This invention relates to power hammers or the like and, in particular, to the guides for the reciprocating ram thereof.

Power hammers as previously constructed have usually comprised a frame including spaced columns with a ram mounted therebetween for vertical reciprocation. Vertical guide bars are customarily secured in pockets in the columns, each column having one or two guide bars, the exposed surface of each bar being tongue-and-grooved for cooperation with the sides of the ram which are correspondingly tongue-and-grooved.

In using such hammers to die-forging long parts, excessive stress is applied to the guide bars and thence to the columns. Forgings such as crankshafts, axles, etc., may require dies as long as 84", the dies being positioned in forging, at substantially right angles to the central plane through the columns and ram. Any mis-matching of such long dies or indeed, any of several other conditions, may result in the force of a hammer blow being applied to the forging blank near one end thereof. The force of the blow may thus be effective on the ram guides through a lever arm as great as 42", thereby setting up tremendous stress in the columns, since they must provide the reaction to oppose the lateral force on the guides resulting from a blow being absorbed at an off-center point. Because of this condition, it is not unusual for the sides of the guide-bar pockets in the columns to crack, rendering the hammer inoperative and necessitating costly repairs.

A further objection to hammers of conventional construction is that looseness develops between the guides and columns, making it impossible to produce perfect forgings because of the mis-matching of the dies resulting from lost motion between the hammer and frame.

I have invented a novel guide for the ram of a power hammer, so constructed that it is particularly adapted to resist the lateral thrust resulting from a hammer blow being absorbed at a point along the dies off the center of the ram, and distribute such thrust across the width of the columns. In a preferred embodiment, the guide comprises a plate adapted to be disposed between the columns and ram, the inner surface of the plate and one side of the ram having interfitting portions such as tongues and grooves. The columns have opposed faces. These faces and the outer surfaces of the guides are shaped, as by forming tongues and grooves therein, to interfit with each other at a plurality of points across their width. The stress created in the columns by the thrust on the guides resulting from the conditions above described, is thus distributed over a substantial area of the column faces instead of being concentrated at one point. The unit stress is thereby reduced and the danger of column breakage minimized.

The plates forming the guides are preferably tapered longitudinally in thickness and provided with means for adjusting them vertically, to take up any wear on the contacting surfaces of the ram and guides.

The novel features and advantages of the invention will be more fully explained and pointed out in the course of the following detailed description of a preferred embodiment which refers to the accompanying drawings.

In the drawings—

Figure 1 is a partial side elevation of a power hammer embodying the invention;

Figure 2 is a sectional view taken along the plane of line II—II of Figure 1;

Figure 3 is a side elevation of the ram apart from the frame;

Figure 4 is a partial sectional view similar to Figure 2 showing a modification;

Figure 5 is a similar view showing a further modification;

Figure 6 is a view similar to Figure 1 showing a modification; and

Figure 7 is a sectional view taken along the plane of line VII—VII of Figure 6.

Referring now in detail to the drawings, a power hammer according to the invention comprises a pair of spaced columns 10, 11 mounted on a suitable supporting base 120. The columns have opposed faces 13. A ram 14 is reciprocable on the columns 10 and 11 between the faces 13 thereof, being actuated by a steam cylinder (not shown) through a piston rod 15 secured to the ram in the known manner. While the described embodiment of the invention is a steam hammer, the principle thereof is also applicable to board, rod or rope actuated drop hammers.

Ram guides 16 are secured to the faces 13 of the columns 10 and 11. The guides 16 have the form of plates tapering longitudinally in thickness. The guides are secured to the columns by bolts 17 traversing slots 18 formed in the edges thereof and flanges 19 formed on the columns. Springs 20 under the nuts of bolts 17 permit vertical adjustment of the guides. The guides are held in vertically adjusted position by eye-bolts 21 pivoted thereto and extending through lugs 22 formed on the housings. The nuts 23 on the
bolts 21 may be turned to raise or lower the guides.

The faces 13 of the columns are not precisely plumb but are inclined to conform to the taper of the guides so that the inner faces 24 of the guides will be exactly vertical, for accurately engaging the vertical side faces of the ram. The contacting surfaces of the guides and ram have interfitting engagement as by V-shaped tongues and grooves or ribs 25 formed therein.

The outer faces 26 of the guides which are in contact with the columns and the faces 13 of the columns are shaped to provide interfitting engagement at a plurality of points across the width thereof. Conveniently, the faces 13 and 26 may be provided with tongues and grooves or ribs 27 similar to those shown at 25.

The springs 30 continuously urge the guides against the columns. This together with the V-shape of the tongues and grooves always insures a close fit between the guides and columns, despite any peening action produced by the heavy forces applied thereto. There is thus no possibility of the guides being in effective stress transmitting relation to the column face over only a portion of the width thereof, as is sometimes the case with conventional hammers, due to a loose fit of one of a pair of guides in its pocket.

It will be observed that the guides 35 are substantially as wide as the faces 13 of the columns and that the guides have interfitting engagement with the column faces at a plurality of points spaced over practically the entire width of the columns.

To explain the effect of the construction described above in distributing lateral thrust across the width of the column faces, it may be assumed that for a particular set of conditions, a blow of the ram on a set of forging dies is applied principally to a point on the dies under the point marked P on the plan of the ram shown in Figure 2. It will be apparent that if the force of the hammer blow is exerted principally upon a point such as P spaced from the center of the piston rod 15, there will be a tendency to bend the piston rod and spring the horizontal direction indicated by the arrow 28 in Figure 2. The thrust resulting from this tendency is exerted upon the guides 16. The reaction necessary to prevent shifting of the guides is furnished by the interfitting engagement thereof with the column faces. By reason of the fact that the guides have interfitting engagement with the columns at a plurality of points across the width thereof, the lateral thrust on the guides is distributed across a considerable portion of the width of the column faces but is not concentrated at any one point. By thus distributing the stress, the unit stress is reduced so there is little or no danger of breakage of the columns, which has been experienced with previous constructions.

The guides 16 are kept in proper adjustment by turning the nuts 22 to provide the necessary running clearance between the ram and the guides. Any excessive clearing resulting from wear may easily be taken up by a downward adjustment of the guides.

An important advantage of the invention is that it may be applied to conventional hammer columns, the guide pockets of which have been cracked in operation. Such a column, after rehabilitation, is shown at 28 in Figure 4. The column is first planed off to provide a flat face. This face may then be machined as shown at 30 for interfitting engagement with a guide 31 generally similar to the guides 16 and having its outer face shaped to interfit with the new face on the column, as by tongues and grooves 32. The guide 31 is secured to the columns 29 by central bolts 33. The inner face of the guide 31 is provided with tongues and grooves 34 cooperating with similar tongues and grooves 35 usually provided in the sides of the ram indicated at 36.

It will be apparent that the guide 31 is effective in the same manner as the guides 16 to distribute lateral thrust applied thereto over a plurality of points spaced across the width of the column 29.

Figure 5 illustrates a further modification which is preferred when new columns are provided for an existing hammer. In such case, columns 37 are provided similar to the columns 10 and 11 in that they are designed for attachment thereto of a guide 38 by bolts 39. Except for the provisions for the bolts 39, the guide 38 is similar to the guide 31 and is adapted to cooperation with a conventional ram 36, the guide and ram having interengaging tongues and grooves 34 and 35.

The columns of power hammers as previously constructed are usually arranged for center bolting of the ram guides and that is the reason for retaining this arrangement in Figure 4, although the style of Figure 5 is preferable when new columns are furnished because of the greater accessibility of the bolts.

Figs. 6 and 7 illustrate a modified form of hammer which is generally similar to that already described. The modified hammer comprises columns 10' having guides 16' for the ram 14. The guides 16' do not bear directly against the face of the column as in the embodiments previously described. Instead, a backing plate 40 intervenes. The contacting surfaces of the ram and guides and of the backing plate 40 and the face of the column 10' interfit at a plurality of points across their width. In addition, the contacting surfaces of the guide and backing plate interfit similarly. These faces, however, are not plumb but inclined slightly whereby adjustment may be made in the direction 16' toward or from the ram 14. The guide itself is held against vertical movement between the lug 22' and a seat 41 adjacent the lower end of the column. The backing plate 40 is suspended by the eye-bolt 21' and adjusted vertically by the nut 23', in the same manner as the guide 16. The guide 16' is held against the backing plate and the latter against the column face by the bolts 17 and springs 20.

The structure shown in Figs. 6 and 7 is effective in the same manner as the forms of the invention shown in Figs. 1 through 5 to transmit horizontal thrust from the ram to the column and distribute it over a plurality of points on the face of the latter.

It will be apparent from the foregoing description that the invention is characterized by numerous advantages over the ram guides previously used. The principal advantage, of course, is that the danger of breakage of the column resulting from concentration of lateral stress is greatly reduced, the stress applied to each column by a single guide being distributed over a large number of points spaced across the width thereof. A further advantage is the possibility of recovering columns which have suffered breakage of the sides of conventional guide pockets. The tapered shape of the guides and provision for vertical adjustment thereof, as previously stated,
permits take-up for any wear on the contacting surfaces of the guides and ram.

Although I have illustrated but a preferred embodiment and certain modifications of my invention, it will be understood that changes in the construction shown may be made without departing from the spirit of the invention or the scope of the appended claims. Instead of the V-shaped tongues and grooves, for example, flutes of other shapes may be employed although the V-shape is advantageous in that it is self-compensating for wear. In the claims, furthermore, the term "guide" as applied to the modification of Figs. 6 and 7 is intended to include the guide proper and the backing plate.

I claim:

1. A guide for a ram reciprocating between spaced columns, said guide comprising a plate having flatwise abutting engagement with a face of one of said columns, the ram having sliding engagement with the exposed surface of the plate, the other surface of the plate having a plurality of spaced longitudinal ribs thereon, and the face of the column engaged thereby having a plurality of spaced grooves to receive said ribs.

2. A guide for a ram reciprocating between spaced columns as defined by claim 1 characterized by the grooves in the face of the column extending over the greater portion of the width thereof.

3. A guide for a ram reciprocating between spaced columns, said guide comprising a plate having flatwise abutting engagement with a face of one of said columns, the ram having sliding engagement with the exposed surface of the plate, the face of the column having a plurality of longitudinal recesses adjacent each edge of said face, and the other surface of the plate being shaped to interfit with said recesses.

4. A guide for a ram reciprocating between spaced columns, said guide comprising a plate having flatwise abutting engagement with a face of one of said columns, the ram having sliding engagement with the exposed surface of the plate, longitudinal grooves spaced across substantially the entire face of the column, and the other surface of the plate being shaped to interfit with said grooves.

ROBERT J. HARRY.