

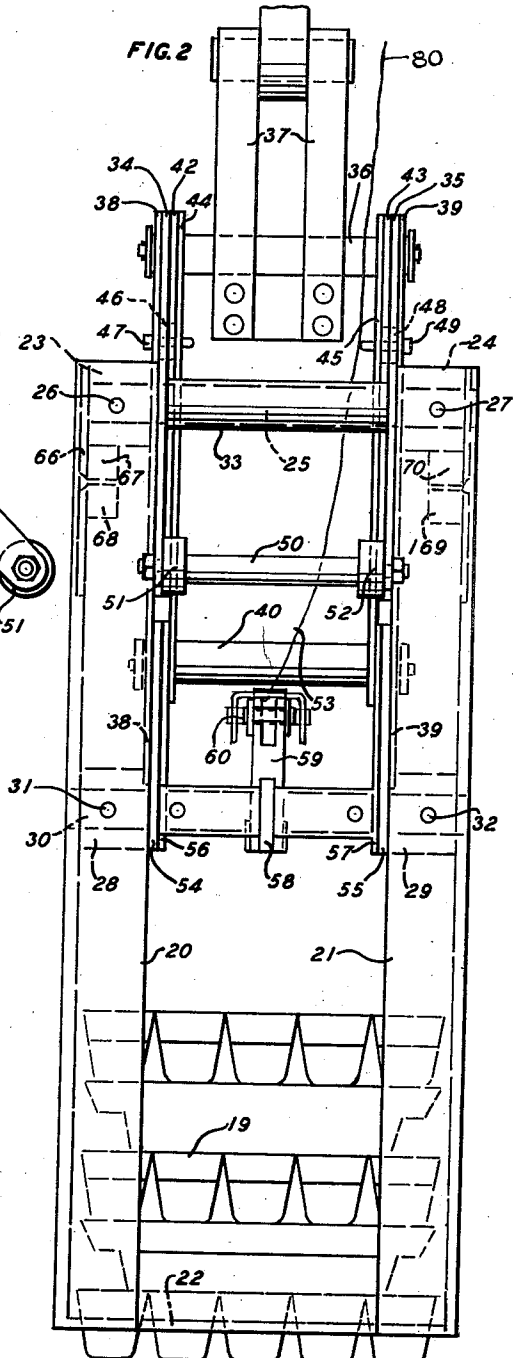
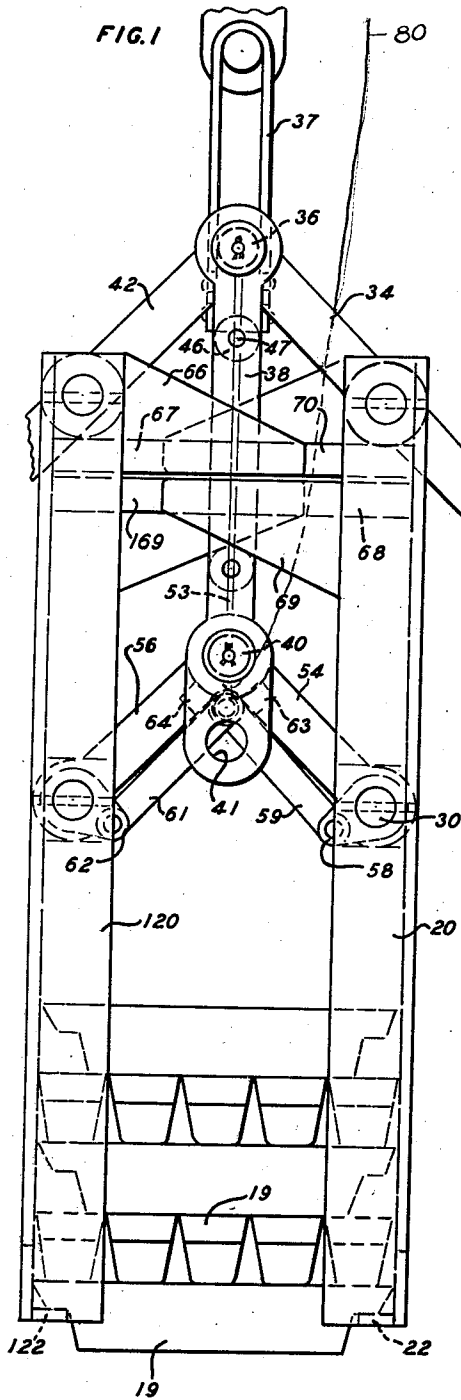
Dec. 17, 1940.

F. V. JOHNSON ET AL
MATERIAL HANDLING APPARATUS

2,224,913

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2 Sheets-Sheet 1



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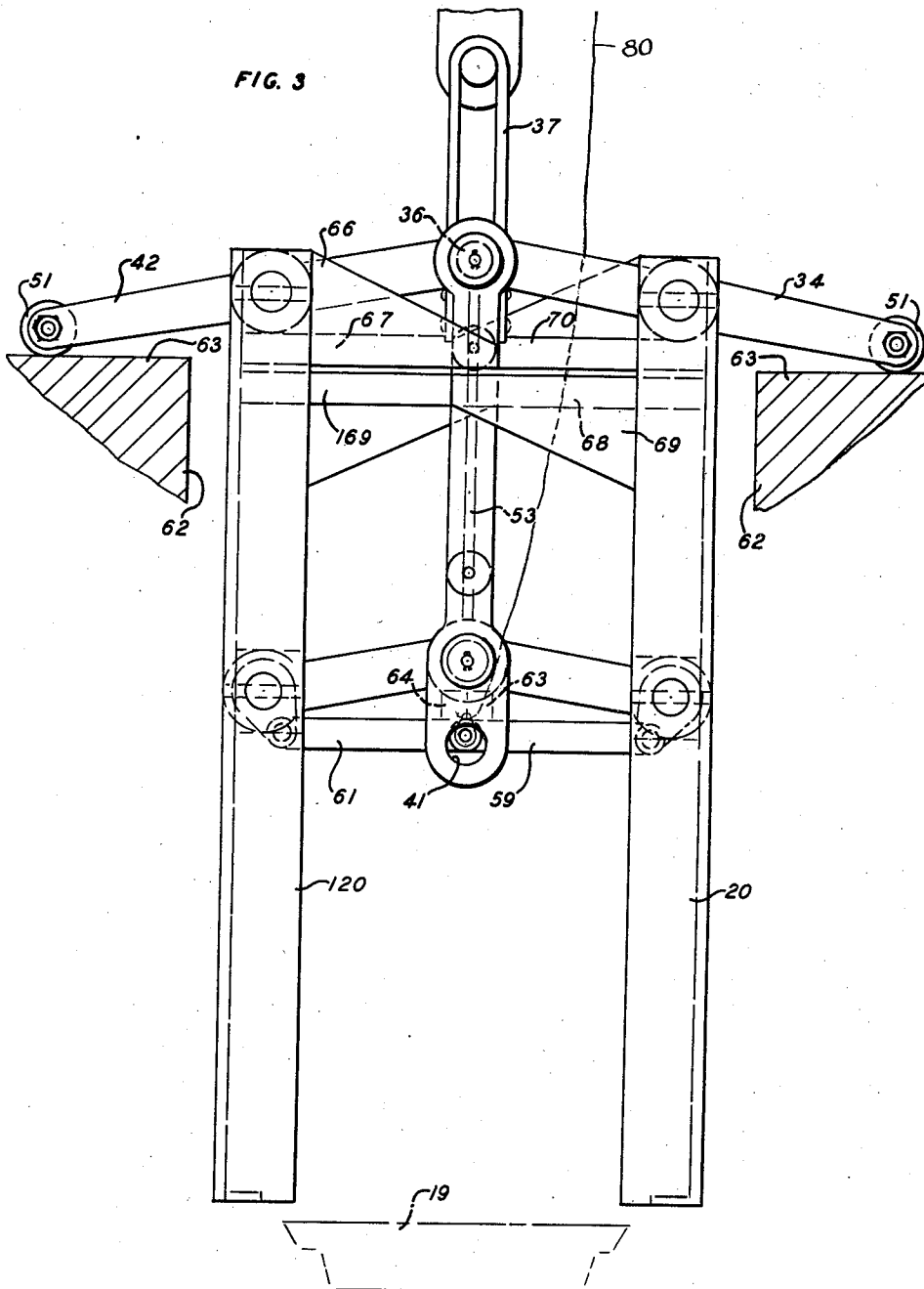
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2,224,913

MATERIAL HANDLING APPARATUS

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3 Claims. (Cl. 294—110)

This invention relates to material handling apparatus and more particularly to apparatus for picking up, transporting and depositing stacked or piled solid materials.

There are innumerable instances in industry where solid materials are stacked in storage and it is necessary for this material to be picked up by some such agency as a travelling crane to be transported to and deposited at some point of use or consumption. Thus, to give a particular illustration, in the manufacture of electrical conductor cable sheathed with a protective sheath of seamlessly extruded lead or lead alloy, a kettle for melting the sheathing metal may be located between a pair of the presses used for the extrusion sheathing to supply molten metal to the presses. The metal to be melted will ordinarily be stored at a nearby depot serving several such kettles, in the form of pigs, and will be transported by travelling crane as required from the depot in batches to the several kettles.

An object of the present invention is to provide a simple, sturdy and reliably functioning device or grapple which may be used in conjunction with a hoist, crane or the like, and capable of picking up, holding and releasing an appropriately dimensioned stack or pile of solid material or objects, e. g. such as stacked pigs of metal, with a minimum need for direct manual manipulation.

With such object in view, one embodiment of the invention may present a pair of vertically disposed, spaced, parallel grappling members, connected and maintained a variable distance apart by two or more toggle linkages which have their middle joints connected to a common vertical hoisting link, and a third toggle linkage also connecting the two grappling members but not connected to the hoisting link, which third toggle may act to maintain the grappling members releasably in their widest spacing; one of the first named two or more toggles having its links extended out beyond the grappling members to be engaged with external supports to force the grappling members apart.

Other objects and features of the invention will clearly appear from the following detailed description of one embodiment thereof taken in connection with the accompanying drawings in which the same reference numerals are applied to identical parts in the several figures, and in which

Fig. 1 is a view in end elevation of a pig metal transporting grapple constructed in accordance

with the invention and shown in its closed or loaded position;

Fig. 2 is a corresponding view thereof in side elevation; and

Fig. 3 is a view like Fig. 1 but showing the grapple in its open or receiving or discharging position.

In the embodiment of the invention herein disclosed there is shown a grapple comprising two principal members interconnected to be at all times spaced from and parallel to each other and movable toward and from each other. Referring to Fig. 1, the right hand member (shown in full in Fig. 2) comprises two vertical angle bars 20 and 21 permanently and rigidly held together and spaced apart at the bottom by an angle member 22 welded or otherwise secured thereto. In the upper ends of the vertical bars are rigidly secured blocks 23 and 24, respectively, preferably welded in place, and horizontally bored to receive a shaft 25 mounted in the bars and secured in place, as by pins 26 and 27, to maintain the upper ends of the bars rigidly interconnected and spaced apart. Blocks 28 and 29 are secured in the angle bars 20 and 21, respectively, about midway of their length and are bored to receive a shaft 30 secured in place by means of pins 31 and 32. This shaft 30 also serves to rigidly connect and space apart the angle bars 20 and 21 as well as for other purposes to be hereinafter described. The left hand principal member of the grapple is in all respects symmetrically identical with the right hand member and, therefore, need not be described in detail. Upon the shaft 25 is a rotatable sleeve 33 extending substantially between the blocks 23 and 24. A lever 34 is pivoted at about its center upon the sleeve 33 and turns with the sleeve upon the shaft 25. The outer lower end of this lever 34 extends outwardly and downwardly beyond the outer face of the angle bar 20. The lever 34 is located near the block 23. An identically similar lever 35 is mounted near the other end of the sleeve 33 in the same fashion. The upper and inner ends of the two levers 34 and 35 are pivotally mounted on a shaft 36, which may be connected in any suitable fashion to the hoisting chain of a travelling crane or similar device, for example, as here shown, by means of strap members 37, 37.

A pair of vertical links 38 and 39 mounted pivotally on the shaft 36 respectively outside of and adjacent to the levers 34 and 35 extend vertically downward and are interconnected and spaced apart by a shaft 40. The links 38 and

39 extend downwardly a short distance below the shaft 40 and near their lower ends are provided with apertures 41 for a purpose to be described hereinafter. It is to be noted that the shaft 36 is also connected to a cross shaft of the left hand principal member by means of levers 42 and 43 identical in form and function with the levers 34, 35 and located adjacent to these levers on the shaft 36. A second pair of vertical links 44 and 45 is also pivotally secured upon the shaft 36 and these links extend downwardly between and parallel to the links 38 and 39 and are pivotally attached to the shaft 40 but do not extend materially below this shaft. The links 38 and 44 are spaced apart near their upper ends but below the shaft 36 by means of a spacing block 46 and are secured together by a screw 47 passing through the two links of the spacing bar. The links 39 and 45 are similarly spaced apart and secured together by screw 49. The outer lower ends of the levers 34 and 35 are spaced apart and secured together by means of a shaft 50 upon which is mounted a pair of rollers 51 and 52.

To further enhance the rigidity of the link structure described, a flat sheet 53 may be welded at its several edges to the approximate center line of the links 44 and 45 and to the bottom and top elements, respectively, of the cylindrical surfaces of the shafts 36 and 40.

Upon the outer ends of the shaft 40 are pivotally mounted links 54 and 55 whose lower ends are pivotal on the shaft 30 and corresponding links 56 and 57 are connected from the shaft 40 to a shaft in the left hand principal member corresponding to the shaft 30. Thus the two principal members are connected together at their top and end by means of a toggle comprising the levers 34, 35, 42 and 43 and the shaft 30, and are similarly connected together near the middle of the two principal members by a toggle comprising the links 54, 55, 56 and 57 and the shaft 30, both toggles being connected together and operated by the links 38, 39, 44 and 45 and by the hoist connection 37.

Upon the shaft 30, at about its middle part, is pivotally mounted a short lever 58 to the outer end of which is pivotally connected a link 59. The other end of the link 59 is secured by a pin 60 to a corresponding link 61 pivotally attached to a short lever 62 identically like the lever 58 and similarly connected to the left hand principal member. The links 59 and 61 are formed at their upper ends with stop lugs 63 and 64 so proportioned and positioned that the toggle 59, 61 can be opened downwardly only as far as the position shown in Fig. 3, which is a little past the widest opening of the toggle, i. e. in this position the toggle 59, 61 is slightly overthrown and thus locks the principal members in the open position shown in Fig. 3.

A flat plate 66 having the shape of a truncated triangle is welded to the vertical inner edge of the front upright angle 120 of the left hand principal member to stand horizontally out as shown in Fig. 1. A bar 67 square in cross section lies horizontally against the lower portion of the plate 66 and extends transversely across the corresponding face of the angle 120 and is welded to both the angle and the plate. A similar bar 68 is secured to the angle 20 of the right hand member and extends horizontally therefrom to the left, parallel to and a small distance below the bar 67. A plate 69 identically similar in form to plate 66 is secured

to the angle 20 and to the bar 68 to brace the latter and bars 67 and 68 are spaced only sufficiently apart to avoid contact and friction therebetween under normal circumstances. Similar bars 169 and 70 are similarly secured to the rear angles of the two principal members, but whereas the upper bar 67 is secured to the left hand member and the lower bar 68 to the right hand member the upper bar 70 is secured to the right hand member and the lower bar 169 to the left hand member.

Should the grapple when in operation as hereinafter described and when loaded as shown in Figs. 1 and 2, be lowered in such a way as to bring the bottom end of one of the principal members only in contact with some unintended supporting obstacle the pairs of bars 67, 68 and 169, 70 will prevent any abnormal distortion of the proper relative position of the parts which might lead to an unintended dumping of part 20 or all of the contents of the grapple.

In operation the apparatus described may be thought of as connected by the means 37 to the hoist chain of a travelling crane for the purpose of picking up pre-piled stacks of lead pigs such as are shown in Figs. 1 and 2, to transport the same to and dump them in a lead melting pot or furnace. Assuming that such a stack of pigs has just been dumped the grapple will be in the position shown in Fig. 3 and in this position it will be lowered by the hoist operator down over a stack of pigs and the attendant at the loading platform will then pass a crow-bar or other pry means through the aperture 41 and under the joint of the toggle 59, 61 and pry the joint up until the toggle is past its neutral point and breaks slightly upwardly. The hoist operator will then start to lift the grapple. The locking toggle 59, 61 being broken the lifting effect of the vertical central links 38, 39, 44 and 45 will cause the toggles 54, 56 and 34, 42 to close the two principal members together, thereby causing the horizontal portions of the cross-wise bottom angle bars 22 and 122 to hook under the stepped ends of the pigs as shown in Figs. 1 and 2 and thus lift the stack of pigs along with the grapple. The grapple is then transported to a point vertically over the opening 62 of the melting pot or furnace, which opening is presumed to be surrounded by horizontal shoulders 63. The grapple being then lowered down into the aperture rollers 51 eventually come into contact with the shoulders 63 and the weight of the grapple and its load is gradually transferred from the hoist member 57 to the levers 34, 35, 42 and 43. These levers, as shown in Fig. 3, then move toward a horizontal position, thus causing the toggles 34, 42 and 54, 56 to open, forcing the principal members apart and removing the support of the members 22 and 122 from under the stack of pigs which is thus permitted to fall into the melting pot or furnace. Ordinarily the stack of pigs will not be thus released until after it has been lowered to lie beneath the surface of molten material already in the furnace in order that there may be no dangerous splashing. The spreading of the levers 34, 42, 35 and 43 is permitted to continue until the position of Fig. 3 is reached, in which the auxiliary toggle 59, 61 is slightly overthrown and locks the principal members in their wide open position whereupon the entire operation is repeated as desired.

It will be observed that by means of this arrangement the material to be melted is carried to and deposited in the furnace without the ne-

cessity for any attendant at the furnace during the actual charging. It has been customary, and in many instances still is so, for the charging of such furnaces to be done by an attendant standing on the shoulders 63 or some place equivalent thereto whose duty it is to slide or throw the pigs of raw material by hand into the furnace. This is a hazardous duty to perform because of the weight of the units to be handled, because of the obvious danger of the open mouth of the furnace, and also because of the health hazard of possible fumes from the furnace and from the inescapable heat of the environment where the work is performed.

Hazards at the loading platform are ordinarily confined to those arising from the weight and unwieldiness of the pigs to be handled. Hence, in the apparatus as thus far described, it has been assumed that an attendant will be present at the loading platform not only to pile the stacks in the form shown to be picked up by the grapple but also to break the locking toggle in the manner described. However, if desired a pull rope 80 or chain or other means running from the pin 60 to the hoist operator's station may be provided whereby the hoist operator may break the locking toggle 59, 61 at will and thereby the presence of an attendant on the loading platform during the operation of loading the grapple may be obviated.

It is to be noted that the members 34 and 35 are together one link of the upper set of principal toggle linkages in the apparatus, the members 42 and 43 together being the other link; and the members 54 and 55 are together one link of the lower set of principal toggle linkages, the members 56 and 57 together being the other link, while the members 59 and 61 are a third toggle linkage. By the phrase "toggle linkage" is meant a system of two rigid links joined together at one point of each link by a pivot on which the links may turn freely relatively to each other. When other points of the two links are respectively pivoted on each of two other objects, the distance between these objects is variable and both determines and is determined by the angle between the links or the distance from the common pivot of the links to the line joining the outer pivots of the links. Also the common pivot of the links is always on the perpendicular bisector of the line joining the outer pivots of the links. The phrases "toggle" and "toggle linkage" and the like, as used in the foregoing description and in the appended claims, are to be taken as referring to and meaning a system of two rigid elements pivoted to each other at one point of each and pivoted to two other elements at other points of each to variably control the distance between the other two elements.

The embodiment of the invention herein disclosed is merely illustrative and may be modified and departed from in many ways without departing from the spirit and scope of the invention as pointed out in and limited only by the appended claims.

What is claimed is:

1. A grappling device comprising a pair of grappling members, a pair of toggle links pivoted directly to each other at one point of each and each pivoted directly respectively to one of the principal members, a second pair of toggle links pivoted directly to each other at one point of each and each pivoted directly respectively to one of the principal members, a spacing member connecting the interlink pivots of the said two pairs of toggle links, and a third pair of toggle links pivoted directly to each other at one point of each and each pivotally connected respectively to one of the principal members and releasably operating to lock the two principal members substantially at a maximum distance apart when substantially in line with each other, the maximum spread of the third pair of toggle links being too small to permit either the first or second pair to assume their respective positions of maximum spread.

2. A grappling device comprising a pair of grappling members, a pair of toggle links pivoted directly to each other at one point of each and each pivoted directly respectively to one of the principal members, a second pair of toggle links pivoted directly to each other at one point of each and each pivoted directly respectively to one of the principal members, a spacing member connecting the interlink pivots of the said two pairs of toggle links, and a third pair of toggle links pivoted directly to each other at one point of each and each pivotally connected respectively to one of the principal members and releasably operating to lock the two principal members substantially at a maximum distance apart when substantially in line with each other, the links of one pair of toggle links being extended beyond their pivot connections with the principal members as levers for actuating the links.

3. A grappling device comprising a pair of grappling members, a pair of toggle links pivoted directly to each other at one point of each and each pivoted directly respectively to one of the principal members, a second pair of toggle links pivoted directly to each other at one point of each and each pivoted directly respectively to one of the principal members, a spacing member connecting the interlink pivots of the said two pairs of toggle links, a third pair of toggle links pivoted directly to each other at one point of each and each pivotally connected respectively to one of the principal members and releasably operating to lock the two principal members substantially at a maximum distance apart when substantially in line with each other, and means to move the interlink pivot of the third pair of toggle links to break the overthrown relation thereof.

LILA T. JOHNSON,

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LESLIE V. MOSHER.