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H. H. HOOKER

2,695,809

LIFTER

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3 Sheets-Sheet 1

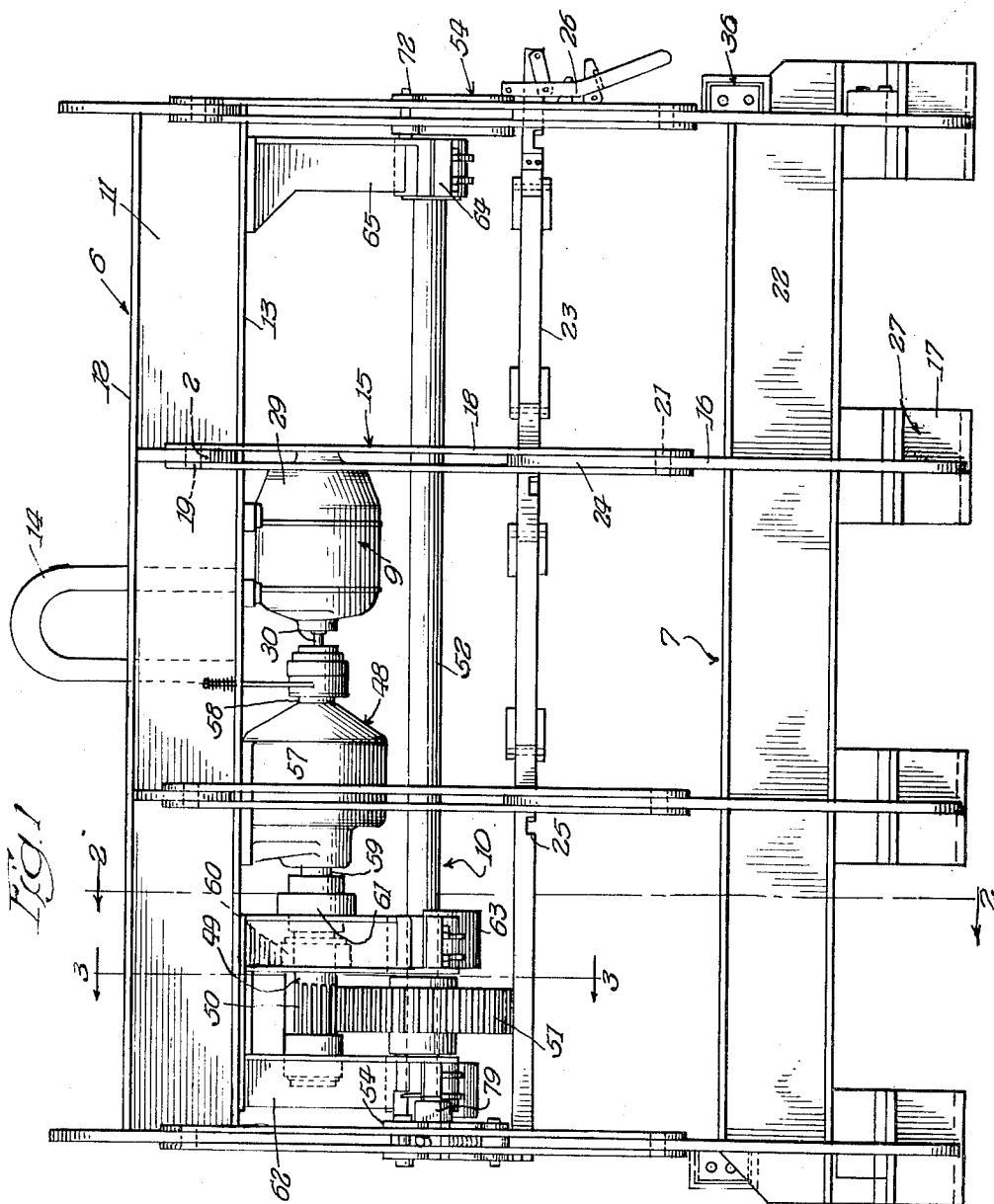


Fig. 1

Inventor
HOWARD H. HOOKER
By: Fred L. Lash, Atty.

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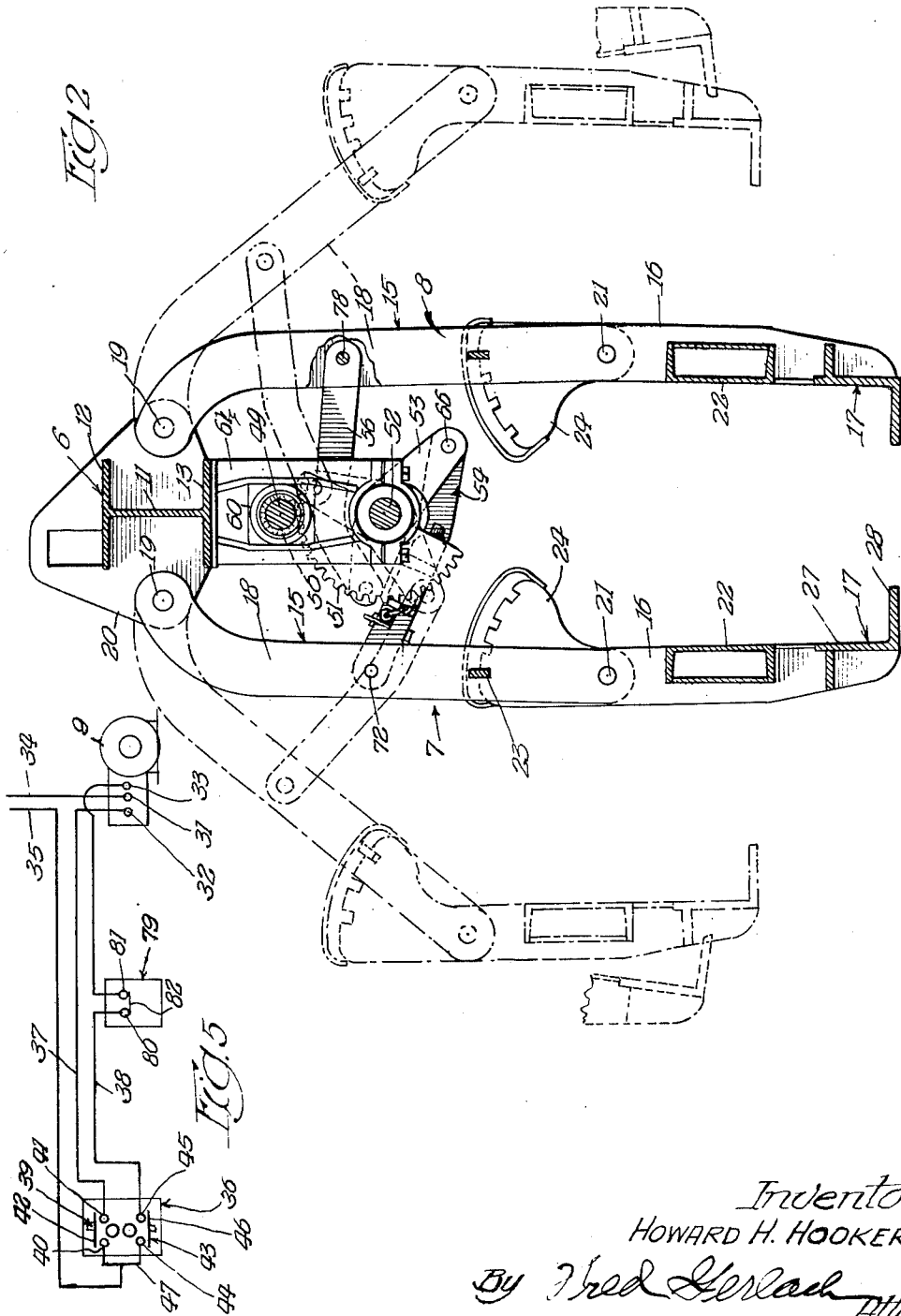
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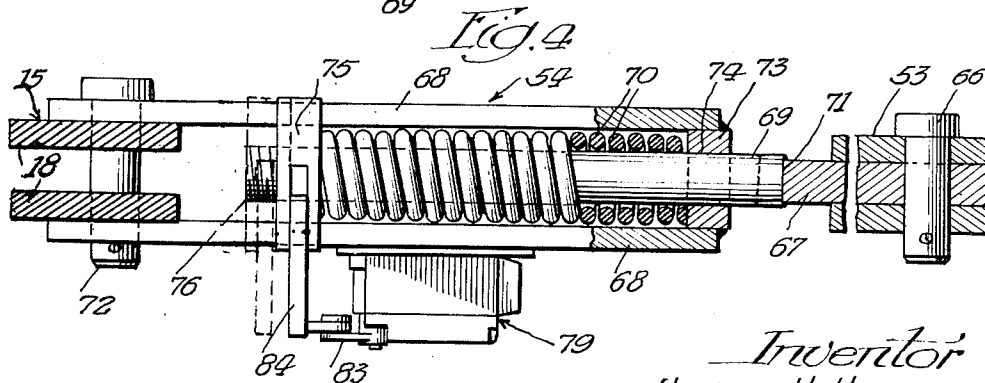
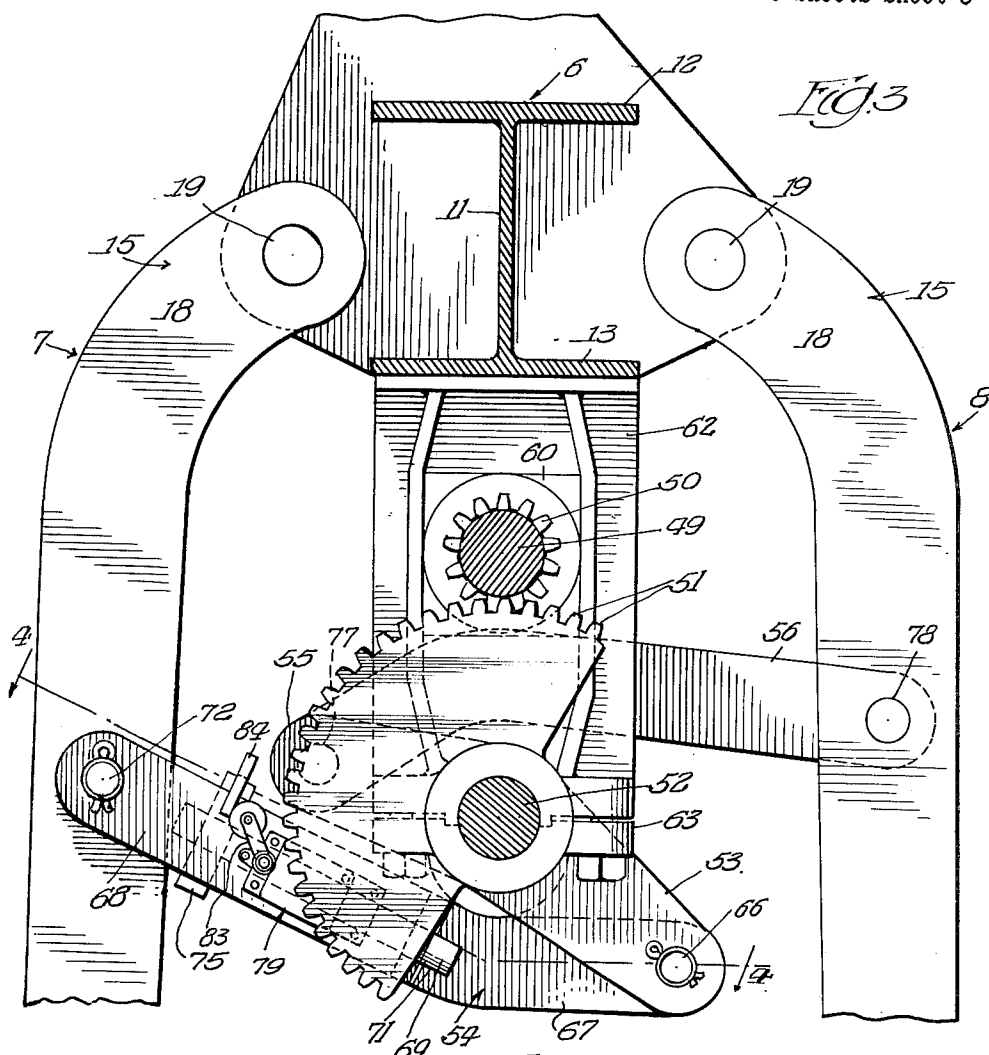
H. H. HOOKER

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Inventor
HOWARD H. HOOKER
By: *Theodore L. Ladd* Atty.

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LIFTER

Howard H. Hooker, Chicago, Ill., assignor to The Cullen-Freistedt Company, Chicago, Ill., a corporation of Illinois

Application May 26, 1951, Serial No. 228,489

1 Claim. (Cl. 294—67)

The present invention relates generally to lifters for use in handling and moving or transporting from place to place metallic sheets and like articles. More particularly the invention relates to that type of lifter which is adapted to be hoisted and moved from place to place by a crane or overhead hoist and as its principal components or parts comprises: (1) an elongated supporting element which is adapted normally to extend horizontally and has means whereby it may be attached to a hook or other connecting device on the operating end of the crane or hoist with which the lifter is used; (2) a pair of opposed horizontally elongated, complementary jaws which are pivotally connected to the supporting element so that they are capable of swinging to and from one another into and out of engagement with the side margins of the sheets to be lifted; (3) a reversible electric motor which is mounted on the supporting element and has in the circuit thereof a push button variety switch for controlling it; and (4) motor actuated gearing which is associated with, and carried by, the supporting element, operates when driven in one direction to shift the jaws apart and when driven in the opposite direction to shift the jaws together into gripping relation with the sheets and includes a gear type speed reducing unit having a drive shaft in connected relation with the armature of the motor and a driven shaft with a pinion thereon, a horizontal and longitudinally extending rock shaft under the supporting element, a gear segment on the rock shaft and in mesh with the pinion and operating connections between the rock shaft and the jaws in the form of radially extending arms on the rock shaft and links between the arms and the jaws.

As evidenced by United States Letters Patent No. 2,256,896, dated September 23, 1941, it has heretofore been proposed in connection with a lifter of the aforementioned type to employ between the gear segment and the rock shaft a lost motion spring variety driving connection in order that the gear type speed reducing unit and the electric motor are not subjected to shock or impact when the jaws are brought into engagement with the side margins of the sheets in connection with inward swinging thereof or strike against objects during outward swinging. In practice it has been found that a lifter having a lost motion spring variety shock or impact absorbing driving connection between the gear segment and the rock shaft is practical but is, however, subject to the objection that when the spring means of the driving connection is distorted to its fullest extent while electric current is supplied to the electric motor the motor stalls and not only is likely to burn out but also subjects the gear type speed reducing unit to damaging strains.

One object of the invention is to provide a lifter which is an improvement upon, and eliminates the objections to, previously designed lifters including that forming the subject matter of aforementioned United States Letters Patent No. 2,256,896, and is characterized by the fact that it includes in addition to a spring variety lost motion connection as part of the gearing between the electric motor and the jaws, means whereby the circuit for the electric motor is automatically broken when the spring means of the connection is distorted after the jaws are arrested due to striking against the side margins of the sheets to be lifted. By employing such automatic motor controlling means there is no likelihood of the motor burning out or imparting damaging strain to the gear type speed reducing unit when the jaws are brought to rest during inward swinging thereof.

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Another object of the invention is to provide a lifter of the type and character under consideration in which the spring variety lost motion connection consists of extensible spring biased or loaded links between certain arms on the rock shaft and one of the jaws and the automatic motor controlling means is in the form of a limit switch which is included in the circuit for the electric motor, is mounted on one of the extensible links and is so arranged that it automatically opens when the one link is extended as the result of the jaw to which it is connected becoming arrested in connection with inward swinging thereof.

A further object of the invention is to provide a lifter which is generally of new and improved construction, effectively and efficiently fulfills its intended purpose and possesses extremely long life due to the means for automatically controlling its reversible electric motor.

Other objects of the invention and the various advantages and characteristics of the present lifter will be apparent from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by the claim at the conclusion hereof.

In the drawings which accompany and form a part of this specification or disclosure and in which like numerals of reference denote corresponding parts throughout the several views:

Figure 1 is a side elevation of a lifter embodying the invention;

Figure 2 is a vertical transverse section taken on the line 2—2 of Figure 1 and illustrating in detail certain parts of the gearing for conjointly swinging the complementary jaws to and from one another in connection with drive of the electric motor;

Figure 3 is an enlarged vertical transverse section on the line 3—3 of Figure 1;

Figure 4 is a section taken on the line 4—4 of Figure 3 and showing in detail the construction and arrangement of the extensible spring loaded link on which is mounted the limit switch for automatically controlling the reversible electric motor; and

Figure 5 is a diagram of the electric circuit for the motor.

The lifter which is shown in the drawings constitutes the preferred form or embodiment of the invention. It is adapted in connection with a crane or overhead hoist (not shown) having a connecting device at its operating end, to lift and move from place to place a stack of metallic sheets or other articles and comprises as its main parts an elongated supporting element 6, a pair of opposed horizontally elongated jaws 7 and 8, a reversible electric motor 9 and gearing 10 between the motor and the jaws for conjointly shifting the latter to and from one another in response to drive or operation of the motor.

The supporting element 6 is adapted normally to extend horizontally. It carries the jaws 7 and 8, the reversible electric motor 9 and the gearing 10 and is in the form of an I-beam. As shown in Figures 1, 2 and 3 of the drawings, the supporting element 6 carries the jaws 7 and 8 in a depending manner and comprises a vertically extending web 11, a horizontally extending top flange 12 and a horizontally extending bottom flange 13. Inwards of its ends the element 6 is provided with an upstanding loop 14 whereby the lifter as a whole may be attached to the connecting device at the operating end of the crane or hoist.

The opposed horizontally elongated complementary jaws 7 and 8 are adapted as hereinafter described, to be shifted or swung to and from one another in response to actuation of the gearing 10 by the reversible electric motor 9. They extend lengthwise of the supporting element 6 and comprise upper members 15, lower members 16 and angle bar variety gripping members 17. The upper members 15 have inturned or inwardly extending upper ends and each comprises a pair of laterally spaced plate metal pieces 18. The upper ends of the members 15 of the jaws are pivotally connected by way of horizontal pivot pins 19 to laterally extending pivot lugs 20 on the elongated supporting element 6. The upper members of the jaw 7 correspond in number to, and are

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transversely aligned with, the upper members of the jaw 8, as shown in Figure 1. The pivot lugs 20 fit between the top and bottom flanges 12 and 13 of the supporting element 6 and are welded in place. The pins 19 extend through aligned holes in the pivot lugs and the upper ends of the plate metal pieces 18 and together with the lugs so pivotally support the jaws 7 and 8 that the latter are free to swing to and from one another into and out of gripping relation with the stack of sheets. The lower members 16 of the jaws extend substantially vertically and carry at their lower ends the angle bar variety gripping members 17. The upper ends of the members 16 project into the spaces between the lower ends of the pairs of plate metal pieces 18 and are pivotally supported by horizontal pins 21 in such manner that the lower members 16 may be swung into different angular positions with respect to the upper members 15 in order to adapt the lifter for use in connection with stacks of wide sheets as well as narrow or small sized sheets. The lower members 16 of each jaw are cross connected by way of horizontally extending box-section variety members 22, the ends of which are welded or otherwise fixedly secured to the central portions of said members 16. A pair of horizontally extending lock bars 23 serves to hold or lock the lower members 16 in their various adjusted positions with respect to the upper members 15. The lock bars 23 are carried by, and horizontally slidable in, slots in the lower ends of the upper jaw members and are adapted to coast with teeth equipped sector shaped elements 24 at the upper ends of the lower members 16. The elements 24 are disposed above the pivot pins 21 and fit slidably between the lower ends of the plate metal pieces 18 that constitute the upper members 15 of the jaws. The lock bars are provided with notches 25 adjacent the tooth equipped sector shaped elements 24 and are adapted when slid longitudinally in one direction to have the notches brought into alignment with the elements 24 so that the latter together with the lower jaw members are free to swing laterally into any desired adjusted position. When the bars are shifted in the opposite direction the notch defining portions of the bars are adapted to interlock with the elements 24 and lock the lower members 16 against swinging movement relatively to the upper members 15. Longitudinal shift of the lock bars 23 is effected by means of handle equipped levers 26 which are carried by certain of the upper members of the jaws. The lock bars 23, the elements 24 and the levers 26 constitute means for releasably locking the lower jaw members in their various adjusted positions. Such means forms the subject matter of United States Letters Patent No. 2,213,055 to which reference may be had for a more detailed disclosure thereof. The angle bar variety gripping members 17 consist of vertically extending legs 27 and horizontally extending legs 28. The vertical legs are welded to the inner faces of the lower ends of the members 16 and are adapted when the jaws are shifted toward one another into hoisting relation with a stack of sheets to abut against the side edges of the lowermost sheets. The horizontal legs 28 of the gripping members 17 are formed integrally with, and project inwardly from, the bottom margins of the legs 27 and are adapted to underlie the side margins of the sheets.

The reversible electric motor 9 is disposed beneath the central portion of the elongated supporting element 6 and comprises a casing 29 and an armature shaft 30. The casing 29 of the motor is suitably connected to the horizontally extending bottom flange 13 of the supporting element 6 and is arranged so that the armature shaft 30 is in parallel relation with the supporting element. The motor is of the single phase alternating current variety. It has three terminals 31, 32 and 33 and is supplied with electric current by a circuit which is shown diagrammatically in Figure 5 of the drawing and comprises a pair of line conductors 34 and 35, a double push button switch unit 36 and a pair of conductors 37 and 38. The line conductor 34 is connected to the terminal 31 and the line conductor 35 leads to the double push button switch unit 36. Such switch is mounted at one end of the lifter in order that it is accessible for operation by the lifter operative or operator. It is of unitary character and comprises a jaw opening switch 39 in the form of a pair of fixed contacts 40 and 41 and a normally open movable contact 42 between the two fixed contacts 40 and 41 and a jaw closing switch 43

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in the form of a pair of fixed contacts 44 and 45, and a normally open movable contact 46 between the two fixed contacts 44 and 45. The end of the line conductor 35 that leads to the switch unit 36 embodies a branch 47 which is connected at its ends to the fixed contacts 40 and 44 of the switches 39 and 43. The conductor 37 extends between, and is connected to, the fixed contact 41 of the jaw opening switch 39 and the motor terminal 32 and the conductor 38 extends between, and is connected to, the fixed contact 45 of the jaw closing switch 43 and the motor terminal 33. When the movable contact 42 of the jaw opening switch 39 is shifted into its closed position wherein it contacts and bridges the two fixed contacts 40 and 41 the following circuit is established: line conductor 35, branch 47, fixed contact 40, movable contact 42, fixed contact 41 and conductor 37. Establishment of such circuit results in the electric motor 9 operating in such direction that it causes, through the medium of the gearing 10, the jaws 7 and 8 to open, i. e., swing away from one another. When the movable contact 46 of the jaw closing switch 43 is shifted into its closed position wherein it bridges the fixed contacts 44 and 45 the following motor circuit is established: line conductor 35, branch 47, fixed contact 44, movable contact 46, fixed contact 45 and conductor 38. Establishment of the last mentioned circuit results in the motor operating in the opposite direction and through the medium of the gearing 10 effecting closing of the jaws 7 and 8.

The gearing 10 for conjointly swinging or shifting the jaws 7 and 8 to and from one another in response to drive or operation of the electric motor 9 underlies the elongated supporting element 6 and comprises a gear type speed reducing unit 48, a shaft 49, a pinion 50, a gear segment 51, a rock shaft 52, a pair of arms 53, a pair of extensible spring loaded links 54 between the arms 53 and the jaw 7, a pair of arms 55 and a pair of links 56 between the arms 55 and the jaw 8. The speed reducing unit 48 of the gearing 10 is located beneath the central portion of the elongated supporting element 6 and is disposed directly opposite the electric motor 9. It is connected to the bottom flange 13 of the supporting element 6 and comprises a gear enclosing housing 57, a horizontal drive shaft 58, and a horizontal driven shaft 59. The drive shaft 58 extends through one end of the housing 57 and is suitably drivably connected to the adjacent end of the armature shaft 30 of the electric motor 9. It is connected through the medium of gearing (not shown) within the housing 57 to drive at slow speed the driven shaft 59. The latter as well as the drive shaft 58 extends lengthwise of the supporting element 6. The shaft 49 is located under one end of the supporting element 6 and is in coaxial relation with the driven shaft 59 of the speed reducing unit 48. It is journaled at its ends in bearings 60 and has its inner end connected to the outer end of the driven shaft 59 by way of a coupling 61. The bearings 60 are mounted on a pair of laterally spaced brackets 62 which are connected to, and depend from, the supporting element 6. The pinion 50 is formed as an integral part of the central portion of the shaft 49 and meshes with, and serves to drive, the gear segment 51. The latter is keyed or otherwise fixedly secured to one end of the rock shaft 52. The rock shaft extends horizontally and is disposed beneath and in parallel relation with the supporting element 6. One end of the rock shaft is journaled in bearings 63 on the lower ends of the brackets 62 and the other end of the rock shaft is journaled in a bearing 64 on the lower end of a bracket 65 which, as shown in Figure 1, is connected to, and depends from, the superjacent end of the supporting element 6. The arms 53 are fixedly connected to, and project radially from, the ends of the rock shaft 52. They are transversely aligned with the outermost upper members 15 of the jaws and are provided at the outer or distal ends thereof with horizontally extending pivot pins 66. The extensible spring loaded links 54 extend between the outer ends of the arms 53 and the outermost upper members of the jaw 7 and serve when the rock shaft 52 is rotated in a clockwise direction as viewed in Figure 3, to swing the jaw 7 outwards away from the jaw 8. As best shown in Figure 4 of the drawing, each of the links 54 comprises an inner link member 67, a pair of parallel spaced apart outer link members 68, a rod 69 and a spiral spring 70. The inner members 67 of the links 54 are elongated and have the

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inner ends thereof pivotally connected to the horizontal pivot pins 66 on the outer or distal ends of the arms 53. The outer ends of the inner link members 67 are provided with rectangular notches 71 in which fit the inner ends of the rods 69. The inner ends of said rods are welded to the notch defining portions of the inner link members 67 in order that the rods and the inner link members are rigidly connected together. The outer link members 68 are disposed in straddled relation with the central and outer end portions of the rods 69 and have the outer ends thereof pivotally connected to the central portions of the outermost upper members 15 of the jaw 7 by way of horizontal pivot pins 72. The latter extend through aligned holes in the central portions of the outermost upper members of the jaw 7 and the outer ends of the outer link members 68. Blocks 73 extend between, and are welded to, the inner ends of the outer link members 68. They serve to hold such members in spaced apart relation and have centrally disposed holes 74 therein. The rods 69 extend slidably through the holes 74 and have the outer ends thereof fixedly connected to the central portions of I-shaped slide blocks 75. Preferably the outer ends of the rods 69 are connected to the slide blocks 75 by screw threaded connections 76. The slide blocks are slidably mounted between the central portions of the outer link members 68 and have the ends of the crosspieces thereof in lapped relation and sliding engagement with the upper and lower surfaces of the outer link members 68. The arrangement of the slide blocks is such that the blocks are permitted to slide lengthwise of the outer link members 68. The spiral springs 70 of the links 54 surround the central portions of the rods 69 and are disposed between the inner end portions of the outer link members 68. The inner ends of the springs abut against the inner side surfaces of the blocks 73 and the outer ends of the springs abut against the inner side surfaces of the I-shaped slide blocks 75. It is contemplated that the springs will normally be extended and that when the springs are extended the outer ends of the inner link members 67 will abut against the blocks 73 to the end that when the rock shaft 52 is turned in a clockwise direction as viewed in Figure 3 the links 54 will swing the jaw 7 away from the jaw 8. When the rock shaft is rocked or turned in a counterclockwise direction as viewed in Figure 3 the inner link members 67 will, through the medium of the rods 69, the I-shaped slide blocks 75, the spiral springs 70 and the blocks 73 shift the outer link members 68 inwards so as to effect inward swinging of the jaw 7. When the jaw 7 is arrested after striking against the adjacent side margins of the stack of sheets to be lifted continued counterclockwise turning of the rock shaft will result in the rods 69 and the inner link members 67 sliding inwards with respect to the outer link members 68 and compressing the springs 70 as shown in full lines in Figure 4. When in connection with opening of the jaw 7 the rock shaft 52 is turned in a clockwise direction as viewed in Figure 3 the springs 70 will expand until the outer ends of the inner link members 67 abut against the blocks 73. As soon as the inner ends of the inner link members 67 abut against the blocks 73 the outer link members will be shifted so as to effect opening of the jaw 7. The arms 55 of the gearing 10 are connected to, and extend radially from, the ends of the rock shaft 52. They are transversely aligned with the arms 53 and have horizontal pivot pins 77 at their outer or distal ends. The links 56 are rigid and have the inner ends thereof pivotally connected to the outer or distal ends of the arms 55 by way of the pivot pins 77. The outer ends of the links 56 are pivotally connected to the central portions of the outermost upper members of the jaw 8 by horizontal pivot pins 78. When the rock shaft 52 is rocked or turned in a clockwise direction as shown in Figure 3 the arms 55 and the links 56 operate to swing the jaw 8 outwards away from the jaw 7. When the rock shaft is rocked in the opposite direction the arms 55 and the links 56 serve to swing the jaw 8 inwards towards the jaw 7.

In addition to the parts heretofore mentioned the lifter comprises a limit switch 79 for automatically interrupting the flow of current to the electric motor when, after the jaws are arrested in connection with inward swinging thereof, the extensible spring loaded links 54 of the gearing 10 become extended. The limit switch 79 is mounted on one of the outer members 68 of one of the links 54

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and is included in the conductor 38, as shown in Figure 5. It comprises a pair of spaced apart fixed contacts 80 and 81 and a movable contact 82 and embodies a roller equipped arm 83 for controlling the movable contact 82. The fixed contacts 80 and 81 are connected to the conductor 38 and are normally bridged by the movable contact 82 in order to permit the flow of current through the conductor 38 when the switch 43 is closed in connection with a jaw closing operation. The roller equipped arm 83 is spring biased in order that the movable contact 82 is normally in its closed position. It is so arranged that when it is swung upwards and rearwards as viewed in Figure 3 of the drawing it moves the movable contact 82 into its open position. Associated with the limit switch 79 is an actuating lug 84. The latter, as shown in Figures 3 and 4, is connected to, and projects laterally from, the slide block 75 of the link on which the limit switch is mounted. The lug 84 is positioned directly outwards of the roller on the arm 83 and is so arranged that it is out of contact with the roller when the springs 70 of the links 54 are in their normal or extended position. When, however, the links are extended as the result of the jaws being brought into engagement or contact with the sides of the sheets in connection with inward swinging of the jaws, the actuating lug 84 moves rearwards (see full line position in Figure 4) and causes the roller carrying arm 83 to swing upwards and rearwards thereby effecting opening of the limit switch and resultant stoppage of the electric motor 9. By stopping the motor automatically when the links 54 are extended the motor is precluded from burning out and imposing damaging strain on the speed reducing unit 48.

When it is desired to open the jaws 7 and 8 the operator of the lifter closes the switch 39 of the switch unit 36. This causes such drive of the motor 9 that the latter, through the medium of the gearing 10, swings the jaws apart. After the jaws have been swung apart to the desired extent the switch 39 is opened. When it is desired to close the jaws, i. e., swing the jaws inward into gripping relation with the stack of sheets to be lifted the operator of the lifter closes the switch 43 of the switch unit 36. This results in reverse drive of the electric motor 9 and the motor, through the medium of the gearing 10, causes the jaws to swing conjointly towards one another. As soon as the jaws are arrested as a result of contact or engagement with the adjacent side margins of the sheets continued reverse drive of the motor results in extension of the links 54 against the force of the spiral springs 70. In connection with extension of such links the actuating lug 84 slides rearwards and, as heretofore pointed out, effects automatic opening of the limit switch 79. As soon as such switch is opened flow of current to the electric motor 9 ceases, thereby resulting in stopping of the motor. The circuit in which the limit switch 79 is included remains open until the operator of the lifter closes the switch 39 to effect opening of the jaws. In connection with initial opening of the jaws the extensible links 54 contract due to the action of the spiral springs 70. In connection with contraction of the links the actuating lug 84 slides away from the roller carrying arm 83, thus resulting in closing of the limit switch 79. As soon as the limit switch is closed the circuit in which it is included may be completed by closing the jaw closing switch 36.

The herein described lifter effectively and efficiently fulfills its intended purpose and is characterized by the fact that it includes spring loaded extensible links 54 and the limit switch 79 whereby the electric motor 9 is automatically stopped directly after, in connection with closing of the jaws, the jaws strike against the side margins of the sheets to be lifted.

Whereas the lifter has been described as being designed for use in connection with sheets it is to be understood that it may be used in connection with other articles merely by changing the shape or character of the gripping members 17. It is also to be understood that the invention is not to be restricted to the details set forth since these may be modified within the scope of the appended claim without departing from the spirit and scope of the invention.

Having thus described the invention what I claim as new and desire to secure by Letters Patent is:

A lifter adapted for use in handling sheets and other articles and comprising: a supporting element; a pair of opposed complemental jaws depending from the element

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and connected to the latter so that they are capable of being shifted to and from one another; a reversible electric motor carried by the element and provided with a circuit for supplying it with electric current; gearing between the motor and the jaws operative conjointly to shift the jaws apart in response to drive of the motor in one direction and conjointly to swing the jaws towards one another into gripping relation with the sheets in response to reverse drive of said motor and including a rock shaft disposed beneath, and extending lengthwise of, the supporting element, meshing gears between the motor armature shaft and the rock shaft, a fixed radially extending arm on the rock shaft and an extensible spring loaded link extending between the arm and one of the jaws and consisting of a single rigid inner link member having one end thereof pivotally connected to the outer end of the arm and its other end provided with a notch, a pair of laterally spaced rigid outer link members having certain opposed ends thereof pivotally connected to the one jaw and their other ends positioned adjacent the other end of the inner link member and provided between them with a fixed block with a hole therethrough in alignment with said notch, a rod extending slidably through the hole in the fixed block and having one end thereof disposed in, and welded to, said notch, an I-shaped block connected fixedly to the other end of the rod and arranged so that it is disposed between, and in sliding engagement with, the central

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portions of the outer link members, and a spiral compression spring extending around the rod, arranged so that one end thereof abuts against the fixed block and its other end abuts against the I-shaped block, adapted normally to assume an extended position wherein it holds the fixed block in abutment with said other end of the inner link member, and further adapted when in connection with shift of the jaws towards one another said one jaw is arrested as the result of striking against the sheets to become depressed and permit the outer and inner link members to move apart and means operative automatically to break the motor circuit when the link members of the link are moved apart and embodying a limit switch mounted on one of the other link members and included in the motor circuit and a switch controlling member mounted on the I-shaped block.

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