn whereby

the small end of the guard collapses first under axial compression.

5. A guard as recited in claim 3, characterized by a progressive change in the metal volume per unit of length throughout the major length of the ribbon decreasing from the large end thereof, whereby the small end of the guard collapses first under axial compression.

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