Aug. 14, 1945. J. H. HOPKINS ET AL 2,382,227

AUTOMATIC INGOT TONGS

Filed Oct. 23, 1943 2 Sheets-Sheet 1

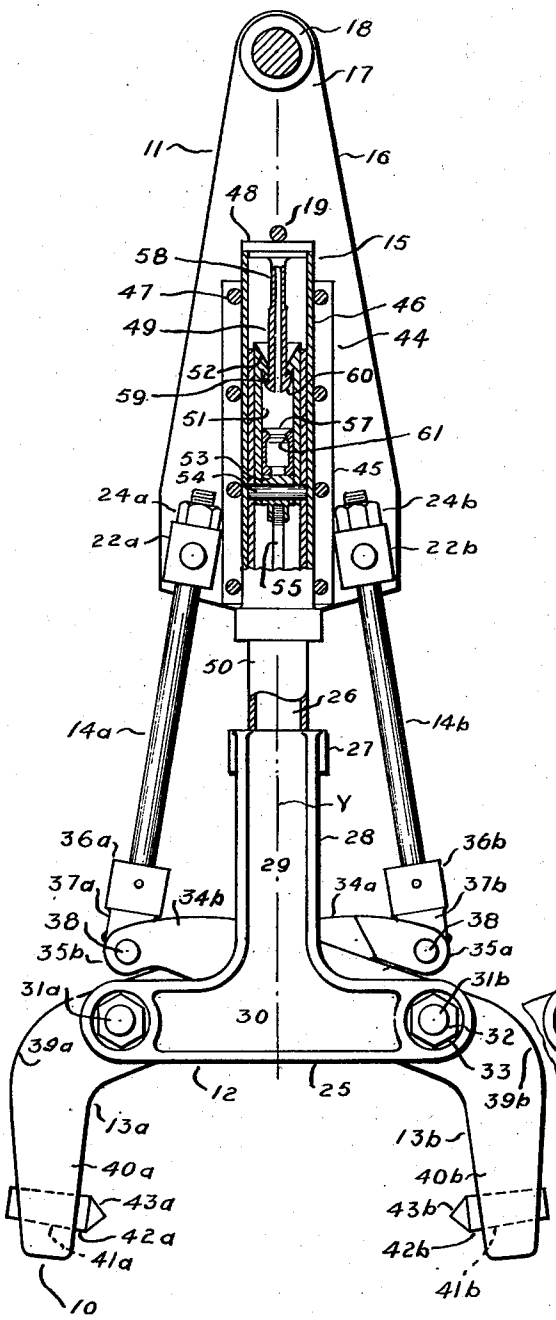


Fig. 1

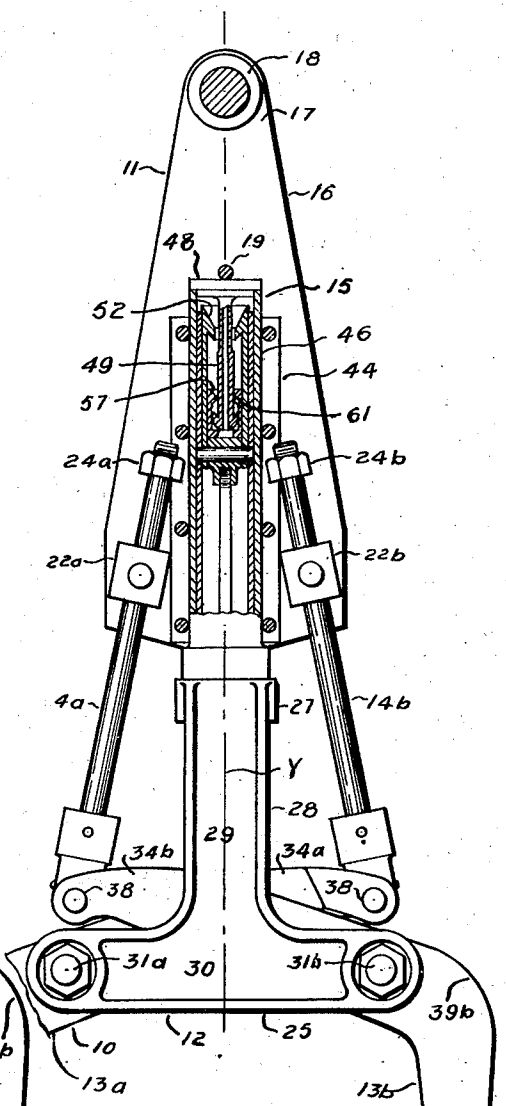


Fig. 2

Inventors

James Hutson Hopkins

Edgar Homer Kendall

By Frease and Bishop

Attorneys

Aug. 14, 1945. J. H. HOPKINS ET AL 2,382,227

AUTOMATIC INGOT TONGS

Filed Oct. 23, 1943 2 Sheets-Sheet 2

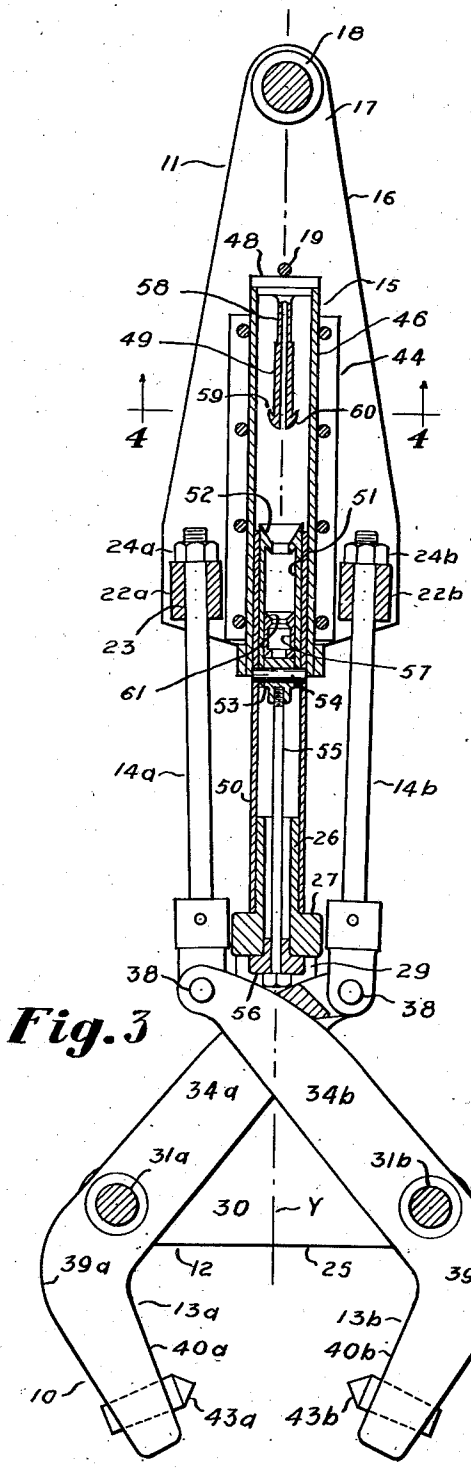


Fig. 3

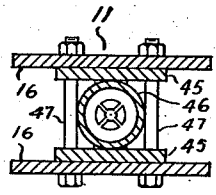


Fig. 4

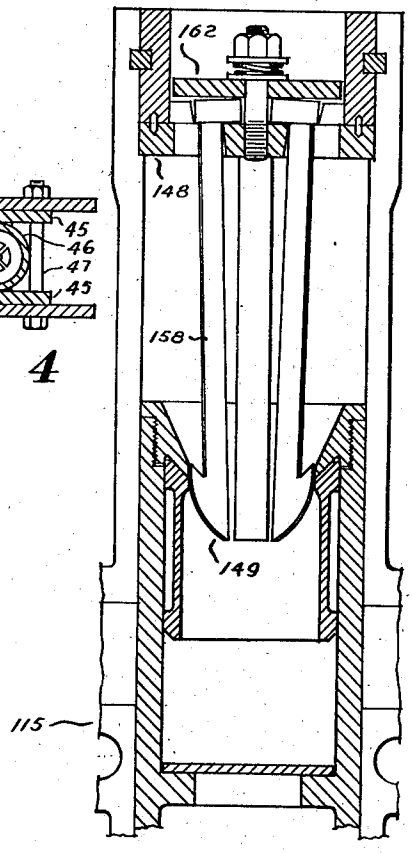


Fig. 5

Inventors

James Hutson Hopkins

Edgar Homer Kendall

By Frease & Bishop

Attorneys

Patented Aug. 14, 1945 2,382,227

UNITED STATES PATENT OFFICE

2,382,227

AUTOMATIC INGOT TONGS

James Hutson Hopkins and Edgar Homer Kendall, Alliance, Ohio

Application October 23, 1943, Serial No. 507,400

2 Claims. (Cl. 294—110)

The invention relates to automatic tongs, and more particularly to automatic tongs adapted for suspension from the end of a crane cable and for being raised and lowered thereby for automatically engaging an article, or releasing an engaged article. More particularly, the invention relates to automatic ingot tongs for handling hot steel ingots and the like.

In the processing of steel ingots and the like, vertical heating furnaces are frequently used, and a vertical heating furnace for relatively long articles, such as ingots, may include an inner elongated article receiving vertical tubular compartment, which may be as deep as 15 feet and have an upper opening with removable covers.

The elongated article, such as a steel ingot, is lowered into and raised out of the vertical compartment through the upper opening by automatic tongs suspended from the hook on the end of a crane cable, the tongs engaging and releasing the upper end of the ingot or the like, by raising and lowering operations of the cable.

After the ingot or the like has been heated to the required extent, the temperature in the vertical compartment may be as high as 2400° F.

It is, therefore, necessary that suitable tongs for handling an ingot or the like into and out of a vertical heating furnace must be not only automatic in operation, but must also be capable of automatic operation at a temperature of as high as 2400° F.

It is also desirable that such automatic ingot tongs adapted for high temperature use should have as long a life as possible, and should be of such construction as to permit rapid as well as economical manufacture and maintenance.

Automatic tongs for handling ingots and the like available prior to the present improvements have not met all of the foregoing enumerated requirements to the degree desired by users of automatic tongs.

The objects of the present invention include the provision of improved automatic tongs particularly adapted for handling ingots during heating operations in vertical heating furnaces, and which are operative in an improved manner by relative straight line movement of the principal parts of the automatic tongs controlling the relative positions and movements of the tong gripping bits.

Further objects of the present invention include the provision of such improved automatic tongs which are simplified in construction and in the arrangement and cooperation of the parts so that they may be manufactured and maintained with facility and economy.

Further objects of the present invention include the provision of improved automatic tongs in which the parts are arranged for positive, certain, and repeating cyclical operation.

The foregoing and other objects are obtained by the automatic tongs, apparatus, parts, improvements, combinations, and sub-combinations which comprise the present invention, and the nature of which is set forth in the following general statement, and preferred embodiments of which together with their mode of use are set forth in the following description, and which are particularly and distinctly pointed out and set forth in the appended claims forming a part hereof.

The nature of the present invention may be stated in general terms as including in automatic tongs, upper head means for suspension from the hook on the end of a crane cable, lower tong lever mounting means, tong levers pivotally mounted on the mounting means, tong lever actuating rods operatively connecting the tong levers with the upper head means, and automatic push and pull actuated cyclically engaging and releasing latch and catch means operative between the upper head means and the tong lever mounting means for controlling the action of the tong levers by successive lifting connections and non-lifting associations of the head means with the tong lever mounting means.

When the tong levers are in gripping position, as on opposite sides of an ingot, they are suspended by the rods from the upper head means.

When the gripped ingot is located at the desired position, the automatic tongs are lowered so that the lower tong lever mounting means seats upon the upper end of the ingot, and the upper head means are further lowered to engage the upper latch means on the upper head means with the lower catch means on the lower tong mounting means, in such a position that the tong levers are locked in the open position.

When it is desired to pick up another object, such as another ingot, the tongs with the levers in the locked open position are lowered so that the tong lever mounting means seats on the upper end of the ingot to be picked up, after which the upper head means are further lowered and raised and during which further lowering and raising operations the latch and catch means are released permitting the tong levers to grip the ingot to be picked up.

By way of example, embodiments of the im-

proved automatic tongs of the present invention are illustrated in the accompanying drawings forming a part hereof, in which

Figure 1 is a fragmentary elevation view with portions broken away and illustrated in longitudinal axial section of one embodiment of the improved automatic tongs, the tong gripping bits and other parts being shown in their relative positions when the tong gripping bits are maintained open;

Fig. 2 a similar view illustrating the relative positions of the parts of the improved automatic tongs at the end of the first push action necessary for releasing the tong gripping bits from the locked open position;

Fig. 3 a similar view illustrating the relative positions of the parts of the improved automatic tongs when the tong gripping bits are in gripping and lifting positions;

Fig. 4 a transverse sectional view as on line 4—4, Fig. 3; and

Fig. 5 a fragmentary longitudinal axial sectional view, illustrating a second embodiment of the improved automatic push and pull actuated cyclically releasing latch and catch means adapted for being included in improved automatic tongs which are otherwise similar to the automatic tongs of Figs. 1 to 4 inclusive.

Similar numerals refer to similar parts throughout the drawings.

The improved automatic tongs are indicated generally by 10, and include upper head means indicated generally by 11, lower tong lever mounting means indicated generally by 12, tong levers indicated generally by 13*a* and 13*b* pivotally mounted on the mounting means 12, and tong lever actuating rods indicated generally by 14*a* and 14*b* operatively connecting the tong levers 13*b* and 13*a* respectively with the upper head means 11.

The upper head means 11 and the lower tong lever mounting means 12 furthermore include in operative association with each other improved automatic push and pull actuated cyclically engaging and releasing latch and catch means indicated generally by 15 for controlling the action of the tong levers 13*a* and 13*b* by successive lifting connections and non-lifting associations of the head 11 with the tong lever mounting means 12.

The upper head means 11 includes as shown a pair of spaced preferably parallel upwardly elongated and tapering outer plates 16, the upper apex ends 17 of which are spaced and connected by lift pin means indicated generally by 18. Below the lift pin means 18 and parallel therewith, a stop bolt 19 extends between the plates 16 and through opposite apertures therein, and is secured therein by the usual bolt head and nut.

The longitudinal axis of the tongs 10 is indicated by the dot-dash line Y, and at equal distances from opposite sides of the longitudinal center plane of the tongs 10 extending through the axis Y and perpendicular to the plates 16, the plates 16 have formed therein opposite pairs of registering apertures which pivot the opposite journal ends of trunnions 22*a* and 22*b*, the axes of the trunnion journals being preferably as shown perpendicular to the plates 16. Each of the trunnions 22*a* and 22*b* has formed therein a slide bore 23 at right angles to the axis of its bearings, each slide bore 23 being preferably cylindric. The upper ends of the preferably cylindric rods 14*a* and 14*b* extend through the slide bores 23 of the trunnions 22*a* and 22*b* respectively. Upper end portions of each rod 14*a* and 14*b* are externally threaded, and nuts 24*a* and 24*b* are screwed respectively on the upper threaded ends of the rods 14*a* and 14*b* above their respective slide trunnions 22*a* and 22*b*.

The tong lever mounting means 12 includes preferably as shown a yoke indicated generally by 25 having an upper tubular shank 26 whose bore is co-axial with the axis Y and having an outwardly flanged lower end 27 from opposite sides of which, preferably parallel with the head plates 16, depend inverted spaced T yoke legs 28. Each inverted T yoke leg 28 includes an upper elongated stem 29 extending downwardly from one side of the shank flange 27 and terminating in a crossbar 30.

At equal distances from opposite sides of the longitudinal center plane extending through longitudinal axis Y and perpendicular to the plates 16, the crossbars 30 of the yoke legs 28 have formed therein opposite pairs of registering apertures in which are located opposite ends of fulcrum pins 31*a* and 31*b*. Each fulcrum pin 31*a* and 31*b* preferably includes at each end a threaded outer end 32 extending through one of the mounting apertures in one of the crossbars 30 and beyond the outer face thereof, where a securing nut 33 is screwed thereon.

The tong levers 13*a* and 13*b* are preferably angled as shown. The tong lever 13*a* includes a longer upper arm 34*a* located between the yoke legs 28 and having formed therein a bearing aperture through which the fulcrum pin 31*a* extends. From the pin 31*a*, the arm 34*a* extends towards the pin 31*b* where the arm 34*a* terminates above the pin 31*b* in a clevis 35*a* having registering apertures formed in its U side members.

The lower end of the rod 14*b* has secured thereon a sleeve cap 36*b* from the lower end of which extends a tongue 37*b* between the U side arms of the clevis 35*a*, the tongue 37*b* having formed therein an aperture registering with the clevis arm apertures, and the registering clevis arm apertures and the tongue aperture are connected by a pin 38.

The tong lever arm 34*a* extends a short distance beyond the outer side of the fulcrum pin 31*a* to a curved apex 39*a* from which depends a shorter tong lever arm 40*a* near the lower end of which is located a tapered aperture 41*a* in the central plane parallel with the plates 16 and passing through the longitudinal axis Y. The tapered aperture 41*a* has its larger end adjacent the axis Y and receives the tapered end of a tong bit 42*a* having a pointed inwardly directed conical gripping head 43*a*.

Similarly the tong lever 13*b* includes a longer upper arm 34*b* located between the yoke legs 28 and having formed therein a bearing aperture through which the fulcrum pin 31*b* extends. From the pin 31*b*, the arm 34*b* extends along one side of the arm 34*a* towards the pin 31*a*, where the arm 34*b* terminates above the pin 31*a* in a clevis 35*b* having registering apertures formed in its U side members.

The lower end of the rod 14*a* has secured thereon a sleeve cap 36*a* from the lower end of which extends a tongue 37*a* having formed therein an aperture registering with the clevis arm apertures, and the registering clevis arm apertures and the tongue apertures are connected by a pin 38.

The tong lever arm 34*b* extends a short distance from the outer side of the fulcrum pin 31*b* to a curved apex 39*b* from which depends a shorter

tong lever arm 40b near the lower end of which is located a tapered aperture 41b in the central plane parallel with the plates 16 and passing through the longitudinal axis Y. The tapered aperture 41b has its larger end adjacent the axis Y and receives the tapered end of a tong bit 42b having a pointed inwardly directed conical gripping head 43b opposed to the other tong bit gripping head 43a.

The automatic cyclically engaging and releasing latch and catch means 15 operative between the head 11 and the tong lever mounting means 12 includes in the head 11 slide bearing and latch mounting means indicated generally by 44 and comprising spaced elongated rectangular connecting plates 45 each having a longitudinal axis in the longitudinal center plane passing through the longitudinal axis Y and perpendicular to the plates 16, and each connecting plate 45 having an outer face in abutment with the inner face of one of the plates 16. The connecting plates 45 are thus located between the head lift plates 16.

Between the connecting plates 45 there is secured as by welding a longitudinally extending slide guide and latch mounting preferably cylindric tube 46 having its longitudinal axis coinciding with the longitudinal axis Y. At each opposite side of its longitudinal axis, each plate 45 has formed therein a row of longitudinally spaced apertures registering with a similar row of apertures in the abutting plate 16 and with the directly opposite rows of apertures in the other plate 45 and its abutting plate 16. Through each set of registering apertures in the plates 16 and 45, a removable connecting bolt 47 extends, each bolt 47 having on the outer opposite sides of plates 16 a usual bolt head and nut.

At the upper end of the tube 46 is secured a cap 48 from which depend within the bore of tube 46 a plurality of latch hooks 49 which will be described in greater detail hereinafter.

Upon the upwardly extending yoke shank 26 is telescoped a slide tube 50 which extends upwardly, and slidably fits in the bore of the guide and latch mounting tube 46. Within the upper end of the bore of the slide tube 50 is located a catch or detent preferably as shown in the form of a cylindric tube 51 fitting in the bore of the tube 50 and having at its upper end a downwardly sloping inwardly extending frusto-conical catch or detent flange 52. At the lower end of the bore of the tube 51 is fitted a cylindric connector plug 53, and the connector plug 53 and the tubes 51 and 50 have formed therein registering apertures through which extends a connector pin 54.

The plug 53 extends below the lower extremity of tube 51 and is provided co-axial with the axis Y with an internally threaded socket in which is screwed the upper threaded end of the shank of a tie bolt 55. The yoke shank 26 is provided with a central aperture and the shank of the tie bolt 55 extends through the central aperture of the yoke shank 26, and there is preferably provided between the lower head of the bolt 55 and the lower end of the shank 26 a centering washer 56. Within the bore of the catch tube 51, there is slidably located a preferably tubular and preferably externally cylindric cam 57.

Each of the latch hooks 49 includes as shown an upper elongated spring stem 58 depending from the cap 48 and a lower hook end 59 extending outwardly from the lower end of the stem 58 away from the axis Y in a direction generally perpendicular thereto for engagement and disengagement of its upper hook face with the lower frusto-conical hook face of the flange 52. The lower cam face 60 of each hook end 59 is curved and preferably spherical. The preferably tubular cam 57 longitudinally slidable in the bore of the tube 51 between the flange 52 and the plug 53 includes at its upper end an inwardly extending annular cam flange 61, which in cross section has a ridge contour in a plane passing through the axis Y, the apex of the ridge being adjacent the axis Y and being preferably flattened.

Accordingly, when the lower spherical cam face 60 and the hook ends of the latch hooks 49 are pushed into the tubular or sleeve cam 57, the hook ends 59 on the spring stems 58 will be sprung inwardly toward the axis Y by the camming action of the spherical faces 60 being pushed downwardly through the throat of the inwardly extending annular ridge cam flange 61.

In operation the improved automatic tongs 10 are usually suspended from a crane cable attached at its lower end to the lift pin means 18 of the upper head means 11. The crane cable, not shown, is a part of a usual crane and is raised and lowered by the usual operation of the crane to raise and lower the automatic tongs.

When the automatic tongs 10 have their parts in the relative positions shown in Fig. 1, the tong levers 13a and 13b and their gripping bits are maintained open, the latch hooks 49 being engaged beneath the frusto-conical catch or detent flange 52.

When the automatic tongs 10 are lowered with the tong levers in their locked open position so that the tong lever mounting means 12 strikes against the upper end of an object to be lifted, such as an ingot, the tong lever mounting means 12 is pushed with respect to the upper head means 11, and the head means 11 is dropped with respect to the lever mounting means 12, so that the latch hooks 49 are pushed into the tubular or sleeve cam 57 below the cam flange 61, as shown in Fig. 2.

Upon next raising the head means 12, the sleeve cam 57 is raised by the hook ends 59 of the latch hooks 49 till the upper end of the sleeve cam 57 abuts against the lower end of the catch or detent annular flange 52, when the hook ends 59 are sprung inwardly from the axis Y and displaced from engaging position with respect to the catch 52 and are permitted to be pulled upwardly through the annular catch or detent flange 52, so that the parts of the automatic tongs 10 may assume the gripping or closed positions of the tong levers and gripping bits shown in Fig. 3.

In Fig. 5 is illustrated a second embodiment of the improved push and pull actuated cyclically engaging and releasing latch and catch means adapted for being included in improved tongs which otherwise are similar to the automatic tongs in Figs. 1 to 4 inclusive. The latch and catch means of Fig. 5 are indicated generally by 115 and generally are similar to the latch and catch means 15, with the exception that in the latch and catch means 115 the latch hooks 149 include rigid stems 158 having upper enlarged heads which are associated with an upper apertured cap 148 by spring pressed plate means indicated generally by 162.

The embodiments of the present improvements illustrated and described herein are by way of example, and the scope of the present invention is not limited to the same or to the particular details thereof, but is commensurate with any and all novel subject matter contained herein

which may at any time properly under the United States patent laws be set forth in the claims hereof or originating herein, and the elements of any such claims are intended to include their reasonable, mechanical and functional equivalents.

We claim:

1. In automatic tongs and the like, upper head means, lower tong lever mounting means, tong levers pivotally mounted on the mounting means, tong lever suspension and actuating rods operatively connecting the tong levers with the upper head means, and push and pull actuated cyclically engaging and releasing latch and catch means operative between the upper head means and the lower tong lever mounting means and controlling the positions of the tong levers, and each rod having a lower pivotal connection with one of the levers and an upper slidable and pivotal connection with the head means.

2. In automatic tongs and the like, upper head means, lower tong lever mounting means, tong levers pivotally mounted on the mounting means, tong lever suspension and actuating means operatively connecting the tong levers with the upper head means, and push and pull actuated cyclically engaging and releasing latch and catch means operative between the upper head means and the tong lever mounting means and controlling the positions of the tong levers, and each suspension and actuating means including a member having a pivotal connection with one of the levers and a slidable and pivotal connection with the head means.

JAMES HUTSON HOPKINS.
EDGAR HOMER KENDALL.