July 27, 1965 N. GRON 3,196,700

DRIVING MECHANISM FOR MACHINES

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Fig. 2

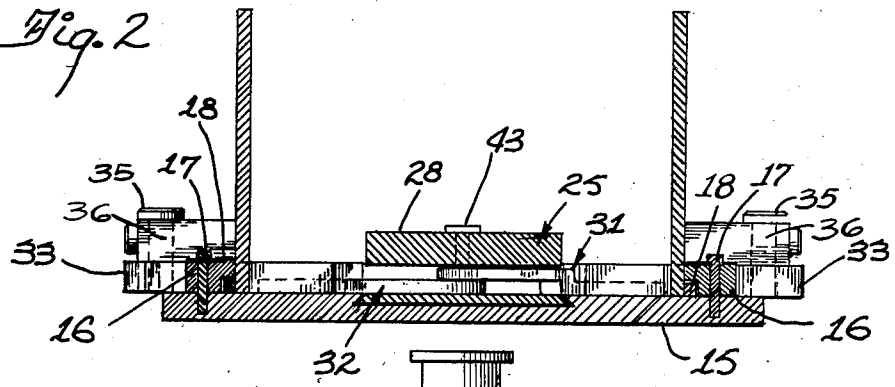
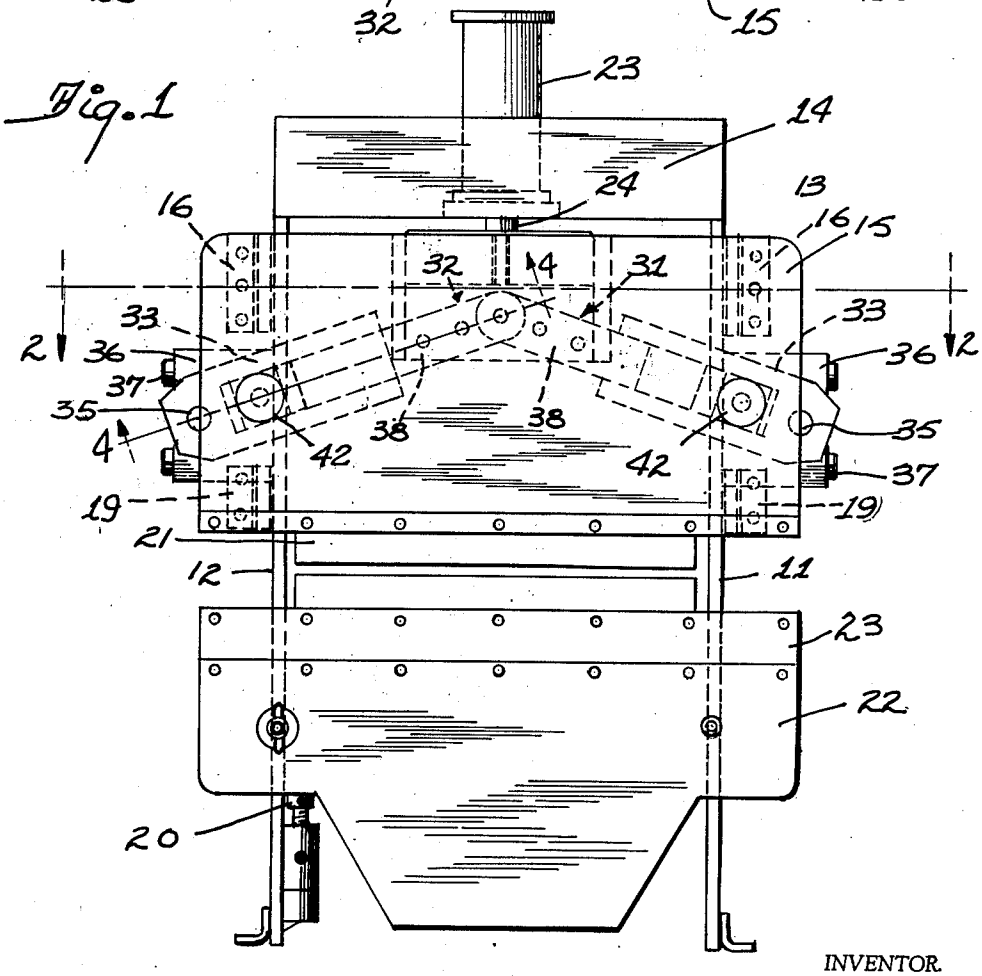


Fig. 1



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Fig 3

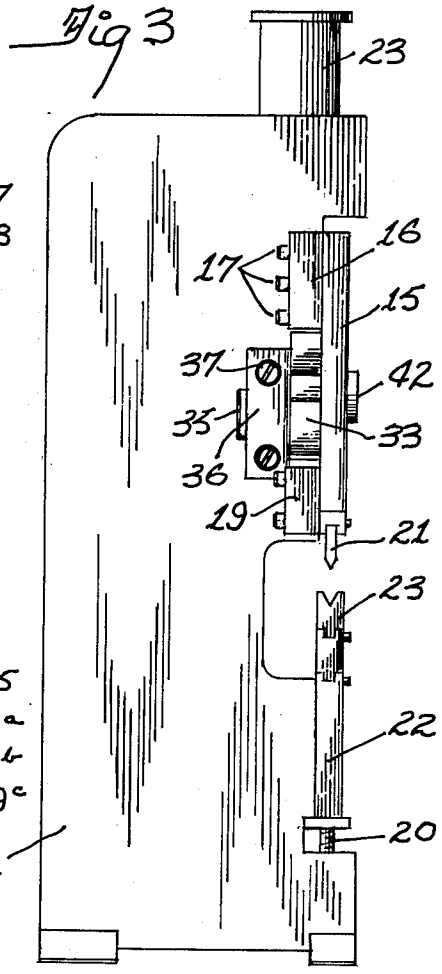


Fig 4

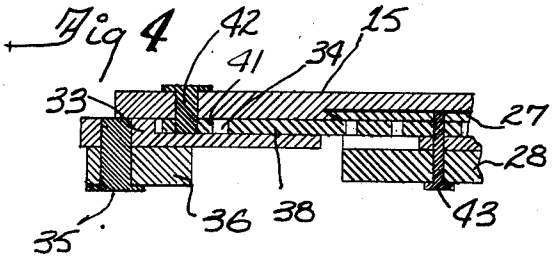


Fig 5

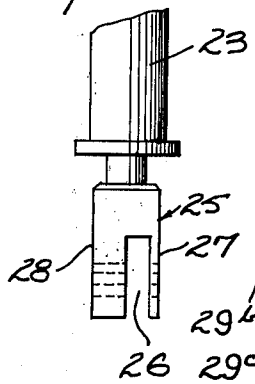


Fig 6

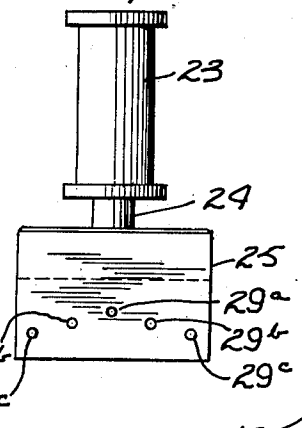
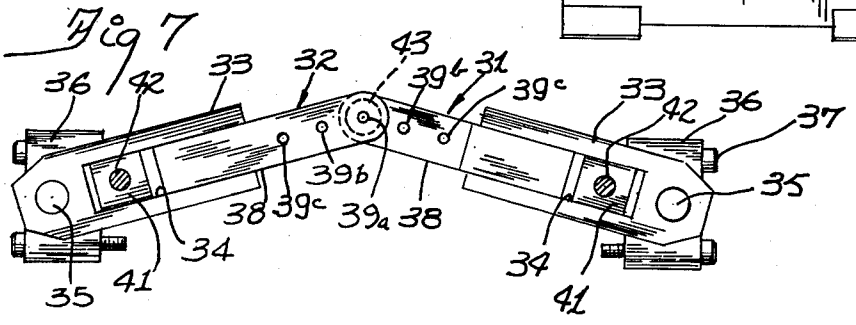


Fig 7



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DRIVING MECHANISM FOR MACHINES

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4 Claims. (Cl. 74—110)

The present invention relates to power-applying mechanism and has special reference to power mechanism for operating machines, such, for example, as shears, presses, bending machines, press brakes, and others.

More particularly, this invention relates to a mechanical leverage mechanism actuated by a single power member for driving the ram or other reciprocating part of a machine.

While the present driving mechanism may be employed with many types of machines, it is herein disclosed and described in connection with a press brake. There is a single power-applying or driving member which, as illustrated, may comprise a hydraulic cylinder mounted on the central upper portion of the frame of the press brake. The hydraulic cylinder is arranged so that the piston thereof extends downwardly and is operatively connected to the inner ends of a pair of longitudinally extensible and contractible levers positioned adjacent the veritically reciprocating ram of the brake. The outer end portions of the levers are pivotally connected to opposite side frames of the press brake. Bearing members mounted on the levers and movable longitudinally thereof are pivotally connected to the adjacent ram. As the pivotal connections between the levers and the ram, in the embodiment illustrated, are intermediate the inner ends of the levers where power is applied and the outer pivot points or fulcrums of the levers, extension of the piston from the hydraulic cylinder will cause the levers to pivot about their outer pivot points and thereby force the ram downwardly to perform its intended work. The pivot members connecting the levers to the ram move vertically in straight lines.

Through the use of an adjustable connecting member secured to the outer end of the piston rod, the inner pivot points of the levers may be varied, thus varying the force exerted on the ram and the length of travel of the ram.

An object of the present invention is to provide a simple, efficient power-applying or driving mechanism for machines of the type having a reciprocating ram. Through the use of a single hydraulic cylinder or other power member instead of a plurality thereof, the operating controls may be greatly simplified.

Another object of the present invention is to provide a construction of the above type which results in great accuracy of the power stroke and permits quick and easy variation of the length of the stroke and the amount of power applied.

It is a further object of this invention to provide power-applying or driving mechanism which can be used with standard machines with little or no modification.

Further objects and advantages will be apparent from the following description and claims when considered with the accompanying drawings, in which:

FIGURE 1 is a front elevational view of a press brake having power-applying or driving mechanism embodying the present invention;

FIG. 2 is a cross-sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is a side elevational view of the apparatus illustrated in FIG. 1;

FIG. 4 is a cross-sectional view taken along the line 4—4 of FIG. 1;

FIG. 5 is a side elevational view of a hydraulic cylinder and connecting member attached to the piston thereof which may be employed in the present construction;

FIG. 6 is a front elevational view of the hydraulic cylinder and connecting member shown in FIG. 5; and

FIG. 7 is a front elevational view of the levers forming part of the present invention and means for connecting them to other parts of the apparatus.

Referring more particularly to the drawings, there is shown a press brake having a drive embodying the present invention. The brake is supported on a frame comprising side members **11** and **12** having cutout portions along their forward edges for the accommodation of parts of the mechanism, a top member **13** and a front vertical, transverse portion **14**.

A ram **15** is mounted on the frame so as to be capable of vertical reciprocating movement thereon. For this purpose top gibs **16** are secured to the rear face of the ram adjacent opposite side edges by suitable means, such as bolts **17**, and are shaped to fit over vertical guides **18** secured to the frame. Bottom gibs **19** are also secured to the lower rear face of the ram adjacent the lower side edges thereof and fit about similar vertical guides. Bolts **17** may also be employed for attaching the lower gibs **19** to the rear of the ram **15**. This construction permits the ram to reciprocate vertically on the frame, but prevents transverse movement of the ram with respect to the frame. The ram is preferably provided at its lower edge with a suitable male die **21**.

A bed or plate **22** is mounted on the frame adjacent the lower end of the machine. Secured on the bed is a female die **23** arranged to cooperate with the male die **21** upon actuation of the driving mechanism of the press brake. An adjusting screw **20** may be provided for vertical adjustment of the bed **22**. Suitable means for holding the bed on the frame are also employed.

The drive mechanism for actuating the ram includes a single power member, such as a hydraulic cylinder **23**, secured to the top frame portion **13**. A piston **24** projects from the lower end of the hydraulic cylinder **23** and has mounted on its lower end a bifurcated connecting member **25** with a slot **26** extending the full width thereof. The slot separates the front portion **27** from the rear portion **28**, and aligned holes extend entirely through the front and rear portions. As shown particularly in FIG. 6, there are upper central openings **29*a*** with pairs of aligned openings **29*b*** and **29*c*** below and to each side thereof. This permits adjustment of the drive mechanism, as will be explained hereinafter. The central opening **29*a*** together with each pair of openings **29*b*** or **29*c*** preferably define isosceles triangles as illustrated.

A pair of similar levers **31** and **32** extend between the connecting member **25** and the opposite side frames of the apparatus. Each lever is longitudinally extensible and contractible. Each has a lever arm housing **33** provided with a longitudinal groove **34** which, in the particular embodiment illustrated, extends inwardly from the inner ends of the lever arm housings a major portion of the length thereof. The outer ends of the lever arm housings are pivotally secured to the frame of the apparatus about horizontal pivot members or fulcrums **35**. For this purpose, end frame blocks **36** are secured to opposite sides of the apparatus by suitable means, such as bolts **37**. The pivot members, such as the pins **35**, extend through the end frame blocks and are secured to the lever arm housings **33**, as shown particularly in FIG. 4. This permits the lever arm housings to pivot vertically about the horizontal pivot pins **35**.

Each lever **31** and **32** also includes a lever arm **38**, the inner end of which is of a size and shape to slidably fit in the groove **34** of its cooperating lever arm housing **33**. The front of the groove is closed by the ram **15** as shown in FIGS. 3 and 4. One of the lever arms **38**, such as that of the lever **31**, has its inner end rear-

wardly offset a sufficient distance to permit it to overlie the inner end of the other lever arm 38 forming part of the lever 32 as appears particularly in FIG. 2. The inner ends of the lever arms 38 are provided with openings 39*a*, 39*b* and 39*c* spaced and arranged to coincide with the openings in the connecting member 25.

Slidably positioned in the grooves 34 between the inner ends of the lever arms and the ends of the grooves are bearing members 41 which are connected to the ram 15 by means of pins 42. The pins 42 extend through openings in the ram 15, preferably being fixedly held therein, and into the bearing members 41. With this construction, the ram moves vertically as the levers 31 and 32 are pivoted about their pivots or fulcrums 35.

In the embodiment illustrated, the end openings of the lever arms 38 are pivotally connected to the center opening 29*a* of the connecting member 25. This may be accomplished by a pin 43 which projects through the rear portion 28 of the connecting member 25, the inner ends of the lever arms 38 and the aligned openings in the forward portion 27 of the connecting member. The press brake, illustrated in the drawings, is in open position with the inner ends of the lever arms above the pivots or fulcrums 35 of the lever arm housings.

Suitable controls (not shown) are provided for controlling the operation of the hydraulic cylinder. By a selection of the proper controls, the drive may be actuated for inching, single stroking, or continuous operation of the ram. When fluid is supplied to the hydraulic cylinder above the piston, the piston rod is forced downwardly, forcing the inner ends of the levers 31 and 32 downwardly about their pivots 35. During the downward stroke, the levers decrease in length due to their telescopic action until the two levers are longitudinally aligned. Simultaneously, the bearings 41 move toward the ends of the slots 34 and the pins 42 move vertically downwardly. If the stroke of the piston is sufficient to bring the connection between the inner ends of the levers and the connecting member 25 below the pivots 35, the levers gradually increase in length again.

The length of the stroke of the ram and the power applied by the male die carried by the ram may be readily varied by changing the points at which the inner ends of the lever arms are connected to the connecting member 25. With the end openings 39*a* of the lever arms 38 positioned over the hole 29*a* in the connecting member, as illustrated, maximum power is applied to the ram, although the distance of movement of the ram is least. That is because the ratio of the distances from the pin 42 to the pivot points of the inner ends of the lever arms and from the pin 42 to the fulcrum 35 is greatest. If the inner ends of the levers are pivotally connected to the connecting member 25 through the holes 29*c* of the connecting member and 39*c* of the lever arms, the ram will be moved a maximum distance but minimum force will be applied. By providing various holes in the connecting member and in the lever arms, the distance of movement of the ram and the force applied to the work may be readily controlled.

With the connecting member positioned midway between the sides of the ram, and the hydraulic cylinder applying the same force to the ram through each pin 42, both sides of the ram and die thereon are forced down equally.

The present invention has been described in connection with the use of a hydraulic cylinder 23. In place of a hydraulic cylinder, any other suitable power means may be used for effecting pivotal movement of the levers 31 and 32 about their respective fulcrums.

The embodiment of the invention disclosed involves a construction in which the pivot or fulcrum of each lever is adjacent the outer end of the lever, and the connection between the lever and the ram is intermediate the fulcrum and point that power is applied to the lever. Other types of levers may be employed. For example, it would be possible to have the fulcrum or pivot 35 inwardly of the connection between the bearings 41 and the ram. In such case, the power stroke would be reversed, and the ram would be forced downwardly when the piston rod is moved upwardly toward the upper end of the cylinder. The mechanism "sides" as used herein has reference to the central longitudinal axis of movement of said ram whether vertical or otherwise.

While particular embodiments of this invention have been illustrated and described, it will be understood, of course, that the invention is not to be limited thereto since many modifications may be made, and it is contemplated, therefore, by the appended claims, to cover any modifications that come within the true scope of this invention.

I claim:

1. The combination with mechanism having a frame and a ram mounted on said frame for reciprocating movement, of means for driving said ram comprising a power member, a pair of similar longitudinally extensible and contractible levers adjacent one face of said ram, said levers having their inner end portions operatively connected to said power member and diverging outwardly therefrom to pivots on said frame portions at opposite sides of said mechanism equidistant from the connections of said levers to said power member, each of said levers comprising an outer housing portion having a longitudinal slot therein communicating with the side thereof adjacent said ram pivotally connected to one of said pivots and an inner member having its outer end slidably fitting in said slot for longitudinal movement therein with its inner end portion operatively connected to said power member for pivotal movement with respect thereto, a bearing member mounted in each of said slots for longitudinal movement therein beteen the outer end of said inner member and the end of the slot in the outer member, and means for pivotally connecting said bearing members and the ram portions adjacent thereto, whereby actuation of said power member causes said levers to pivot about their pivots on said frame and effect reciprocal movement of said ram in said frame.

2. The combination with mechanism having a frame and a ram mounted on said frame for vertical reciprocating movement, of means for driving said ram comprising a power unit mounted on said frame having a reciprocating connecting portion movable in the direction of movement of said ram, a pair of similar longitudinally extensible and contractible levers adjacent one face of said ram extending between said driving portion and similarly positioned pivots on opposite sides of said frame equidistant from the connections of said levers to said driving portion, each of said levers comprising a lever arm and a lever arm housing, said housing being pivotally mounted adjacent its outer end on one of said pivots and having a longitudinal groove extending from its inner end toward the pivot a substantial portion of the length thereof, a bearing member movably positioned in said groove a substantial distance from the open end thereof and being secured to an adjacent portion of said ram by a connecting member, said groove communicating with the side of said lever arm housing adjacent the ram to permit said bearing and connecting members to move longitudinally of said housing and vertically with respect to said frame upon pivotal movement of said lever arm housing, a lever arm secured to said connecting portion and having its outer end slidably fitted into said groove, the length of said lever arm being such that when the inner end of said lever arm is at a maximum distance from said pivot the outer end of said lever arm will extend a distance into said groove and when the inner end of said lever is closest to said pivot the outer end of said lever arm will lie inwardly of said bearing member, whereby actuation of the power applying member causes said levers to pivot about their pivot points and effect reciprocating movement of said ram with respect to said frame.

3. The combination with mechanism having a frame and a ram mounted on said frame for vertical reciprocating movement, of means for driving said ram comprising a power unit mounted on said frame having a reciprocating connecting portion movable centrally of the ram in the direction of movement thereof, a pair of similar longitudinally extensible and contractible levers adjacent one face of said ram extending between said connecting portion and similarly positioned pivots on opposite sides of said frame, each of said levers comprising a lever arm and a lever arm housing, said housing being pivotally connected adjacent its outer end to one of said pivots and having a longitudinal groove extending from its inner end toward the pivot a substantial portion of the length thereof, a bearing member movably positioned in said groove a substantial distance from the open end thereof and being secured to an adjacent fixed portion of said ram by a connecting member, said groove communicating with the side of said lever arm housing adjacent the ram to permit said bearing and connecting members to move longitudinally of said housing and vertically with respect to said frame upon pivotal movement of said lever arm housing, a lever arm secured to said connecting portion and having its outer end slidably fitted into said groove, the length of said lever arm being such that when the inner end of said lever arm is at a maximum distance from said pivot the outer end of said lever arm will extend a distance into said groove and when the inner end of said lever is closest to said pivot the outer end of said lever arm will be inwardly of said bearing member, whereby actuation of the power unit causes said levers to pivot about their pivot points and effect reciprocating movement of said ram with respect to said frame.

4. The combination with mechanism having a frame and a ram mounted on said frame for vertical reciprocating movement, of means for driving said ram comprising a single reciprocating power member mounted on the upper portion of said frame substantially midway between opposite sides thereof, a connecting element on said power member for movement therewith in the direction of movement of said ram, a pair of similar longitudinally extensible and contractible levers adjacent one face of said ram diverging downwardly and outwardly a similar distance

at substantially equal angles to the path of movement of said ram from said connecting element to similarly positioned pivots on opposite sides of said frame, each of said levers comprising a lever arm and a lever arm housing, said housing being pivotally mounted adjacent its outer end on one of said pivots and having a longitudinal groove extending from its inner end toward the pivot a major portion of the length thereof, a bearing member movably positioned in said groove a substantial distance from the open end thereof and being pivotally secured to an adjacent fixed portion of said ram by a connecting member extending substantially normal to the general plane of said ram, said groove communicating with the side of said lever arm housing adjacent the ram to permit said bearing and connecting members to move longitudinally of said housing and vertically with respect to said frame upon pivotal movement of said lever arm housing, a lever arm adjustably secured to said connecting element and having its outer end slidably fitted into said groove, the length of said lever arm being such that when the inner end of said lever arm is at a maximum distance from said pivot the outer end of said lever arm will extend a distance into said groove and when the inner end of said lever is closest to said pivot the outer end of said lever arm will lie inwardly of said bearing member, whereby actuation of the power applying member causes said levers to pivot about their pivot points and effect reciprocating movement of said ram with respect to said frame.

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