Dec. 8, 1964 R. R. RAIHLE 3,160,217

MECHANICAL HAMMER

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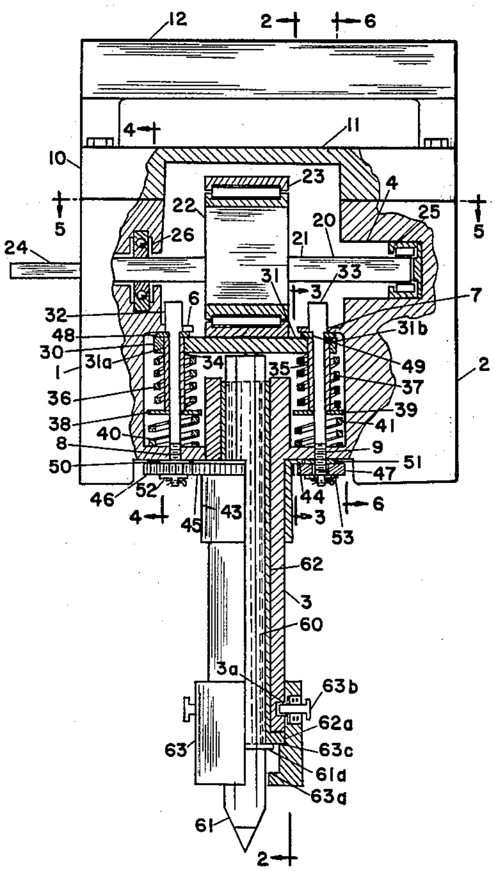

FIG 1

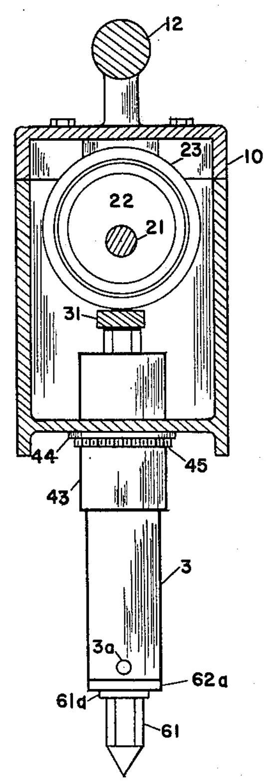

FIG 2

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MECHANICAL HAMMER

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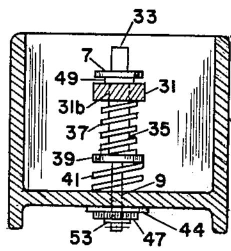

FIG 3

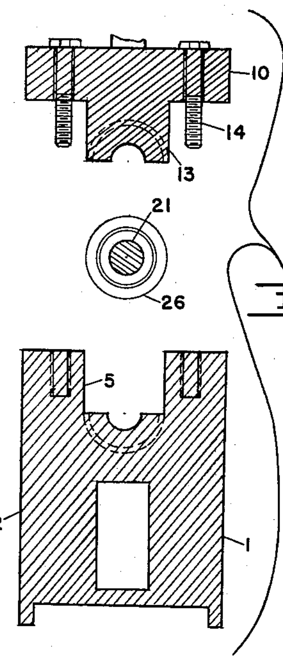

FIG 4

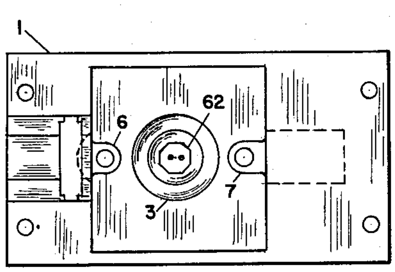

FIG 5

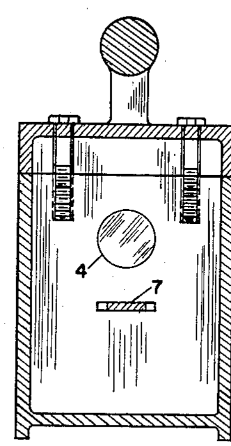

FIG 6

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3,160,217
MECHANICAL HAMMER

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6 Claims. (Cl. 173—94)

The present invention relates to a mechanical hammer which is designed to be used by hand so as to perform such operations as cutting, chipping, chiseling, drilling, hammering, punching, riveting and trimming. It is especially adapted for performing the operations where pneumatic hammers are now generally used. My hammer is an improvement of the present type of mechanical hammer as illustrated by Jackson, U.S. Patent Number 952,255, and Groom, U.S. Patent Number 2,226,559, in simplicity, cost of construction, durability, ease of manipulation, cost of operation, and in safety. It can be used to perform its work on practically any material and is limited in its performance only by the power of its prime mover and the strength and design of the working tools used.

An object of this invention is to provide a mechanical hammer which can be used with a multitude of working tools which may be exchanged within a matter of seconds and which remain useable and replaceable regardless of how much the top of a working tool may become deformed or expanded by blows delivered thereon.

Another object of this invention is to provide a mechanical hammer which can use a maximum amount of component parts which are already manufactured and readily available.

Still another object of the present invention is to provide a mechanical hammer that uses a roller bearing secured on an eccentric cam and a plate to transmit power from the drive shaft to the working tool and thus reduce friction or power losses and wear to a minimum.

Yet another object of this invention is to provide a mechanical hammer which will discontinue its reciprocating movement and thus stop delivering its impact blows whenever the operator releases his pressure on the handle of the hammer.

A further object of this invention is to provide a mechanical hammer which will permit the operator to change one working tool for another without the necessity of shutting down the power source of disconnecting it from the hammer.

A still further object of this invention is to provide a mechanical hammer which will permit the operator to lay his hammer down without going to the trouble of turning off the power.

Yet another object of this invention is to provide a mechanical hammer which is designed to be easily used by hand to perform any of a variety of operations such as chipping, chiseling, cutting, drilling, hammering, punching, riveting and trimming.

A further object of this invention is to provide a mechanical hammer whereby various size prime movers or motors may be used regardless of the material being worked on.

A still further object of this invention is to provide a mechanical hammer which may vary the stroke of a working tool without disturbing its operating cycle.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description taken in connection with the accompanying drawings, in which:

FIGURE 1 is a perspective view of the preferred embodiment of my mechanical hammer with a portion thereof broken away so as to illustrate the construction and arrangements of the operating parts.

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FIGURE 2 is a sectional view taken on line 2—2 of FIGURE 1 without the attaching cap.

FIGURE 3 is a sectional view taken on line 3—3 of FIGURE 1.

FIGURE 4 is an exploded sectional view taken on line 4—4 of FIGURE 1.

FIGURE 5 is a sectional view taken on line 5—5 of FIGURE 1 without the operating parts.

FIGURE 6 is a sectional view taken on line 6—6 of FIGURE 1.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring now to the drawing wherein like reference numerals refer to like and corresponding parts throughout the several views, the preferred embodiment of the invention disclosed in FIGURES 1–6 inclusive consists of a two piece housing, the lower section or housing designated by reference numeral 1 and the upper section or housing designated by reference numeral 10; a drive assembly 20; a driven assembly 30; and a tool assembly 60.

The lower section 1 includes a casing 2, a tube or shank 3, a recess 4, a notch 5, projections 6 and 7, and openings 8 and 9.

The upper section 10 includes a cover 11, a handle 12, and a projection 13. The upper section is secured to the lower section by means of bolts 14.

The drive assembly 20 includes a shaft 21, an eccentric cam 22 rigidly secured to the shaft, roller bearing 23 whose inner race encloses the cam. The shaft has an extension 24 which extends beyond casing 2 to permit the attachment thereto of suitable driving mechanism. The extension has a smaller diameter than the shaft.

The drive assembly is positioned within casing 2 and rotates at one end within roller bearing 25 situated within recess 4 and near its other end within ball bearing 26 situated within a recess beneath notch 5 and within a recess in projection 13 (see FIGURE 4). Ball bearing 26 is fixedly secured to shaft 21 so as to prevent any axial movement of shaft 21 when it is in position within casing 2.

The driven assembly 30 includes a plate or impact member 31, guide rods 32 and 33, tubular bearing surfaces 34 and 35, working springs 36 and 37, spacers 38 and 39, positioning springs 40 and 41, sleeve 43 with collar 44 at one end thereof and a spur gear 45 located adjacent to said collar, spur gears 46 and 47, and spacers 48 and 49.

Each of guide rods 32 and 33 has an enlarged head at one end, a reduced end portion with a hole therein at the other end, and a threaded portion adjacent to the reduced end portion. The guide rods extend through holes in projections 6 and 7 of lower section 1, through holes in spacers 48 and 49, through holes 31*a* and 31*b* in plate 31, through tubular bearing surfaces 34 and 35 which are enclosed in working springs 36 and 37, through holes in spacers 38 and 39, through positioning spring 40 and 41, through circular openings 8 and 9 in lower section 1, through holes in spacers 50 and 51, through the threaded openings in spur gears 46 and 47, and through holes in spacers 52 and 53.

Spacers 48 and 49 are located between the projections 6 and 7 and the plate 31. Spacers 38 and 39 are located between working springs 36 and 37 and positioning springs 40 and 41. Spacers 50 and 51 are located between the lower end of the lower section 1 and spur gears 46 and 47. Spacers 52 and 53 are located immediately below spur gears 46 and 47. Spacers 50 and 52 may be made integral with spur gears 46 and spacers 51 and 53 may be integral with spur gear 47.

Spur gears 46 and 47 mesh with spur gear 45 and sleeve 43 and are threadedly engaged to the threaded portions of guide rods 32 and 33. Two cotter pins are placed within the holes at the reduced end portions of guide rods 32 and 33 to prevent spur gears 46 and 47 from being unthreaded from the threaded portions of said guide rods.

Rotation of sleeve 43 will cause guide rods 32 and 33 to move either up or down depending on the direction of rotation. By limiting the length of the threaded portion of guide rods 32 and 33, I prevent the withdrawal of their enlarged heads from the holes in projections 6 and 7 of the lower section 1 when sleeve 43 is rotated in a direction which will cause the guide rods to move downward. Cotter pins in the holes at the reduced end portions of guide rods 32 and 33 prevent spur gears 46 and 47 from being threaded off the guide rods by rotation of sleeve 43 in a direction which will cause the guide rods to move in an upward direction.

The tool assembly 60 includes a tool 61, a matching removable liner 62, and an attaching cap 63. The tool 61 extends throughout and beyond the liner 62 at both its ends. It is in contact at one end with the lower surface of plate 31 and at the other end with the material to be worked on. The liner 62 acts as a guide and bearing surface for the working tool 61 during its reciprocating cycle. The outer surface of the tool 61 and the inner surface of the liner are of the same configuration. When no rotation of the tool is desired, a many sided configuration should be used; when rotation of the tool is desired, a circular configuration should be used. The tool is loosely fitted inside of the liner so that although it is guided in its reciprocating movement by the liner there is a minimum of friction and wear between the tool and the liner. The tool is in no way fastened to the hammer itself except that it is prevented from falling out of the liner by a circular projection 61*a* located near the working end of the tool and circular projection 63*a* located at the lower end of the attaching cap 63. Circular projection 63*a* during normal operation of the mechanical hammer is located far enough away from the end of tube 3 so that circular projection 61*a* will not come into contact with it. It is only when the mechanical hammer is being carried or held off the material to be work on would there be a chance of tool 61 sliding out of the hammer as gravity would tend to move the tool out of the liner. It is only in this case that circular projection 63*a* would prevent tool 61 from leaving its liner.

The attaching cap 63 is secured to the bottom portion of tube 3 by means of spring loaded detents 63*b* that fit into holes 3*a*. To remove the attaching cap 63 from the tube 3 all that is required is to pull the spring loaded detents 63*b* from the holes 3*a*. The attaching cap 63 has a shoulder 63*c* at its middle portion. The shoulder 63*c* cooperates with a circular projection 62*a* located at the bottom end of the liner to prevent the liner from falling out of the tube 3. At the uppermost position of tool 61, projection 61*a* will be adjacent to projection 62*a*.

In FIGURES 1 and 2 the eccentric cam 22 has longer radius pointing directly upward from its center. As shaft 21 is rotated the longer radius will come to a direction pointing directly downward from the center of the cam. During the half of the rotation of shaft 21 that the longer radius of cam 22 is changing from an upward to a downward direction the roller bearing 23 is pressing downward on plate 31 to cause plate 31 to deliver impact blows to tool 61. During the other half of the rotation of shaft 21, roller bearing 23 is releasing its pressure on plate 31.

I assemble the components of my mechanical hammer in the following manner: (1) Place positioning springs 40 and 41 beneath projections 6 and 7, respectively; (2) place on top of these springs spacers 38 and 39; (3) place on top of these spacers working springs 36 and 37; place tubular bearing surfaces 34 and 35 within the working springs 36 and 37, respectively; (4) compress the working springs and the positioning springs and place plate 31 on top of the workings springs 36 and 37; (5) allow tubular bearing surfaces 34 and 35 to enter holes 31*a* and 31*b* near the opposite ends of the plate 31; (6) place spacers 48 and 49 on top of the plate 31 in line with the tubular bearings; (7) insert guide rods 32 and 33 through the holes in projections 6 and 7, through holes in spacers 48 and 49, through holes 31*a* and 31*b* in plate 31, through tubular bearing surfaces 34 and 35, through holes in spacers 38 and 39, through positioning springs 40 and 41, and through circular openings 8 and 9 so that the threaded portion thereof extend outside the lower section 1; (8) place sleeve 43 over tube 3; (9) bring sleeve 43 along tube 3 until it rests against the bottom of the lower section 1; (10) place spacers 50 and 51 on the threaded portions of guide rods 32 and 33; (11) thread spur gears 46 and 47 onto the threaded portions of guide rods 32 and 33; (12) mesh the teeth of spur gears 46 and 47 with the teeth of spur gear 45 of sleeve 43; (13) place spacers 52 and 53 onto the reduced end portions of guide rods 32 and 33; (14) insert cotter pins through the holes in the reduced end portions of guide rods 32 and 33; (15) insert roller bearing 25 in recess 4; (16) insert one end of shaft 21 into roller bearing 25; (17) position the ball bearing 26 within recess provided for it beneath notch 5; (18) place upper section 10 on lower section 1 and secure the sections together by bolts 14; (19) insert tool 61 within liner 62; (20) attach attaching cap 63 to the bottom portion of tube 3 by means of spring loaded detents 63*b* that fit into holes 3*a*. Now my mechanical hammer is ready for use.

If spacers 50 and 52 are made integral with spur gear 46 and spacers 51 and 53 with spur gear 47, steps 10 and 13 are eliminated.

The operation of the preferred embodiment of my mechanical hammer is as follows: (1) A suitable power source, preferably an electric hand drill, is connected to the extension 24 and turned on. (2) The operator holds handle 12 in one hand, tube 3 in his other hand, and presses the operating end of tool 61 into contact with the material to be worked. (3) The rotation of shaft 21 rotates cam 22 and roller bearing 23. (4) During one half of the rotation of roller bearing 23 it presses downward on plate 31 and during the other half of its rotation it releases its pressure on plate 31. This action is due to the eccentricity of cam 22 on which roller bearing 23 is positioned. (5) Plate 31 is forced downward against the top of tool 61 during the half of the rotation of roller bearing 23 when it presses downward on plate 31 to provide the downward portion of the reciprocating movement of tool 61 when tool 61 delivers rapid blows or impacts against the material worked on. (6) The resistance of the material worked on brings on a reaction which forms the basis for the upward portion of the reciprocation movement of tool 61 by forcing the top of the tool 61 against the underside of plate 31.

Whenever the operator releases his pressure on my mechanical hammer, as when he lays it on its side, the tool 61 will be acted on by a downward force only. Since there is a force in only one direction the tool 61 will then come to rest as soon as it had been extended outward by the force of the blow on the top of the tool by plate 31, even though the power source is still connected to the mechanical hammer and is still rotating the shaft 21. Thus there is a reciprocating movement of tool 61 only so long as the operator continues to exert pressure on the handle of my mechanical hammer when tool 61 is in contact with the material worked on.

I consider the feature wherein the tool 61 will discontinue its reciprocating movement whenever the operator of my mechanical hammer releases his pressure thereon a safety feature since it permits the operator to inadvertently lay my mechanical hammer down without any chance of injuring himself should he forget to shut down the power source or to disconnect it from the mechanical hammer. Also this feature will permit the operator to change tools without the necessity of shutting down the power source or disconnecting it from the hammer. This feature is similar to putting an engine in neutral gear.

One tool may be substituted for another without the necessity of shutting down the power source or disconnecting it from the hammer, if it is so desired to do so, by removing the attaching cap 63, substituting another tool and liner for the tool and liner in the tube 3, and then replacing the attaching cap. The readiness in which the operator of my mechanical hammer can change one tool for another will encourage even the laziest operator to utilize it for many types of jobs, such as chipping, chiseling, cutting, drilling, hammering, punching, riveting, and trimming.

The tool 61 and liner 62 may be removed separately or as a unit whenever attaching cap 63 is removed. However, should the top of tool 61 become so enlarged so that it will not pass through the liner 62, then tool 61 and liner 62 must be removed as a unit. The tool 61 has enough strength so that its top will never become so deformed that it cannot pass through the tube 3.

Practically any type of already manufactured and readily available tool may be utilized in my mechanical hammer just as long as the shank of the tool will fit within the proper liner.

Other prime movers besides an electric hand drill may be used if they are adaptable to provide power to shaft 21 through such power transmission means as a flexible drive connection of sufficient length to permit free and convenient manipulation of my mechanical hammer.

Various size prime movers or motors may be used regardless of the material being worked on. This is accomplished by changing the force exerted by the tool 61 by varying the stroke of the tool or the pressure exerted on the hammer or both. The length of the stroke may be varied by rotating the sleeve 43 in a clockwise or counterclockwise direction depending whether it is desired to lengthen or shorten the stroke of the tool.

Present day hammers transmit their power from the drive shaft to the working tool by means of an eccentric cam coming in direct contact with either the working tool or other hammer member which in turn makes contact with the working tool so that the action consists of metal pounding and scraping against other metal with the resulting excesses of heat generation, friction power losses and wear of major components. In my mechanical hammer the rotary power of shaft 21 is converted into downward linear power through cam 22, roller bearing 23 and plate 31. The inner surface of the inner race of roller bearing 23 is secured to the outer surface of cam 22 so that there is no friction or power losses or wear caused solely by contact between these two surfaces when they are rotating in unison with shaft 21. Likewise the outer surface of the outer race of roller bearing 23 will, when in contact with plate 31, generate a negligible amount of friction or power losses and metal wear because of inherent efficiency of roller bearings. As the outer surface of the outer race of roller bearing 23 makes contact with plate 31 under varying degrees of force, the outer race will rotate or move its various contact points which come into direct contact with plate 31 so as to wear evenly. Thus by use of a roller bearing secured on an eccentric cam and a plate, I have been able to reduce friction or power losses and wear to a minimum.

Plate 31 is used in conjunction with the roller bearing 23 to convert the rotary power of the roller bearing 23 into linear power and to then transmit this linear power to the working tool 61. Plate 31 should be made of

metal thick enough and of sufficient strength to withstand the force of the roller bearing 23 and the resistance of the working tool 61 so that it will not buckle or bend. Little or no surface deformation will occur on the upper surface of plate 31 or on the outer race of roller bearing 23. However, the lower surface of plate 31 and the top of tool 61 may become chipped, battered, expanded or otherwise deformed. This will in no way impair the working of my hammer as adjustments in the length of stroke may be made by rotating sleeve 43 to compensate for the deformity. Moreover, such deformations will be very small considering that fairly strong metal will be used in making plate 31 and tool 61.

Plate 31 is forced vertically downward from its position as shown in FIGURE 1 to where it will nearly make contact with the top of tube 3. Eccentric cam 22 has its longer radius just the right length necessary to move plate 31 this distance. By varying the position of plate 31, the distance travelled by plate 31 during its reciprocating movement will vary. The force exerted by tool 61 will in turn vary so that the operator need not change the size of the power source or its speed.

Although but a single embodiment of the invention has been disclosed and described herein, it is obvious that many changes may be made in the size, shape, arrangement, and detail of the various elements of the invention without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. A mechanical hammer including a lower section comprising a casing and a tube; an upper section comprising a cover and handle; a drive assembly comprising a shaft, a cam eccentrically secured to the shaft, and a roller bearing positioned on said cam; a driven assembly comprising a plate, means to keep the plate in reciprocating relationship with the roller bearing, means to vary the distance between the top of the plate and the roller bearing; and a tool assembly comprising a tool, and an attaching cap; said upper section being secured to the lower section by means of bolts; the drive assembly being journaled in said lower section; the plate being situated in the vicinity of the roller bearing so that during one half of the rotation of the shaft, the roller bearing presses on the plate; the tool being reciprocally secured within the tube by the attaching cap with the upper end of the tube being located, relative to the plates, so as to receive an impact from the plate resulting from the pressing of the roller bearing on the plate, said means to keep the plate in reciprocating relationship with the roller bearing includes guide rods, tubular bearing surfaces, working springs, spacers, and positioning springs; the guide rod extending through the tubular bearing surfaces, working springs, spacers, positioning springs, and holes in the lower section; the tubular bearing surfaces, extending through holes in the plate, being encircled by working springs and resting on the spacers; said positioning springs being situated between the spacers and the portions of the lower section having the guide rod holes therein.

2. The mechanical hammer of claim 1 wherein the means to vary the distance between the top of the plate and the roller bearing includes a sleeve with a spur gear thereon and spur gears that mesh with the spur gear on the sleeve, the sleeve encircling a portion of the tube near the bottom of the lower section, the spur gears in meshing relationship to the spur gear on the sleeve being threadedly engaged to the lower portion of the guide rods, whereby a rotation of the sleeve will result in a longitudinal adjustment of the guide rods.

3. A mechanical hammer comprising a casing having a bottom and sides forming a generally open interior, a shaft positioned transversely in said casing and projecting beyond one side thereof, means mounting said shaft within said casing for rotation in response to a driving means engaged with the projecting end of the shaft, an

eccentric cam fixed to an intermediate portion of said shaft, within the casing, for rotation therewith, a flat plate positioned below said cam for engagement therewith upon a rotation of the cam, spring means engaged between the plate and the bottom of the casing on opposite sides of the cam, a guide rod extending vertically through each spring means, both the plate and the bottom of the casing having holes therein with the guide rods projecting therethrough and therebeyond, the upper end of each guide rod, above the plate, being enlarged, means on said casing receiving and stabilizing the enlarged upper ends of the guide rods while allowing the vertical movement thereof, the lower end of each rod being threaded, a spur gear threaded on the lower end of each rod exteriorly of the casing, an elongated tube fixed to and projecting vertically through the bottom of the casing in alignment with the cam, a spur gear rotatably mounted on said tube below the bottom of the casing and meshed with the spur gear on each rod whereby a rotation of the tube gear will effect a simultaneous rotation of the rod gears and an extension or retraction of these rods which, through the enlarged ends, varies the distance between the plate and the cam, and an elongated tool slidably mounted in said tube and projecting thereabove for engagement with the plate and therebelow for engagement with a workpiece, said plate reciprocating in response to rotation of the cam so as

to provide a periodic impact on the upper end of the tool.

4. The device of claim 3 wherein each spring means consists of an upper working spring and a lower positioning spring with a spacer therebetween, and an elongated tubular bearing surface seated on the top of the spacer and extending through the working spring and through the corresponding plate hole, the guide rod being received through the tubular bearing surface.

5. The device of claim 4 wherein the spur gear on the tube has a sleeve fixed thereto and depending therefrom in surrounding relation to said tube, said sleeve forming a handle so as to effect a rotation of the tube spur gear.

6. The device of claim 5 wherein said cam includes, a roller bearing peripherally thereabout, said plate engaging said roller bearing.

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