Sept. 5, 1961 T. A. G. SHIMELD 2,998,888

TURN-OVER GEAR USE WITH ROLLING MILLS AND THE LIKE

Filed Nov. 22, 1957 4 Sheets-Sheet 1

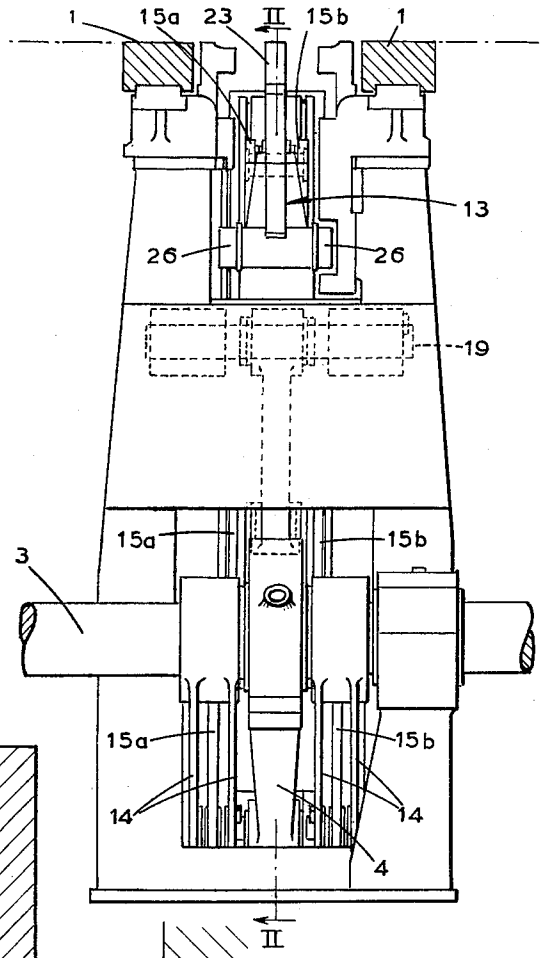


FIG. 1.

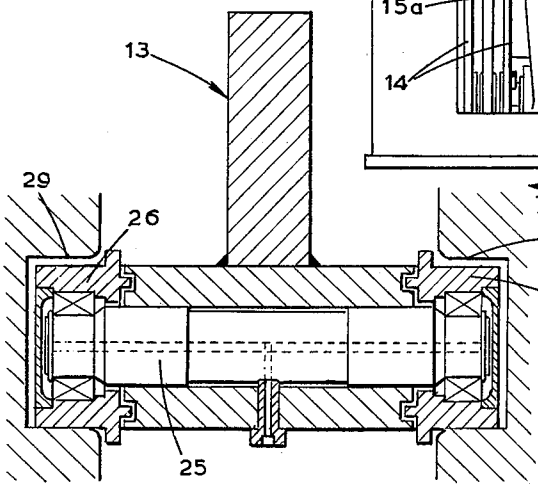


FIG. 5.

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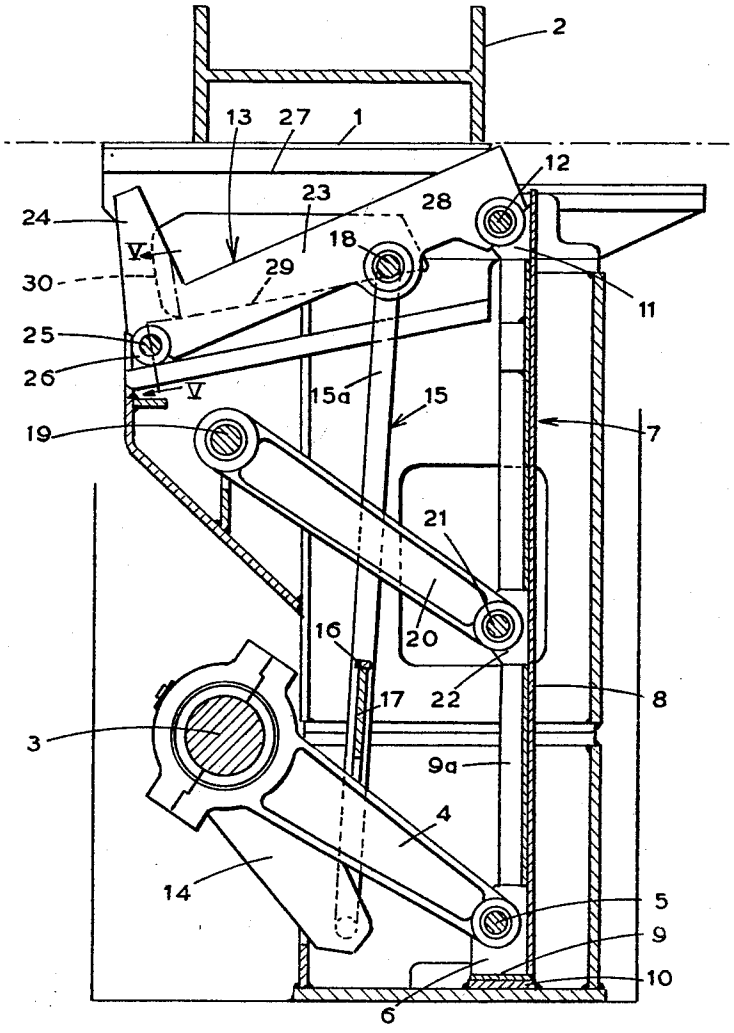
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TURN-OVER GEAR USE WITH ROLLING MILLS AND THE LIKE

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FIG. 2.



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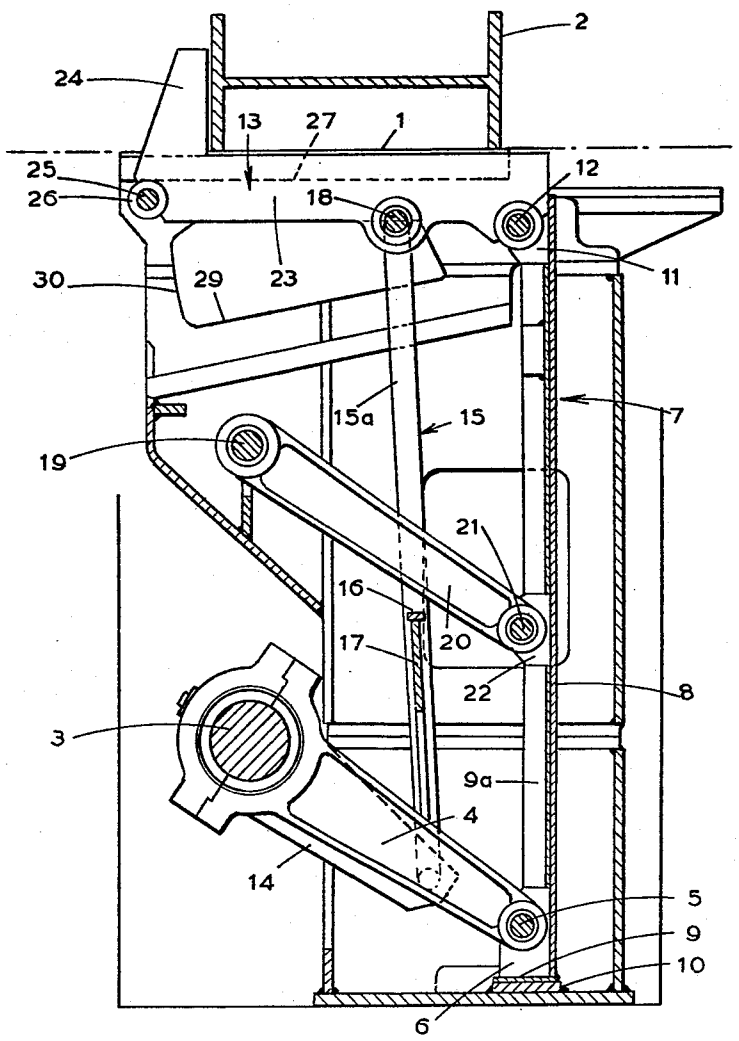
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TURN-OVER GEAR USE WITH ROLLING MILLS AND THE LIKE

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FIG. 3.



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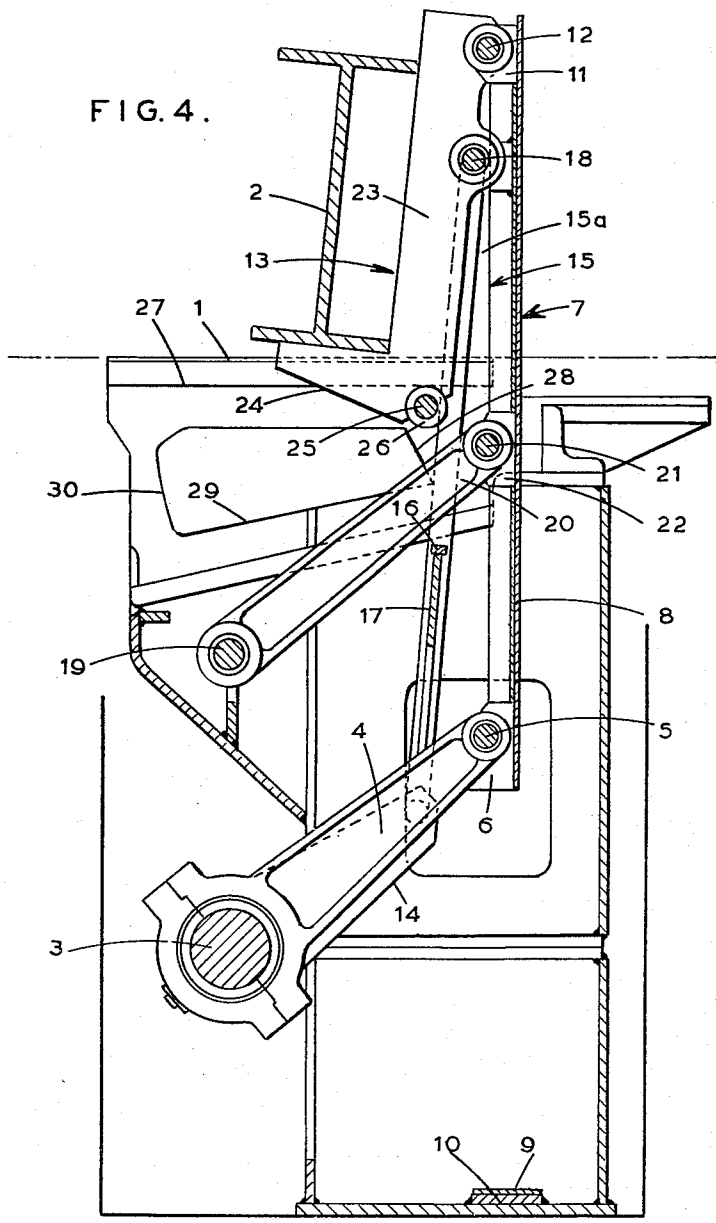
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TURN-OVER GEAR USE WITH ROLLING MILLS AND THE LIKE

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FIG. 4.



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TURN-OVER GEAR FOR USE WITH ROLLING MILLS AND THE LIKE

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Filed Nov. 22, 1957, Ser. No. 698,248
Claims priority, application Great Britain Nov. 23, 1956
3 Claims. (Cl. 214—1)

This invention relates to turn-up or turn-over gear for use in conjunction with a rolling mill or the like.

It is common practice in rolling mills to deliver a rolled billet, bar or structural section on to a series of driven conveyor rollers which take it to a sawing, shearing or like dividing appliance and thence to a further series of rollers from which the severed pieces are transferred, one by one, to a series of skid rails lying in a direction perpendicular to the run of the conveyor, the rails forming a bank upon which the pieces are allowed to cool. The pieces are usually transferred by a series of skid monkeys moving in tracks between the rails and each provided with a pivoted finger so that the skid monkey is capable of moving the pieces along the skid rolls in one direction, but the finger is depressed below the rails as the monkey returns under further sections on the rails.

When cooling structural shaped such as I-beams, particularly broad-flanged beams, which are rolled and divided with their flanges vertical, it is desirable to turn the beam through an angle of 90° in order to avoid damage to the edges of the flanges.

Various forms of turn-over gear for rolled sections are well known in the art, but they suffer from one or more of the following disadvantages.

(*a*) They are very cumbersome and/or costly.

(*b*) The turning means may comprise serrated fingers which damage the surface of the section,

(*c*) The gear cannot be retracted until the section has been withdrawn longitudinally,

(*d*) The gear is unreliable in operation,

(*e*) The gear has no provision to prevent the section turning through 180°, and

(*f*) No known gear is capable of operating at the speed provided for in this invention.

The object of the invention is to provide a simple and reliable turn-over gear which can turn sections of relatively large size, e.g. 36" x 16½".

According to the invention, turn-up or turn-over gear for use with a rolling mill or the like and arranged to be located between skid rails which receive the sections to be turned, comprises a turning member having at least two limbs set at an angle, means to raise and lower the member, and guide means for the member so arranged that as the member is raised, a section on the rails and in a position to be turned is caught at the junction of said limbs, lifted clear of the rails and turned through substantially 90° of arc and as the member is lowered the section is deposited on the skid rails in its turned position.

The means for raising or lowering the member may include a rotatable arm and a connecting rod pivotally connected between the member and the arm. The guide means may include a bar pivotally connected to a pair of pivoted parallel arms and also pivotally connected to one limb of the turning member, and also a track around which the junction of said limbs is constrained to move during raising or lowering of the member. The turn-over gear may have an inoperative position below the level of the skid rails and as the turning member is raised from and then lowered to its inoperative position the junction of said limbs is first raised, then moved substantially parallel with the skid rails, then lowered and then returned to its inoperative position.

Considered from another aspect the turning member may be considered to have two points which are constrained to follow predetermined paths during a turning operation, the sequence being such that, starting from an inoperative position, the first point is raised while the member pivots about the second point which is held stationary, then the second point is raised and simultaneously the first point is moved towards the position originally occupied by the second point, then both points are lowered and finally both points are returned to their inoperative positions.

The path followed by the second point is conveniently the arc of a circle and the chord of the arc is approximately vertical. The final part of the path followed by the first point lies under that part of the path which the first point follows in moving towards the original position occupied by the second point.

In order that the invention may be clearly understood and readily carried into effect, one construction in accordance therewith will now be described, by way of example, with reference to the accompanying drawings, in which:

FIGURE 1 is an end elevation of a turn-up gear;

FIGURE 2 is a section on the line II—II in FIGURE 1;

FIGURE 3 shows a section similar to FIGURE 2 with certain of the parts in different operative positions;

FIGURE 4 is a section similar to FIGURE 2, but showing certain of the parts in yet other operative positions; and

FIGURE 5 is a cross-section on one line V—V in FIGURE 2 through a detail of the gear of FIGURES 1 to 4, shown on an enlarged scale.

The turn-up gear is located in a pit between adjacent pairs of skid rails **1**, to which are delivered rolled I-sections **2** to be turned up from positions in which they rest on the edges of their flanges to positions in which their webs are vertical. Mounted towards the bottom of the pit and running transversely to the directions of the skid rails **1** is a main shaft **3** which can be turned to-and-fro about its fixed axis by a reversible motor (not shown). Rotatable on the shaft **3** is an arm **4**. The outer end of the arm **4** is pivoted by means of a gudgeon pin **5** between two plates **6** forming parts of a vertical bar **7** including a vertical plate **8** to which two vertical channel sections **9***a* carrying the plates **6** are fixed. The bottom of the bar **7** is shown in FIGURES 1 to 3 to be resting on a metal pad **10** at the bottom of the pit, with an intervening plate **9** inserted precisely to define the lower limit of the stroke of the bar **7**. The top of the bar **7** carries a pair of plates **11** supporting a gudgeon pin **12** to which one end of a turning member **13** is pivoted.

Keyed to the main shaft **3** on each side of the arm **4**, rotatable thereon, is a pair of bifurcated arms **14**. These arms **14** are of the same length and are pivotally connected to the lower end of an upwardly extending connecting rod **15** comprising two upwardly extending parts **15***a*, **15***b* joined by webs **16**, **17**. The two parts **15***a*, **15***b* are bent so that their lower ends, pivoted to the arms **14**, are wider apart than their upper ends which lie one on each side of the turning member **13** to which they are pivoted by a gudgeon pin **18** passing through the turning member **13** and through both parts **15***a*, **15***b* of the rod **15**. Situated some distance vertically above the main shaft and parallel thereto is a second shaft **19** which has a fixed axis and is provided with an arm **20**, parallel to the arm **4** and pivoted by means of a gudgeon pin **21** between plates **22** included in the vertical bar **7**. The arms **4** and **20** pass freely between the two parts

15*a*, 15*b* of the upwardly extending rod **15**. The arrangement is such that when, as shown in FIGURES 1 and 2, the vertical bar **7** is in its lowermost position, the arms **4**, **20** are inclined downwardly from the shafts **3**, **19**; thus, when the bar **7** is raised it remains vertical although its perpendicular distance from the axis of the shafts **3**, **19** varies as the bar is moved.

The turning member **13** is L-shaped, being formed with a longer limb **23**, to which the bar **7** and rod **15** are pivoted, and a shorter limb **24**. At the junction between these two limbs the turning member carries a transverse horizontal shaft **25** carrying rollers **26** at its opposite ends. When the gear is into its lowermost and inoperative position the free end of the longer limb **23** is substantially level with the top of the skid rails **1** and the longer is inclined downwardly (FIGURE 2) from its free end so that its shorter limb **24** is completely below the level of the skid rails **1**.

The operation of the gear is as follows; assuming that a section **2** has arrived in position above the gear, which is in its inoperative position of FIGURES 1 and 2, the electric motor is operated to turn the mainshaft **3** and raise the connecting rod **15**. As the connecting rod **15** is raised towards the position of FIGURE 3, the lifting member **13** pivots about its connection **12** with the vertical bar **7** until the shorter limb **24** of the L is above the level of the skid rails **1**. The rollers **26** then engage a pair of parallel horizontal guide rails **27** and thereby prevent the junction of the limbs of the L from rising any higher. In this first stage the lifting member **13** pivots about its connection **12** with the vertical bar **7** since the bar **7** is sufficiently heavy to keep the free end of the longer limb **23** of the L in its original position. Any tendency for the rollers **26** to move to the right is prevented by parallel guide surfaces **30**.

Upon further rotation of the main shaft **3**, since the rollers **26** on the lifting member **13** have coacted with the guide rails **27** and are prevented from rising further, the member **13** begins to pivot about the axis of the rollers **26**. As it pivots the free end of the longer limb **23** of the L is lifted and lifts the vertical bar **7**. As the vertical bar **7** is lifted the rollers **26** on the lifting member **13** move along the guide rails **27** towards the bar **7** and along a path parallel to the skid rails to the position of FIGURE 4. The vertical bar **7** is lifted until it can be lifted no further due to the guide rails **27** coacting with the rollers **26**. When this state is reached the shorter limb **24** of the L is above and at a slight angle to the skid rails **1** and the longer limb **23** of the L is at a slight angle to the vertical.

During these first two stages of movement, the section **2** has been caught at the junction of the limbs of the turning member, lifted clear of the skid rails **1** and turned through substantially 90° of arc.

The electric motor driving the main shaft **3** is now reversed and the lifting member **13** is lowered. During the first stage of lowering the angular position of the lifting member **13** remains substantially unchanged and the rollers **26** descend past parallel guide surfaces **28**. The shorter limb **24** of the L is lowered below the level of the skid rails **1** and the section is deposited on the skid rails **1** in its turned position. As the bar **15** is lowered still further the rollers **26** engage parallel guide rails **29** along which they run as the member **13** returns to its first inoperative position below the level of the skid rails **1**.

It will be seen that since the lifting member in its inoperative position is below the level of the skid rails **1** the normal movement of the sections by skid monkeys will not be hindered. Thus a plurality of turn-up gears according to the invention may be situated in line across a bank of skid rails and driven in simultaneously to turn over a long length of a section. Conventional skid monkeys may be situated between each pair of turn-up gears.

By repeating the turn-up operation without using the monkeys to feed the section beyond the turn-up gear, the section, assuming the shapes of the section and the turning member to be properly related, is, of course, turned over by 180° of arc. Monkeys may, however, be used to position the section prior to the second operation.

I claim:

1. Turn-up gear arranged to be located between skid rails which receive rolled sections to be turned comprising, in combination, a turning member having first and second limbs set at an angle to one another, means having a pivotal connection with said member for raising and lowering at least part of said member past the skid rails from an initial position in which said member lies wholly beneath said skid rails to a position in which the second of said limbs projects above the skid rails, a pivot at the free end of said first limb about which said member swings upwards to cause the second limb to project above the skid rails, means operable after the operations of said raising means for causing said pivot to rise in a substantially vertical direction, and guiding the junction between said limbs to move substantially horizontally towards the vertical plane containing said pivot while said pivot is moving upwards, the section being located in the angle between said limbs by said upward swinging of said member and turned through substantially 90° of arc by said raising of said pivot and substantially horizontal movement of said junction, said pivot raising means including a bar carrying said pivot, and a pair of parallel arms freely pivoted respectively about two fixed axes, said bar being pivoted to said arms.

2. Turn-up gear arranged to be located between skid rails which receive rolled sections to be turned comprising, in combination, a turning member having first and second limbs set at an angle to one another, means having a pivotal connection with said member for raising and lowering at least part of said member past the skit rails from an initial position in which said member lies wholly beneath said skid rails to a position in which the second of said limbs projects above the skid rails, a pivot at the free end of said first limb about which said member swings upwards to cause the second limb to project above the skid rails, means operable after the operations of said raising means for causing said pivot to rise in a substantially vertical direction, means guiding the junction between said limbs to move substantially horizontally towards the vertical plane containing said pivot while said pivot is moving upwards, the section being located in the angle between said limbs by said upward swinging of said member and turned through substantially 90° of arc by said raising of said pivot and substantially horizontal movement of said junction, and a roller mounted on said member, said means guiding the junction between said limbs to move substantially horizontally comprising a track beneath which said roller runs, and means to exert a load on said member on the side of said pivotal connection remote from said roller, said load exerting a turning moment about said pivotal connection maintaining said roller in contact with said track.

3. Turn-up gear arranged to be located between skid rails which receive rolled sections to be turned comprising, in combination, a turning member having first and second limbs set at an angle to one another, means having a pivotal connection with said member for raising and lowering at least part of said member past the skid rails from an initial position in which said member lies wholly beneath said skid rails to a position in which the second of said limbs projects above the skid rails, a pivot at the free end of said first limb about which said member swings upwards to cause the second limb to project above the skid rails, means operable after the operations of said raising means for causing said pivot to rise in a substantially vertical direction, means guiding the junction between said limbs to move substan-

tially horizontally towards the vertical plane containing said pivot in the angle between said limbs by said upward swinging of said member and turned through substantially 90° of arc by said raising of said pivot and substantially horizontal movement of said junction, and a roller mounted on said turning member, said means guiding the junction between said limbs to move substantially horizontally comprising a first track mounted substantially horizontally beneath which said roller is adapted to run, a second track beneath said first track beneath which said roller is adapted to run, and spaced guide surfaces respectively adapted to direct said roller downwards from said first track to said second track, and upwards from said second track to said first track, said raising and lowering means being operative to swing said turning member upwards about said pivot until said roller engages said first track, then to swing said turning member upwards about said roller axis while

said roller runs along said first track, then to lower said turning member until said roller engages said second track, and finally to permit said roller to run along said second track towards said initial position.

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