pins, so that the movement of levers causes them to grip the board for the lift, or release it for the fall, these levers being under the control of the attendant. They can also be set to operate automically for any height of lift.

These types are all subject to much concussion and vibration, because the machines are self-contained; anvfl, standards and heads being rigidly bolted together, the concussion of every blow is trans- mitted through the entire mechanism. The Brett hammers (fig..60) are designed to lessen this, in some cases by making the anvil distinct from the superstructure, and in all by connecting the lifting ropes to the ends of long levers which act something like elastic springs, absorbing vibration. The driving mechanism is also original, comprising a cylinder with a wing piston, which is’rotated by steam pressure through an arc of a circle only, sufficiently to operate the lifting levers. Another advantage is that the lifter cylinder need not be immediately over the hammer, but may be situated elsewhere. The hammer can be operated by hand directly for each stroke, or be set to work automatically.

*Spring Hammers* are a rather smaller group than the others. In these a belt-driven pulley actuates the tup through the medium of elastic leaf springs. The length of stroke is adjustable across the face of a slotted disk on the driving shaft.

*Forging Machines.—*The Ryder forging machine is fitted with four or five pairs of swage tools, the lower halves being fixed and the upper ones driven by a rotating eccentric shaft. The operations imitate those on the anvil by hand forging, but from 800 to 1200 blows are delivered in a minute. The swages are arranged in succes- sion, so that an operation is begun at one end and finished at the other, the attendant moving the bar rapidly through the successive swages or dies.

*Forging Presses.*—These are rivals to the hammers, especially for heavy forgings, from which hammers are being rapidly dis- placed (fig. 61). It is now well understood that a hammer will not

effect the consolidation of a massive forging right to the centre as a press will. The force of the hammer blow is not transmitted to the centre as is that of a press, nor is the hammer so useful in work of large dimensions but of no great weight. In railway and wagon shops the presses are used far more frequently than the hammers.. A great advan­tage of the press is that two and three rams can be brought into operation so that a forging may be pressed from above, from below and to one side, which is of great value in complicated forms and in welding, but is not practicable in the hammers. Hence the forging presses have be­come developed for work of average dimensions as well as for the most massive. Many are of horizontal type, termed bull-dozers.

*Power presses* for working sheet- metal articles include those for cutting out the blanks, termed cutting- out or blanking presses, and those for cupping or drawing the flat blank into shape if desired (fig. 62). The lower dies are held upon a bed, and the upper in a sliding ram, moved up and down by a cam or crank­shaft. A clutch mechanism is fitted, by means of which this shaft is connected with or disconnected from the heavy driving-wheel at will to give a single stroke or a series of strokes to the ram. In the normal state the ram remains stationary at the top position. The lightest presses are driven direct by belt on the crank-shaft pulley, but in the heavier classes spur-gearing must be interposed between the pulley shaft and the final shaft. The operation of drawing requires an encircling die which presses on the blank as it lies on its die, the cupping of the blank being effected by the downward motion of the plunger.

This is why the machine shown in fig. 62 has an outer slide *D,* which is made to “ dwell ” with an even pressure, while the middle ram is moving down and drawing out the article. Blanking and cupping may be done as one continuous operation if the work is shallow.

*Inclinable presses* are employed for certain classes of work, the object being to let the stamped articles slide down the slope of the bed as rapidly as they are produced, instead of having to be removed by the operator. Much work can be placed on the dies by hand, but for producing large quantities of small articles automatic feeds