Nov. 23, 1965 H. BERNS ETAL 3,218,902

ADJUSTABLE METAL SHEARING MACHINES

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Fig. 2

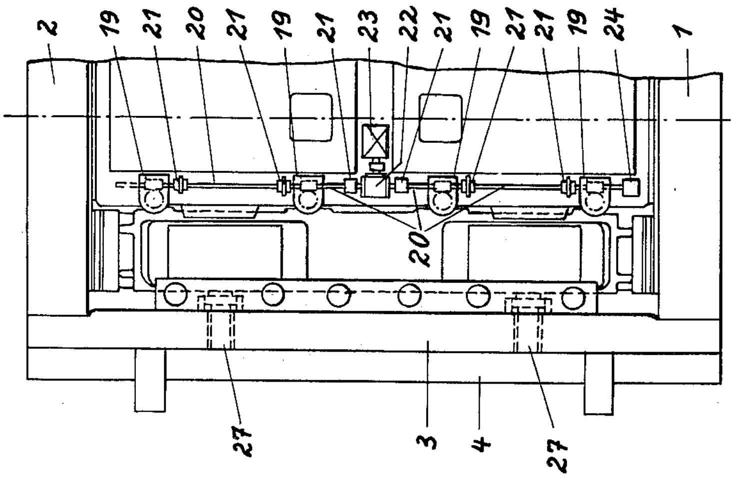
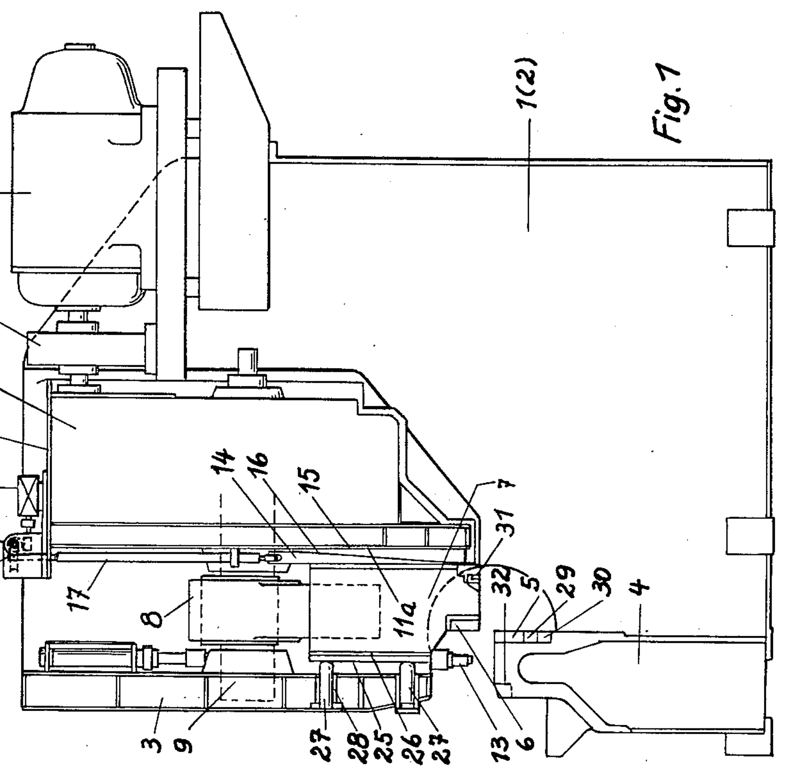


Fig. 1



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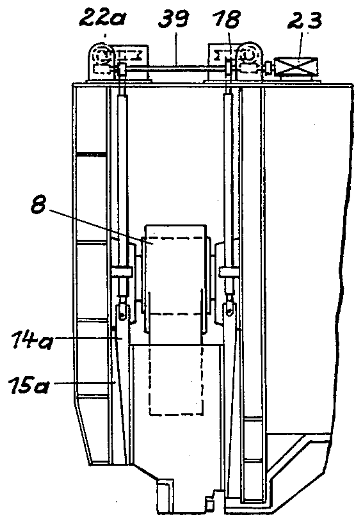

Fig. 3

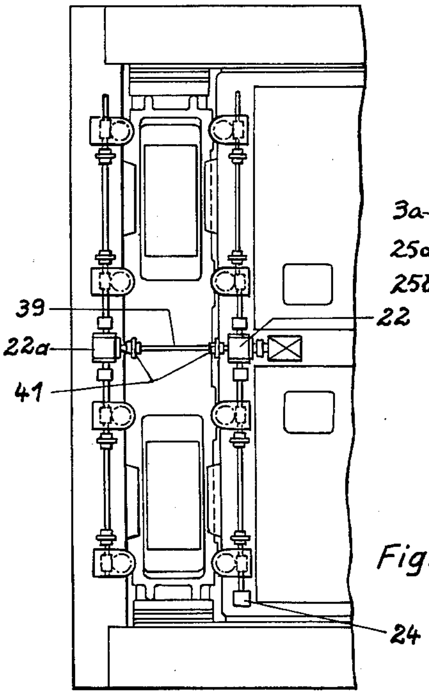

Fig. 4

Fig. 5

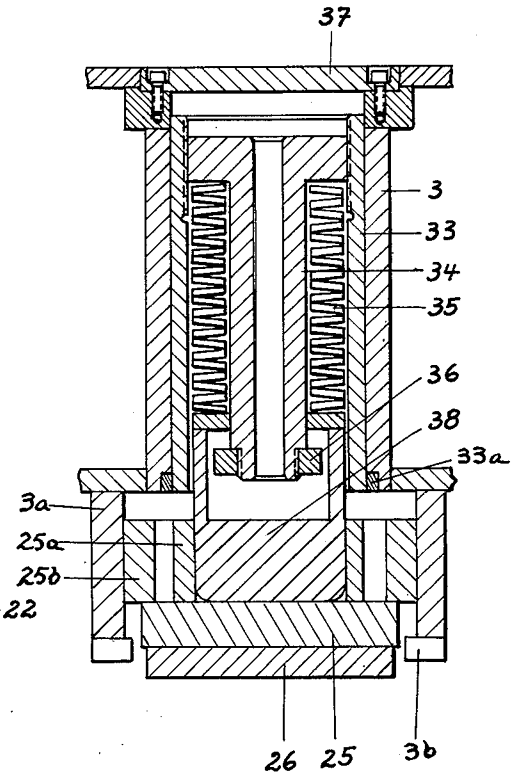

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Fig. 6

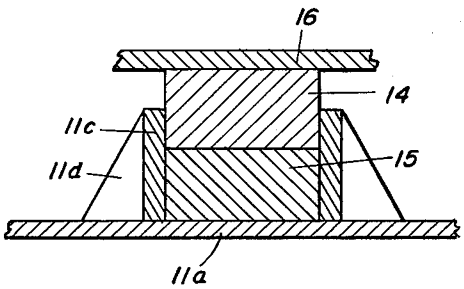
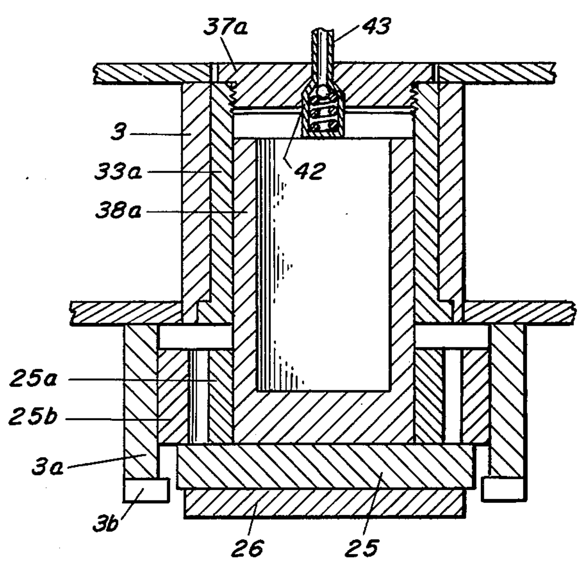


Fig. 7



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ADJUSTABLE METAL SHEARING MACHINES

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Filed Aug. 2, 1963, Ser. No. 299,644
5 Claims. (Cl. 83—582)

This invention relates to mechanism for adjusting and resetting the blades of metal shearing machines, particularly of heavy mechanically driven sheet metal shearing machines.

A known method of adjusting and resetting the blades in metal shearing machines consists in correctly repositioning the blades when their sections have been reduced by regrinding by shifting them with the aid of movable cotters cooperating with gibs. Within limits the reduction in thickness of the movable and fixed blades due to grinding as well as the magnitude of the clearance between the two blades can thus be corrected or adjusted by two cotters located to the rear of the fixed blade. However, if the material removed from the blade by regrinding exceeds a given amount, then the adjusting cotter can be withdrawn into starting position and a gib of appropriate thickness interposed between cotter and blade. Further readjustment after grinding can then again be accomplished by progressively resetting the cotter. By making available a set of gibs of thicknesses suitably graded to conform with the adjustability range provided by the movable cotters the entire possible reduction in section of the blades by regrinding can be allowed for. However, if it is desired to adjust only the clearance between the blades the described arrangement has the drawback that all the bolts which secure the fixed blade as well as the gib and cotter to the supporting table must be undone and then retightened when the necessary adjustment has been made. This involves a most undesirable loss of time, especially since such sheet metal shears are usually continuously in demand.

In order to achieve a cut edge of satisfactory quality the operation of the slide of the shearing blade should be as even as possible within the smallest possible tolerance. This is conventionally achieved by the provision of guide rails which are infinitely variably adjustable by cotters. Apart from compensating the wear of the rails these cotters also permit the shearing blade to be adjusted into complete parallelism with the fixed blade. However, in order to provide a smooth sliding fit the fixed guide rails on opposite sides must be remachined in the workshop and this is also a time-consuming operation.

In the selection of the clearance between the blades it has hitherto been the practice to accept a useful mean value. However, tests have confirmed that much greater importance attaches to the selection of the correct clearance than had been supposed. If the clearance is suitably adjusted, wear of the blades and the magnitude of the stress are greatly reduced. The life not only of the blades can thus be considerably prolonged, but also that of all the other mechanically movable parts. Since the quality of the cut likewise depends upon the selection of the correct cutting clearance and more and more importance is attached to the production of a high quality cut, the provision of suitable means for adjusting the clearance quickly and precisely has become a problem of increasing urgency. The clearance between the blades is desired to be adjusted to the gauge of the sheet and the nature of the material that is to be cut, for instance, according to whether the material is a carbon steel of varying mechanical strength, an alloyed steel, a light or a nonferrous metal. This means that an adjustability range between 0.3 and 3.5 mm. and sometimes even more is desirable.

In a known type of shearing machine the shearing blade slide is guided by adjustable bronze rails mounted at each end of the shearing frame. In this machine the blade is fitted to a shearing blade slide in the form of a heavy, flexurally rigid beam of arched cross section and uniform strength. The guide rails are adjusted by two pairs of gibs and moving cotters. The cotters are connected to two levers mounted on a common shaft. The shaft carries a segmental rack which is driven by a worm. The arrangement thus permits one cotter to be withdrawn whilst the other is advanced and this action shifts the shearing blade slide in relation to the table carrying the fixed blade and varies the horizontal clearance between the two blades (Iron and Steel Engineer, November 1961, pages 158/61). Although this device solves the problems of varying the clearance, of adjusting and resetting the blades after grinding and, when necessary, of adjusting them for parallelism, it is nevertheless still necessary to adjust each of the gib and cotter systems on the outside of the shear to the same clearance for achieving uniform clearance across the full width of the blades. For access to the couplings in the two systems long shafts or rods must be provided to extend across the full width of the shear or, alternatively, costly electrical devices are needed to ensure that the two systems operate in complete synchronism. Moreover, since these devices are located on pedestals on the outsides of the frame of the shear, the overall width of the machine is not only increased, but the above mentioned connecting members must be correspondingly longer, involving greater expense besides adversely affecting the precision of the coupling transmission by its greater overall torsional and elongational deflectability. Finally, when the guide rails are worn, readjustment of the clearance in the sliding fit is a very time-consuming operation which must be done by hand because several adjustments are needed to reset the two systems.

The object envisaged by the present invention is to equip metal shearing machines with a simplified and hence cheaper mechanism which will solve all the above mentioned problems, and which in a particular embodiment will even operate automatically. The proposed mechanism is therefore intended to permit the following operations to be performed:

The clearance between the blades to be adjusted,

The loss of material on the flanks of both the shearing and fixed blade due to regrinding to be compensated,

Wear of the guide rails to be compensated,

The blades to be adjusted for parallelism,

The sliding clearance of the shearing blade slide in its guide means in a particular embodiment to be eliminated.

According to the invention these requirements are satisfied by the provision of mechanism which by using the known type of gib and cotter motions permits the shearing blade to be horizontally shifted in relation to the fixed blade and the relative clearance between the two blades to be adjusted by transversely shifting the shearing blade by action from both longitudinal sides. This is effected by shifting systems. At least on one longitudinal side several individual shifting systems are provided, all connected to a longitudinal common shaft through adjustable clutches or coupling means which are as such rigid but disengageable, said common shaft being driven by a motor.

The shearing blade slide is therefore guided, not as heretofore between a fixed guide rail as a counter-supporting surface on one side to a gib and cotter motion on the other side of the slide, but between shifting systems on both sides.

These shifting systems may both be constituted by gib and cotter motions, in which case the two motions must be adjusted to provide a given sliding clearance, or alternatively the shifting system on one side may be a gib and cotter motion and that on the other side a yielding thrust applying system. This latter arrangement permits a horizontally shiftable shearing blade slide to be positively slidably guided without lateral clearance. The yielding thrust applying systems may take the form of springs, such as coil springs, dished springs or pneumatic or hydraulic systems.

As such, it is already known to provide a plurality of independent gib and cotter motions at intervals along one side of the shearing blade slide for adjusting the sliding clearance in accordance with the wear of the guide rails. Each individual system is associated with support means and threaded connections of its own which are inconvenient and time consuming to undo, and which call for the utmost care and attention during readjustment. However, if the several gib and cotter motions are connected to a common drive means through adjustable coupling means, then the work of readjustment can be quickly and correctly performed because only *one* coupling need be disengaged and readjusted.

In order to adjust the shearing and fixed blades to parallelism it is likewise merely necessary to disengage the couplings of the several systems and to reset one system after another, reengaging the couplings when the adjustments have been made. The cutting clearance between the blades can then be set to the required value and the blades parallelised without affecting the adjusted sliding clearance, if such clearance is needed at all.

Another advantage offered by mechanism according to the invention is that indicating means such as a pulse generator may be readily associated therewith. This permits the magnitude of the adjusted clearance between the blades, for instance in circular shears, to be read on a control panel and to be adjusted to a fresh setting, for instance by push-button control, and safety means may be provided for stopping the motor when a minimum clearance is reached, preventing further reduction and possible fouling which would damage the blades.

Another advantage of the device is that assembly of the machine in the workshop is greatly simplified because fixed guide rails which require final finishing before being fitted are absent.

If the horizontal shift is controlled from one side of the blades by spring means it is preferred to use dished springs which may then be mounted in suitable bores in the face plate of the shearing machine in the form of preassembled units. They can then be most conveniently replaced whenever required.

Nothing is changed in the manner the fixed blade is mounted. Lateral cotters are unnecessary, cotters being provided only for adjusting the elevational position of the fixed blade. Lateral adjustment is effected exclusively by the mechanism associated according to the invention with the movable shearing blade.

Two embodiments of the invention are shown in the accompanying drawings which also illustrate other details of the invention. In these drawings:

FIGURE 1 is a shearing machine equipped in the manner proposed by the present invention and comprising thrust applying spring systems on one side of the shearing blade slide, shown in section,

FIGURE 2 is a plan view of the same shearing machine,

FIGURE 3 is a fragmentary section of a shearing machine equipped with gib and cotter motions on both sides of the shearing blade slide,

FIGURE 4 is a plan view thereof,

FIGURE 5 is a preassembled spring pack shown on a larger scale and its location in the face-plate of the shearing machine, and

FIGURES 6 and 7 show details in section.

The frame **1, 2** of the shearing machine carries a motor **10** for driving the slide **7** of the shearing blade **6**, the

blade fixing bolts being indicated at **31**. The slide is driven by a thrust member **8**, an eccentric shaft **9** and a transmission comprising a clutch and brake **40** as well as gearing **11** not illustrated in detail. The faceplate is shown at **3**, the holding-down jacks at **13** and the table for the fixed blade at **4**. The fixed blade **5** is elevationally adjustable by cotters **29** and **30** secured by bolts **32**. The slide **7** of the movable blade is horizontally shiftable in relation to the fixed blade **5** by the gib and cotter system **14** and **15**, **14** being the movable cotter and **15** the cooperating gib bearing against wall **11*a*** of the casing containing the transmission gear **11**. Resilient means, such as hydraulic, pneumatic or combined hydraulic and pneumatic thrust-applying means, or springs **27** in the form of a preassembled pack, located in holes **28** in faceplate **3** hold the other side of the slide. Wearing plates **16** and **26** are interposed, plate **26** being further associated with a counter-rail **25**.

The gib and cotter system **14, 15** is guided between the gear-case wall **11*a*** and the wearing plate **16**, as shown in FIGURE 1, and between guiding ledges **11*c***, supported by webs **11*d***, mounted on the wall **11*a***, as shown in section in FIGURE 6. Similarly constructed guides may be provided on the face-plate **3** or on the wearing plate **26** for the members **14*a*** of FIGURE 3.

The gib and cotter system **14, 15** is controlled by a motor **23** which is arranged to stop instantaneously and contains a built-in brake to prevent run-out when stopping. This motor drives a transmission **22**, which may be a worm drive, through a clutch. Through shafts **20** this transmission drives adjusting gear units **19**, each preceded by a clutch or coupling **21**. The adjusting gear units **19** may be constituted by worm or bevel gear and are arranged to move the cotters **14** by lead screws **18**. The boxes containing the adjusting gear units **19** are secured to the cover **11*b*** of gear casing **11**.

Shafts **20** may be provided with a pulse generator **24** which transmits its signals to measuring instruments on a control panel.

The preassembled spring packs each comprise a spring carrier **34** which can be screwed into a bush **33**, which may be mounted in the face-plate **3** either fixedly, or, preferably with the interposition of a collar **33*a***, which bears against the face-plate **3**, and can thereby take up the reaction of the spring. The springs **35** are mounted on the carrier and can be precompressed by a nut **36**. The spring housing is closed by a cover plate **37**. The spring assembly also comprises a hollow thrust member or ring **38**. The thrust member **38** is shown in FIGURE 5 as having the form of a ram provided with an axial recess, and engaging in a tubular element **25*a***, fixedly connected with the counter-rail **25**. The counter-rail **25** is guided laterally by members **25*b*** mounted on it between members **3*a*** secured to the face-plate **3**. The wearing or closure plates **16** and **26** are however fixedly mounted on the upper knife slide **7**. By **3*b*** are denoted end stops for the members **25*b***, and therefore for the counter-rail **25**.

FIGURE 7 illustrates in axial section a fluid-operated thrust-applying member. Here the bush **33** of FIGURE 5 is replaced by a pressure-fluid cylinder **33*a***, in which is slidable a hollow piston or ram **38*a***, which, like the collar or ring **38** in FIGURE 5, exerts a direct thrust upon the counter-rail **25**. The cylinder **33*a*** is closed by a screw cover **37*a***, in the middle of which there is a spring-loaded non-loaded non-return valve **42**, and a pressure-fluid admission pipe **43**. Between the cover **37*a*** and the piston or ram **38*a*** there may also be provided an auxiliary spring, not shown, which permanently prestresses the piston, urging it towards the counter-rail **25**.

If gib and cotter motions **14, 15** and **14*a*, 15*a*** are provided on each side of the shearing blade slide, then the cotters are mirror symmetrically placed and they are acting in opposite directions. In other words, when the movable cotter on the right hand side is raised, then the corresponding movable cotter on the left hand side must be lowered. For performing these relative movements the cross shafts **20** on each side are interconnected by a connecting shaft **39** and a transmission **22***a*, similar to the transmission **22**, with the interposition of disengageable coupling members **41**.

It will be understood that when opposed-acting gib and cotter assemblies are used, the arrangement must be such as to provide a suitable sliding clearance for the shearing blade slide, whereas this need not be allowed for when spring locating assemblies are used.

We claim:

1. Mechanism for adjusting and resetting the blades of metal-shearing machines, particularly in heavy mechanically driven sheet-metal shearing machines, comprising: upper and lower shearing blades, a shearing-blade slide carrying the upper shearing blade, gib-and-cotter means acting transversely on one side of the shearing-blade slide, displacement means acting on the other side of the shearing-blade slide, and releasable and adjustable stationary couplings and common connecting shafts, through which the gib-and-cotter means are actuated.

2. Mechanism for adjusting and resetting the blades of metal-shearing machines, particularly in heavy mechanically driven sheet-metal shearing machines, comprising: upper and lower shearing blades, a shearing-blade slide carrying the upper shearing blade, gib-and-cotter means acting transversely on one side of the shearing-blade side, resilient and adjustable pressure-applying displacement means acting on the other side of the shearing-blade slide, and releasable and adjustable solid couplings and common connecting shafts, through which the gib-and-cotter means are actuated.

3. Mechanism as claimed in claim **2**, the said displacement means acting on the shearing-blade slide also being gib-and-cotter means.

4. Mechanism as claimed in claim **2**, further comprising. a face-plate, and the said pressure-applying means being spring packs interposed between the face-plate and the shearing-blade slide.

5. Mechanism as claimed in claim **2**, further comprising a face-plate, and the said pressure-applying means being fluid-operated means interposed between the face-plate and the shearing-blade slide.

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