Aug. 13, 1935. M. W. LAMPRECHT 2,011,106

FORGING MACHINE

Filed March 13, 1934 2 Sheets-Sheet 1

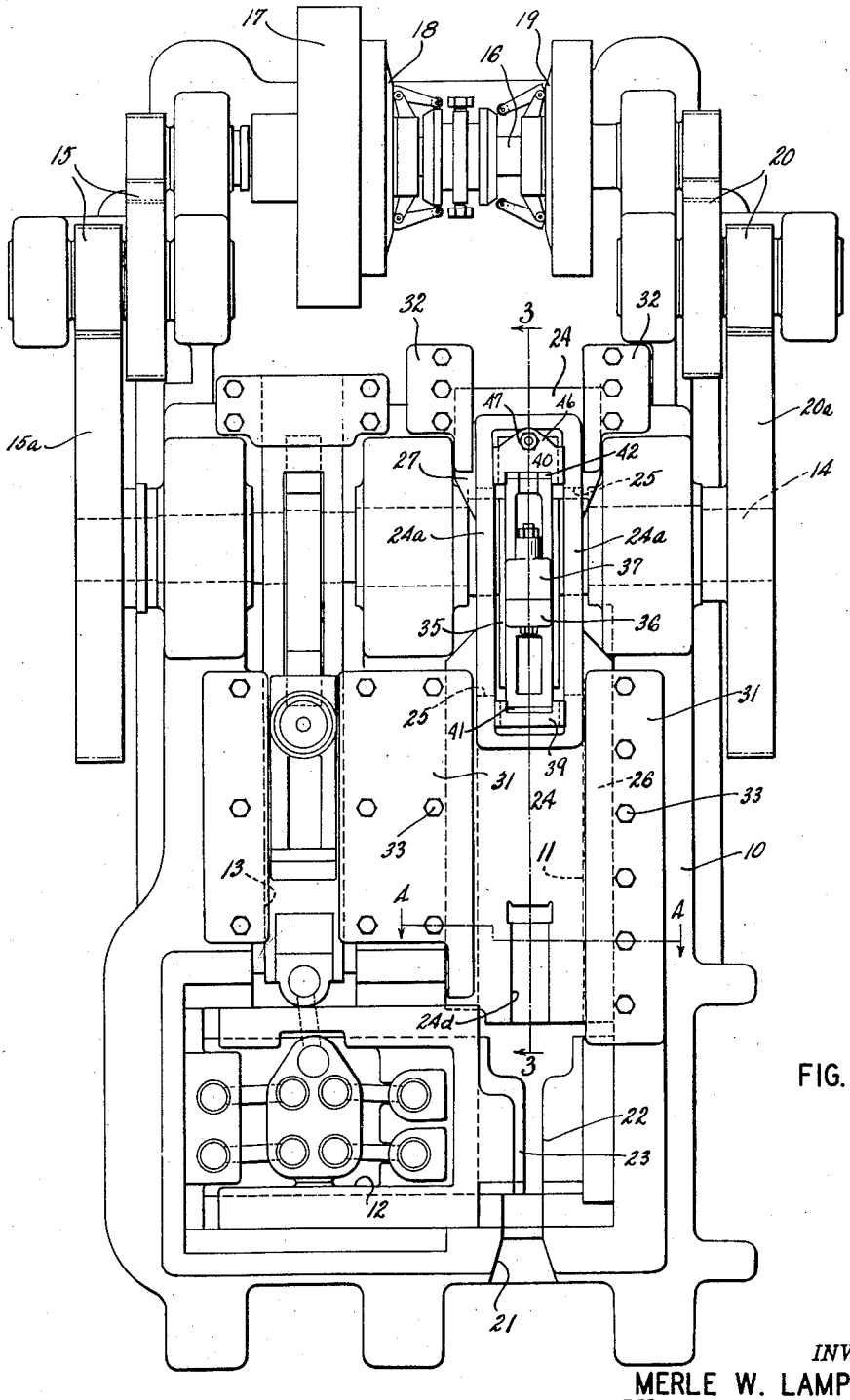


FIG. - 1

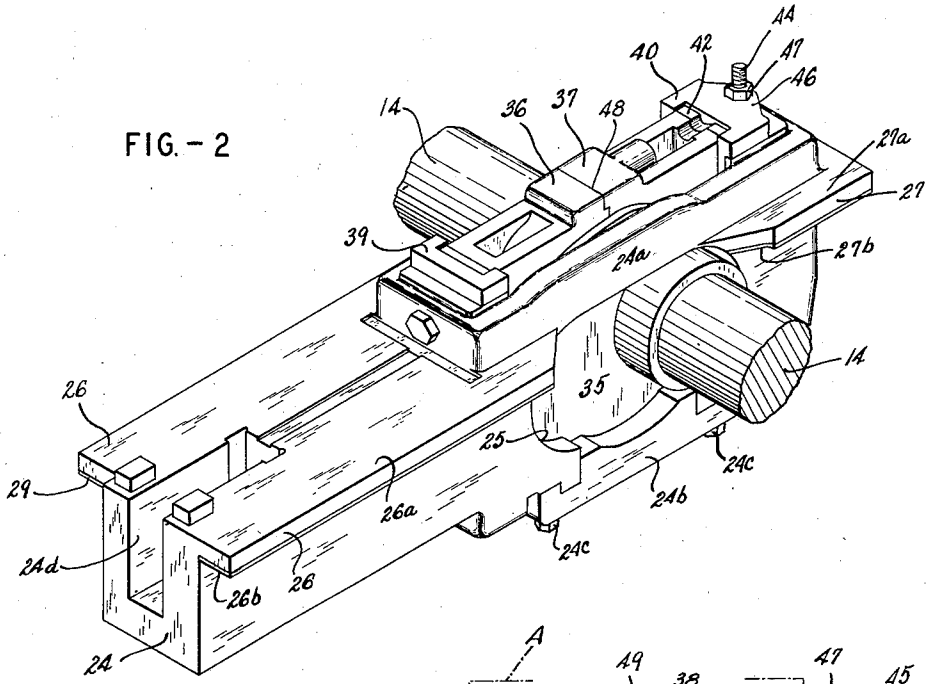
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FIG. - 2



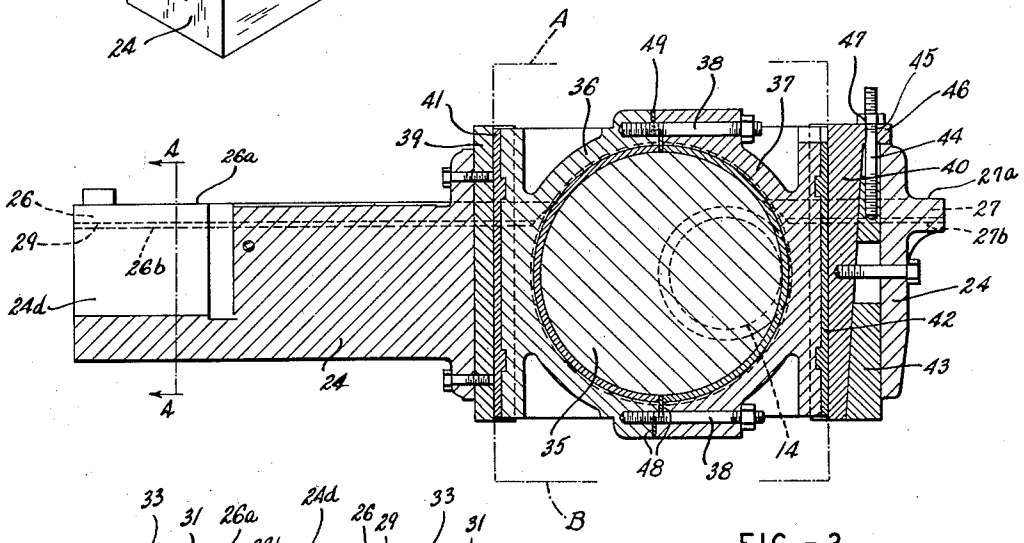


FIG. - 3

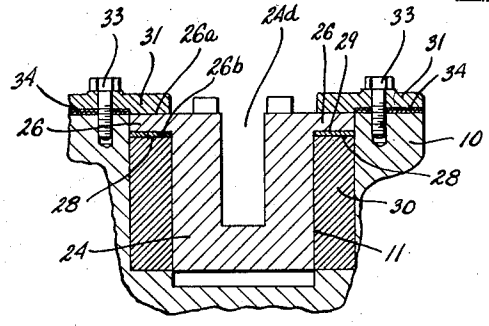


FIG. - 4

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FORGING MACHINE

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9 Claims. (Cl. 308—3)

This invention relates to a forging or upsetting machine and more particularly to a horizontally reciprocable header slide for a heavy duty machine.

The stresses developed in heavy-duty forging and upsetting machines of this type are of such magnitude that difficulty has been experienced in maintaining accurate bearing and guiding surfaces for the header slide. Proper alignment of the slide is necessary if accurate work is to be performed and if wear on the tools and dies is to be kept at a minimum. This is particularly true where the horizontally disposed header slide is massive and has considerable vertical depth. In such cases, a blow delivered to a piece of work at the upper or lower portion of the working face is sufficiently eccentric to the usual slide reciprocating connection to provide a moment of considerable magnitude tending to tilt or rotate the header slide about the said connection. This results in excessive and uneven wear of the bearing surfaces of the slide. Furthermore, it has been customary in the art to reciprocate the header slides of heavy duty forging machines by a pitman connection. This results in great wear on the lower header slide bearing surfaces forward of the crank due to the weight of a massive slide plus the angular thrust of the pitman at the time of delivering a blow. At the same time there is a slight tilting of the slide which causes line contact between the slide and any upper bearing surfaces which may be provided. This results in uneven, rapid wear which produces misalignment of the header slide.

An object of my invention is to provide, in a header slide, large bearing surfaces so distributed that wear is substantially even thereover; to provide a driving connection of such size and so arranged that the tendency of the slide to tilt or rotate, due to blows at the extreme upper and lower limits of the working face of the slide, is reduced to a minimum.

Another object of my invention is to provide a driving connection for a heavy duty slide, comprising a cam rotatable in a block, which is adapted to reciprocate transversely of the header slide. This type of driving connection has advantages over the usual pitman connection not heretofore realized in heavy duty machines.

Other objects and advantages include the provision of a cam and a sliding block of dimensions greater than the depth of the header slide and improved means for taking up wear in the driving connection, as will more fully appear.

In the drawings Fig. 1 represents a top plan view of a machine embodying my improved slide; Fig. 2 is a perspective view of the header slide and a portion of the drive shaft; Fig. 3 is a central longitudinal section through the slide along the line 3—3 of Fig. 1; while Fig. 4 is a transverse section through the slide along the line 4—4 of Figs. 1 and 3.

My invention comprises in general a rigid, massive header slide, horizontally disposed in a frame and reciprocable by means of a drive shaft and an eccentric driving connection on said shaft, said driving connection acting on the slide intermediate its ends. Near its upper edges the slide is provided with laterally extending parallel bearing surfaces on bearing portions, both forward and rearward of the driving connection. The bearing surfaces of these portions lie in common planes forward and rearward of the driving connection and cooperate with complementary surfaces on the frame beneath the bearing portions and caps secured to the frame which overlie the bearing portions.

The machine illustrated in Fig. 1 comprises a frame or bed-plate 10 in which are formed the channel shaped recesses 11 for a header slide, 12 for a die slide and 13 for a toggle slide which operates the gripping dies. The toggle and header slides are reciprocated in a substantially horizontal direction by crank members or cams which are positioned on a common drive shaft 14 journalled in the frame. This drive shaft is rotated through trains of gears, indicated generally at 15 and 20, from a rear shaft 16 which is driven by member 17 which has a drive connection by belt or otherwise with a power source not shown. A drive clutch is shown at 18 and a braking clutch at 19, which in turn is connected with drive shaft 14 by the gear trains above mentioned. The large rotating member 17 also serves as a flywheel to store energy which is delivered when a blow is struck. The work is introduced through an opening 21 in the frame, is gripped between a fixed die 22 and a movable die 23, and is formed by blows delivered by tools or dies secured to the header slide. All of this forms no part of the present invention and further description is thought unnecessary.

The header slide, indicated generally at 24, comprises a rigid, massive, elongated member having a transverse opening 25 therethrough intermediate its ends. The shaft 14 extends through the opening and has an eccentric driving connection for reciprocating the slide. For a 1½ inch machine, that is to say, one having approximately the capacity to upset a 1½ inch

diameter steel rod, the header slide is approximately 10 inches deep, 9 inches wide and 54 inches long overall and weighs about twelve or thirteen hundred pounds. For larger machines the dimensions and weights are correspondingly greater.

The header slide is rigid from end to end but is provided with means for assembling the parts about the drive shaft. For this purpose the portion above or below the shaft, in this case the portions 24*a* above the shaft, are unitary with the slide, and tie bars 24*b* are secured beneath the shaft after the parts are assembled, as by means of bolts, 24*c*. The tie bars are so connected to the slide that they form both compression and tension members. The slide therefore forms an open cage in the region of the shaft with two bars 24*a* above the shaft and two bars 24*b* below it.

These heavy slides require special bearing supports if accurate forgings are to be continuously produced. To this end I have provided bearing portions 26 and 27 rigid with the slide and extending laterally outward from each side of the slide near the top. In the present instance the top of the bearing portions is flush with the top of the slide, although the parts need not be arranged in exactly this manner. The frame or bed is recessed to provide broad ways 28 which cooperate with the bearing portions so that the slide hangs suspended therefrom in the frame. In thus providing bearing surfaces near the top of the slide instead of at the bottom, as is customary, the possibility of dirt, scale and water coming in contact with these surfaces is practically eliminated.

It will be noted that the bearing portions on the slide are located along substantially its entire length except over the drive shaft, and include the portions 26 forward of the shaft and the portions 27 rearward of the shaft. The upper and lower surfaces 26*a* and 26*b* and 27*a* and 27*b* of the respective bearing portions are parallel. The upper and lower bearing surfaces forward and rearward of the driving connection preferably lie in common planes respectively. The ways 28 in the frame are therefore in a common plane to cooperate with the lower faces of bearing portions 26 and 27. The lower faces of the bearing portions are preferably provided with wearing plates 29 of bronze or other bearing metal, and the ways 28 may be fitted with accurately ground gibs 30 to avoid wear on the frame. When the parts are assembled, upward movement of the slide is prevented by caps 31 and 32 which contact the upper bearing surfaces 26*a* and 27*a*, and which are secured to the frame, as by bolts 33, with shims 34 between the caps and frame to allow for adjustment after wear.

There is a great advantage in having the header slide bearing surfaces in common planes. So arranged, these surfaces are easy to form in the original construction and assembly of the machine. Only one set-up for each surface is required and a straight cut insures that the parts will align perfectly. Furthermore, the bearing portions are long and broad and the other parts of the machine are so constructed that wear is not excessive and the bearings surfaces receive substantially even wear at all points. Usually, therefore, adjustment after wear is simply a matter of removing shims 34, as required. If wear is too great or too uneven for such adjustment, a cut or a grinding operation in the common plane of the bearing surfaces restores the parts to perfect alignment.

Side play of the header slide is prevented by contact of the vertical faces of the slide with the vertical faces of the gibs 30. Each vertical face of the slide extends in one plane from front to rear of the machine.

The working tools or dies are placed in a recess 24*d* at the forward end of the header slide, and it will be noted that drive shaft 14 is substantially aligned with the mid-portion of the usual working face of the slide. In the customary use of the machine about as many blows will be delivered above the shaft center as below it. Blows off-center above the shaft axis will tend to tilt the slide in a clockwise direction as viewed in Figs. 2 and 3. This movement will be resisted by bearing surfaces 26*a* and 27*b*. Blows off-center below the shaft axis will tend to tilt the slide in a counter-clockwise direction and this movement will be resisted by bearing surfaces 26*b* and 27*a*. Because no blow ever occurs very far off-center, and because the bearing surfaces are ample, and because the bearing surfaces are in common planes and easily maintained in such a condition that all surfaces cooperate in taking the load, I am able to maintain very accurate alignment of the header slide and thus continuously to produce very satisfactory forgings.

For reciprocation of the header slide, I have replaced the customary pitman driving connection with a circular cam 35, eccentric with shaft 14. The cam is embraced by a sliding box comprising blocks 36 and 37 which are secured together as by bolts 38. The box moves back and forth with the reciprocating slide, but also is mounted for reciprocation transversely of the slide in vertically extending bearing plates or guides 39 and 40 which line recesses on opposite vertical edges of the opening through the slide. The sliding blocks 36 and 37 may be provided with the gibs 41 and 42, if desired.

Means is provided to take up wear between the sliding blocks and the cam and guides respectively. To this end the rearward face of guide 40 is wedge-shaped and a complementary wedge member 43 is provided between guide 40 and the slide, together with means for relatively moving the wedges to take up wear. The adjusting means comprises a stud 44 threaded into the adjustable wedge and passing through an opening 45 in a rearwardly extending bracket 46 which forms a part of guide 40. A nut 47 adjusts the wedges to the desired position. The division between blocks 36 and 37 is along planes substantially parallel to the guides as indicated at 48. Shims 49 are provided between the blocks and are removable to compensate for wear between the blocks and the cam. It will be apparent from a study of Fig. 3 that the adjusting wedges are arranged to take up simultaneously any play between the sliding blocks and the cam and wear between the blocks and the guides.

As shaft 14 rotates, cam 35 moves the slide alternately forward and backward, the parts being shown in all the views with the slide in its most advanced position. During such rotation of the shaft and cam, the sliding box moves transversely of the slide, its extreme positions being indicated by the dot-dash lines A and B in Fig. 3.

The eccentric cam of large diameter is superior to the usual crank pin type of connection for equal length of throw. The shaft is far more rigid and is not submitted to constant deflection

under heavy pressure, with the consequent tendency to crystallize and break. The stress, with my improved driving connection, is one of direct shear against the supporting journals on each side of the eccentric, instead of a bending moment, as is the case with the crank pin connection.

Furthermore, the usual pitman connection with the slide concentrates the blow on a relatively small area, that is to say, the projected area of the pitman pin; whereas with my improved sliding box or "Scotch yoke" connection the blow is distributed over a relatively large area, namely, the projected area of the cam. It will be noted that the diameter of the cam is greater than the depth of the slide and thus provides a very large area which evenly distributes the blow. To construct a pitman pin connection having a projected area equal to that of my eccentric cam would require a slide of much greater size than mine.

From an inspection of Fig. 3 it will be apparent that a concentrated blow delivered at the working face of the slide will be distributed over a portion of the vertical face of the sliding box, and will be communicated thence to the large arcuate surface of cam **35**. Due to the large diameter of cam **35** any blow off-center relative to the cam axis will have a large component acting horizontally and a small component acting vertically. Hence, the tendency to rotate or tilt the slide about its driving connection will be very small with consequent slight wear on the bearing surfaces.

A more powerful blow is delivered by the sliding block driving connection than by the usual pitman connection because, for equal rates of shaft rotation, my sliding block moves the slide slower during the latter portion of a power stroke than is the case with a pitman drive. Thus more energy is transmitted from the flywheel to the work in the case of my improved machine.

What I claim is:

1. In a heavy-duty forging machine, the combination of a frame, a rigid massive header slide horizontally reciprocable in said frame, a driving member having an operative connection therewith intermediate the ends of said slide, bearing portions suspending said slide in said frame, said bearing portions being rigid with said slide and extending laterally therefrom adjacent the upper portion thereof and on opposite sides of the driving connection, said bearing portions having bearing surfaces on their lower faces, bearing surfaces on said frame adapted to cooperate with the bearing surfaces on said slide portions, all of said bearing surfaces lying in a common plane, and caps secured to said frame and overlying said bearing portions.

2. In a heavy-duty forging machine, the combination of a frame, an elongated, rigid, horizontally extending header slide having laterally extending bearing portions rigid therewith and adjacent the upper edges thereof, said slide being suspended in said frame by said bearing portions for reciprocating movement, there being a transversely extending opening through said slide intermediate its ends, guides on opposite vertical edges of said opening, a drive shaft extending through said opening, a circular cam eccentric with said shaft, and blocks embracing said cam and slidably fitting said guides.

3. The combination of claim 2, in which said slide is of massive proportions and the diameter of said cam is greater than the depth of the slide.

4. The combination of claim 2, in which said blocks are slightly separated along planes substantially parallel to the guides, oppositely extending coacting wedge-shape members are provided between a guide and the frame, with means for causing relative movement between said members, whereby to compensate simultaneously for wear between the blocks and the cam and wear between the blocks and guides.

5. In a forging machine, the combination of a frame, a header slide horizontally reciprocable in said frame and having a substantially vertical working face at its forward end, a driving shaft having an eccentric driving connection with said slide intermediate its ends, bearing portions extending laterally outward from said slide forward and rearward of said driving connection, the bearing portions on each side of the connection having parallel upper and lower bearing surfaces, bearing surfaces on the frame adapted to cooperate with the surfaces on the bearing portions of the slide, and the axis of said shaft being aligned with substantially the midportion of the working face of the slide.

6. The combination of claim 5, in which the upper and lower bearing surfaces on opposite sides of the driving connection lie in common planes respectively.

7. In a heavy-duty forging machine, the combination of a frame, a rigid massive header slide horizontally reciprocable in said frame, a driving member having an operative connection therewith intermediate the ends of said slide, portions of said slide above the bottom thereof being provided with bearing surfaces lying in parallel horizontal planes extending longitudinally of each side of the slide, said bearing surfaces being provided both forward and rearward of the driving connection, and portions of the frame having surfaces adapted to cooperate with said bearing surfaces on the slide.

8. In a heavy-duty forging machine, the combination of a frame, a rigid massive horizontally extending header slide reciprocable in said frame, coacting bearing portions on said slide and frame, there being a transversely extending opening through said slide intermediate its ends, guide ways on opposite vertical edges of said opening, a drive shaft extending through said opening, a circular cam eccentric with said shaft, blocks embracing said cam and slidably fitting said guide ways, and the diameter of said cam being at least equal to the vertical depth of said slide.

9. In a heavy-duty forging machine, the combination of a frame, a rigid massive header slide horizontally reciprocable in said frame, a driving member having an operative connection therewith intermediate the ends of said slide, bearing portions suspending said slide in said frame, said bearing portions being rigid with said slide and extending laterally therefrom substantially above the center of gravity of the slide and forwardly and rearwardly of the driving connection, said bearing portions having bearing surfaces on their lower faces, and bearing surfaces on said frame adapted to cooperate with the bearing surfaces on said slide portions.

MERLE W. LAMPRECHT.