July 28, 1931. C. L. EKSERGIAN 1,816,319

AUTOMATIC FEEDING APPARATUS FOR SHEET METAL WORKING MACHINES

Filed April 3, 1929 6 Sheets-Sheet 1

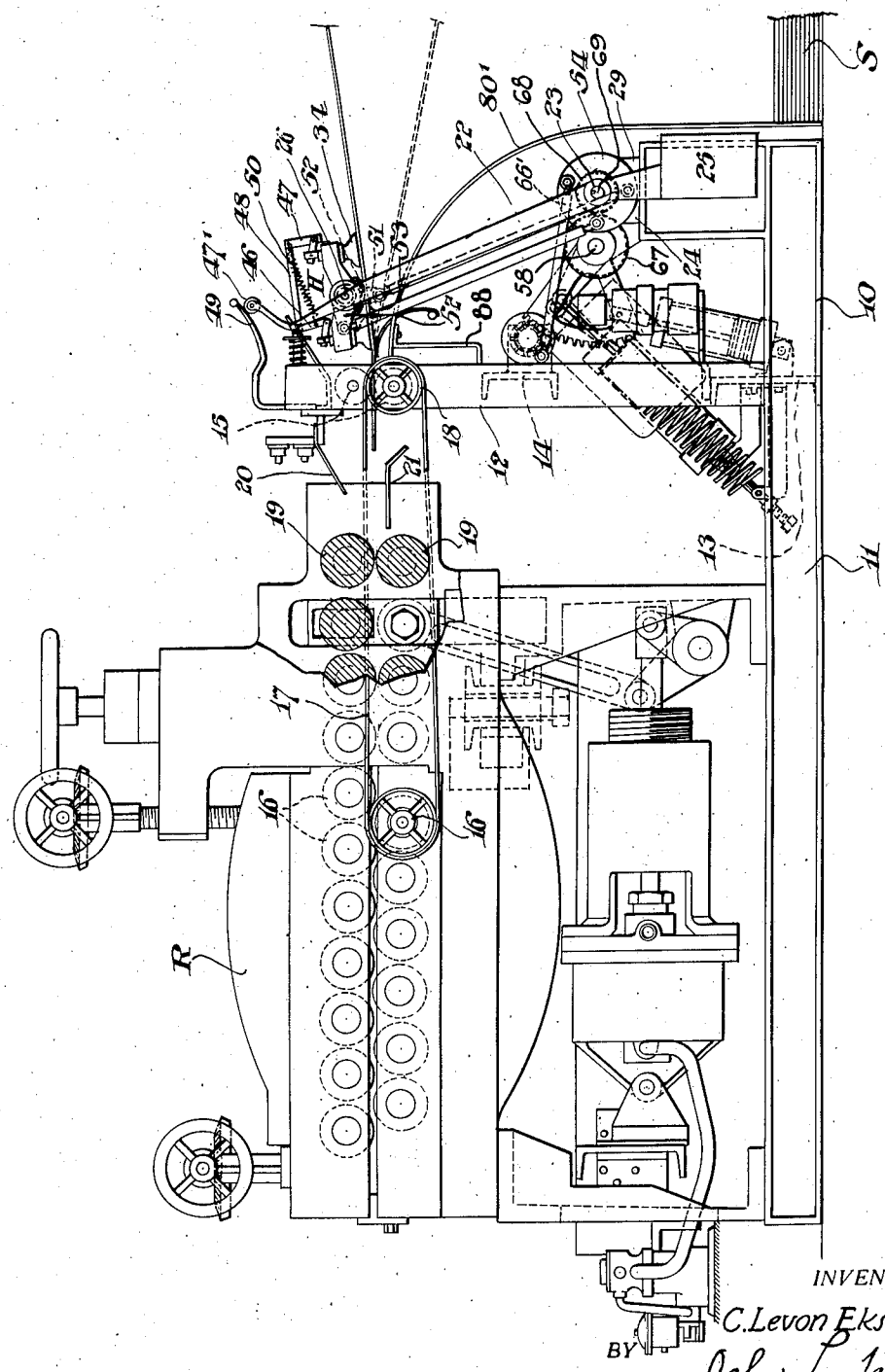


Fig. 1.

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AUTOMATIC FEEDING APPARATUS FOR SHEET METAL WORKING MACHINES

Filed April 3, 1929 6 Sheets-Sheet 2

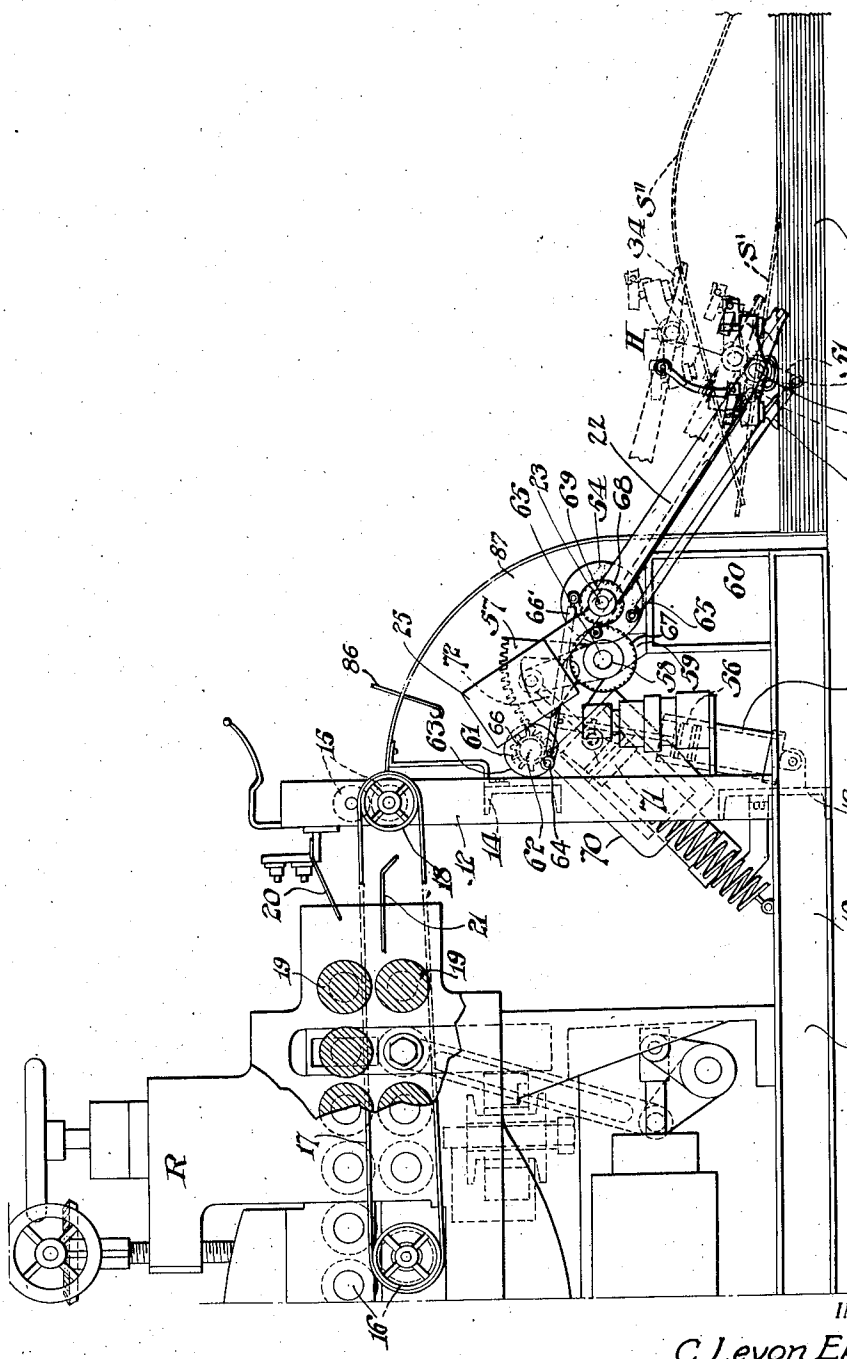


Fig. 2.

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AUTOMATIC FEEDING APPARATUS FOR SHEET METAL WORKING MACHINES

Filed April 3, 1929 6 Sheets-Sheet 3

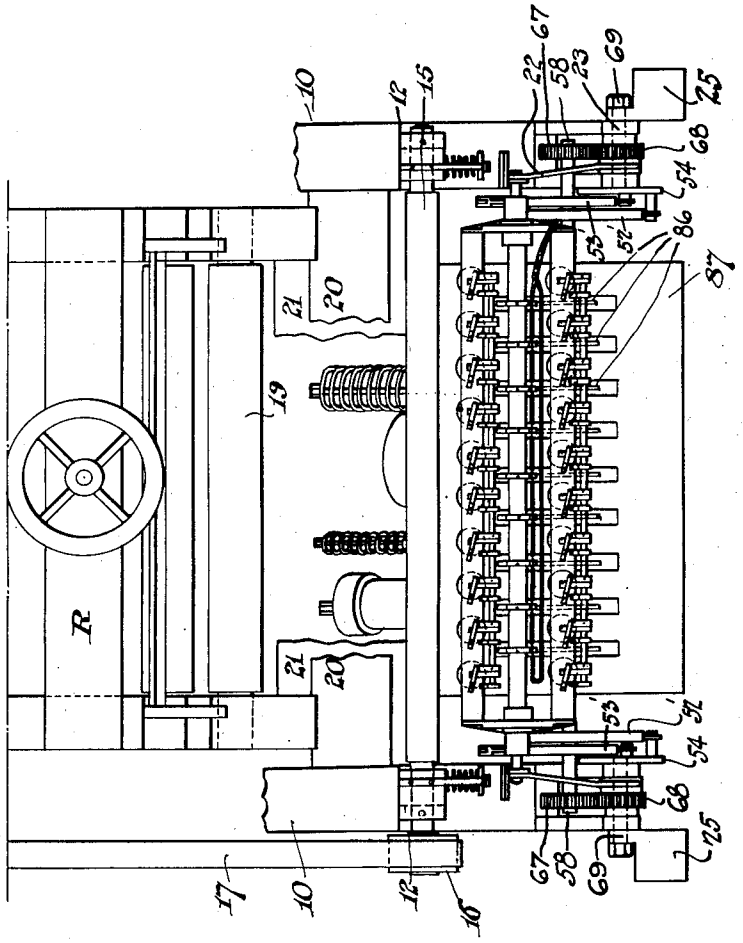


Fig. 3.

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AUTOMATIC FEEDING APPARATUS FOR SHEET METAL WORKING MACHINES

Filed April 3, 1929 6 Sheets-Sheet 4

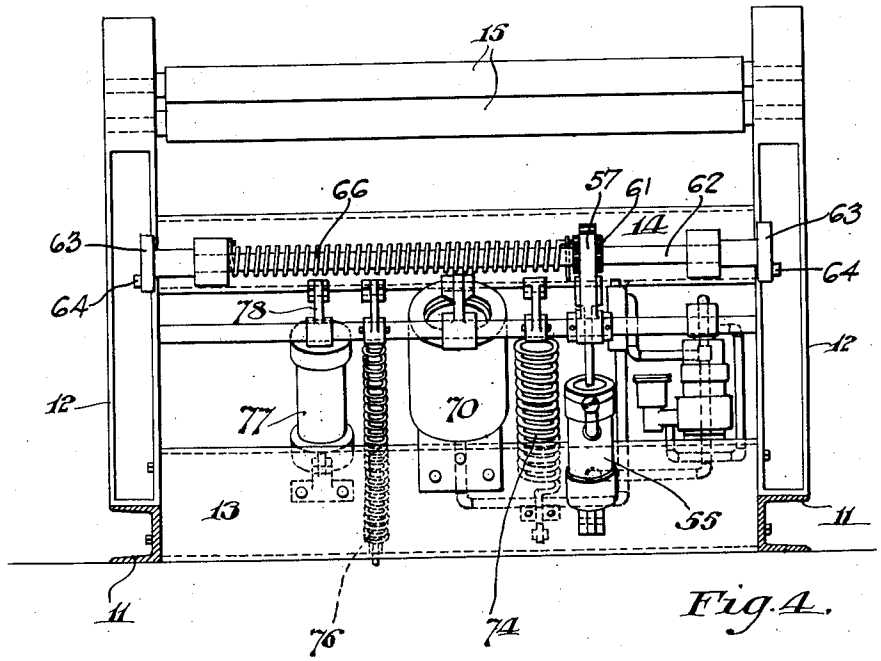


Fig. 4.

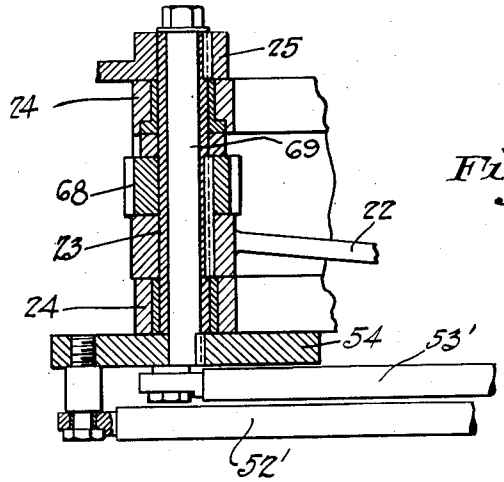


Fig. 6a

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AUTOMATIC FEEDING APPARATUS FOR SHEET METAL WORKING MACHINES

Filed April 3, 1929 6 Sheets-Sheet 5

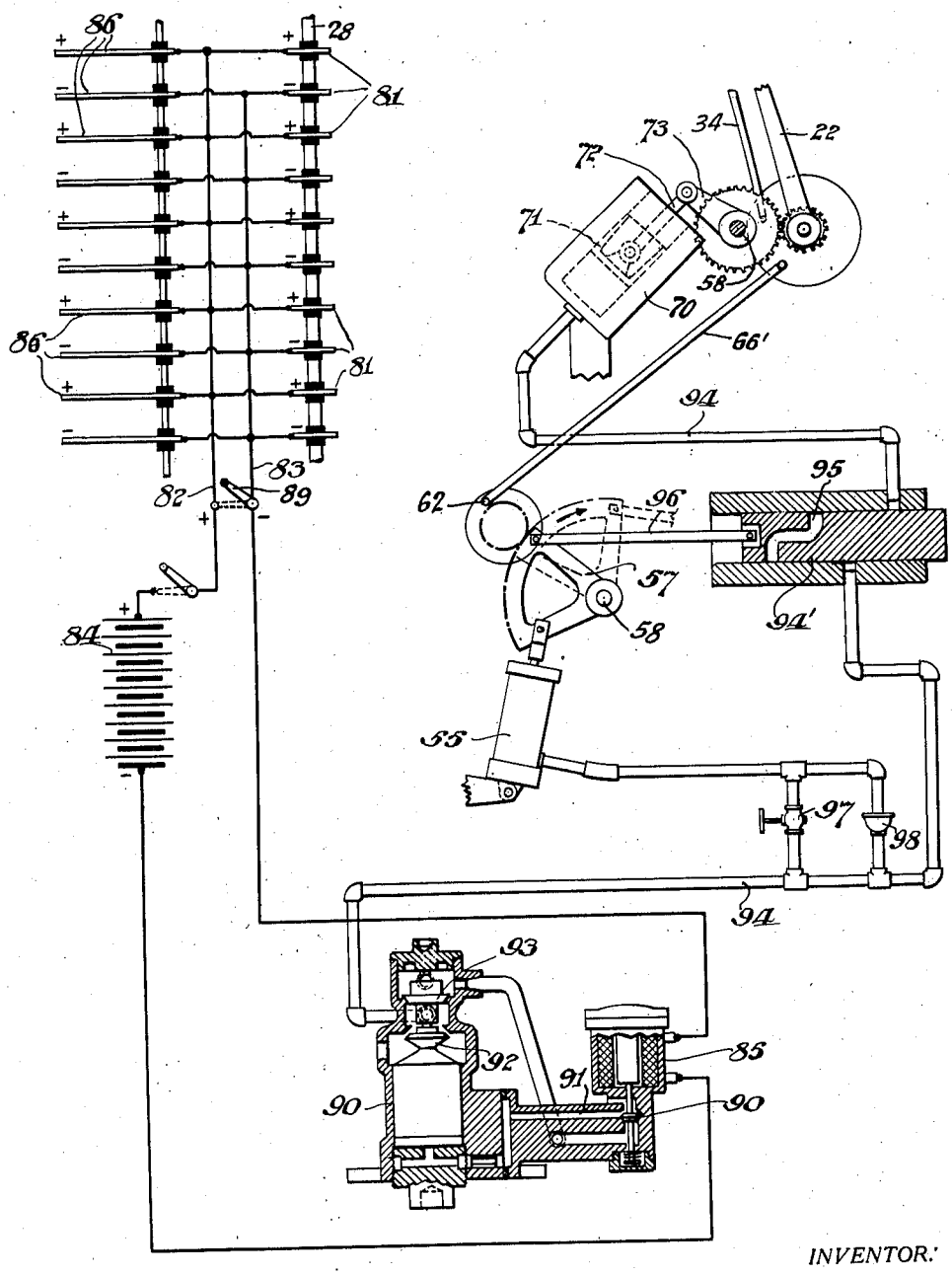


Fig. 5.

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AUTOMATIC FEEDING APPARATUS FOR SHEET METAL WORKING MACHINES

Filed April 3, 1929 6 Sheets-Sheet 6

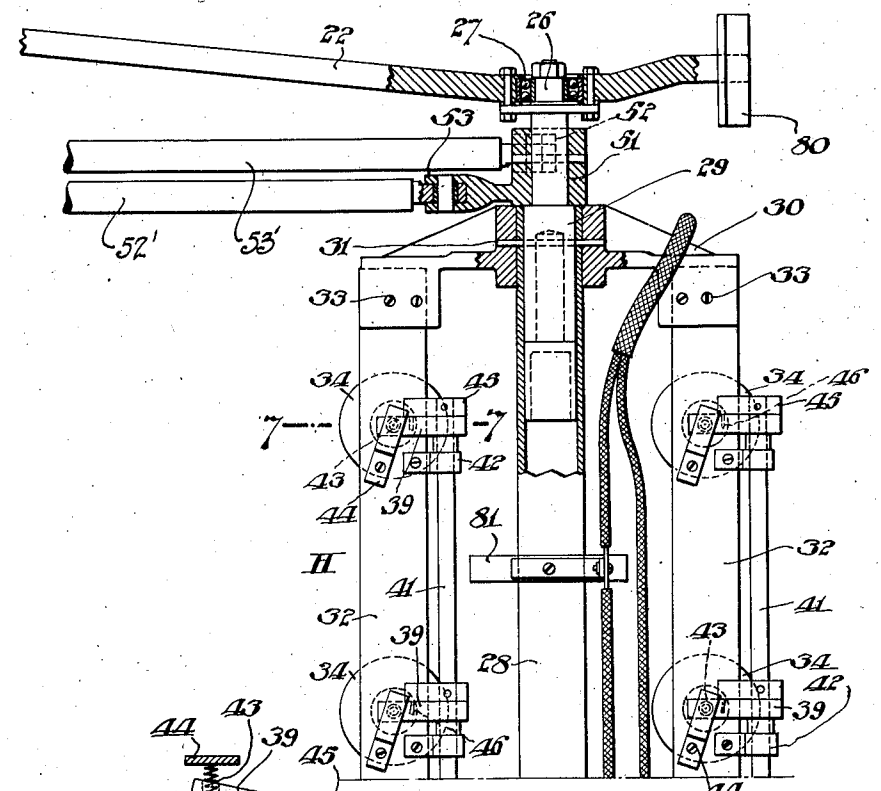


Fig. 6.

Fig. 7.

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Patented July 28, 1931 1,816,319

UNITED STATES PATENT OFFICE

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AUTOMATIC FEEDING APPARATUS FOR SHEET METAL WORKING MACHINES

Application filed April 3, 1929. Serial No. 352,301.

The invention relates to a sheet feeding device, and particularly to such a device adapted to lift thin sheets one at a time from a stack and deliver them into operative relation to the machine being fed.

It is among the objects of my invention to provide such a machine which is automatic in operation, one which can pick up sheets from stacks of varying heights through quite an extensive range of heights, one which, should the sheets stick together, is operative to shake them apart to insure delivery of one sheet at a time, and one which automatically returns its lifting mechanism without completing the full lifting stroke, should the sheet being lifted drop back to the pack during any stage of the lifting stroke.

These and further objects and advantages, which will become apparent as the description proceeds, are attained by the sheet feeding device shown in the accompanying drawings, in which is represented one embodiment of the invention, the operation of which will become apparent when read in connection with the accompanying drawings in which:

Fig. 1 is a view in side elevation of the novel improved sheet feeding device as applied to the feeding of a roller-leveling machine, and showing the lifting mechanism in its raised position.

Fig. 2 is a view similar to Fig. 1, but shows the lifting mechanism in full lines in its fully lowered position, and in dotted lines in two intermediate positions.

Fig. 3 is a plan view of the feeding device with the lifting mechanism shown in the raised position, as in Fig. 1, but with the sheet being fed in that figure removed.

Fig. 4 is a sectional elevation of the device with parts removed to show the motor mechanism.

Fig. 5 is a diagrammatic view of the motor mechanism and electrical control therefor.

Figs. 6 and 7 are detail views of the lifting mechanism, Fig. 7 being a sectional view, taken substantially on the line 7—7 of Fig. 6 through one of the suction cups, the cup being shown inactive in full lines, and actively grasping a sheet in dotted lines.

Fig. 6*a* is a detail view on substantially the same scale as Fig. 6 through the axis of the swinging arm of the lifting mechanism.

In the drawings I have shown my invention applied to the feeding of a roller leveling machine, such as is shown, for example, in the patent for Roller leveler mechanism, No. 1,649,706, granted to G. L. Kelley and C. L. Eksergian on November 15, 1927. It comprises in the present embodiment a framework 10 consisting of longitudinal beams 11, uprights 12, transverse beams 13 and 14 bolted or otherwise secured together to form a rigid framework. Mounted in the upper ends of the uprights 12 are a pair of feed rolls 15 driven from one of the rolls 16 of the roller leveler machine (designated generally by the reference character R) by a belt and pulley connection 16′, 17, 18. Between the feed rolls 15 and the first pair of rolls, the hold-down rolls 19, of the roller leveling machine the sheet may be guided, where considerable space intervenes, by the guide plates 20 and 21, secured, respectively, to brackets on the uprights 12 and to the side frame members of the roller leveler.

It will be understood, however, that it is within the purview of my invention to dispense with the feed rolls 15 altogether, where desired, and to build the feeding device directly on an extension of the frame of the roller leveler R in such close proximity to the hold down rolls 19 thereof that the sheet may be delivered by the lifting device of the feeder directly to the rolls 19.

The lifting mechanism for carrying the sheets one at a time from a stack of sheets S includes in the present embodiment of the invention a pair of lifting arms 22 each pivoted, at 23, in the ears 24 projecting up from a low pedestal erected on the outer ends of the base beams 10. The height of these pedestals and their distance from the feed roll supporting uprights 12 is such that the ends of the arms may have a relatively wide radius of movement, to permit the feeding device to pick up sheets with almost equal ease from an extensive range of heights of stacks. To counterbalance the long arms 22 and the lifting mechanism carried thereby

adjacent their ends, I provide suitable counterweights, as 25.

The lifting mechanism proper consists of a transversely extending lifting head designated generally by H, which is journalled through trunnions 26 adjacent the outer ends of the lifter arms 22 by non-binding anti-friction bearings 27, which permit the free turning of the head H in the arms.

The lifter head comprises a central tube 28 within the ends of which the enlarged inner ends of the trunnion bearing shafts 29 are firmly secured. At the ends of this tube are secured crossheads 30 securely held in place and against rotation relative to the tube 28 and trunnion shafts 29 by pins 31. Since both of these crossheads and their manner of mounting are the same, only one is shown in detail in Fig. 6.

On opposite sides of the tube 28, the crossheads carry the spaced hollow square bars 32, the ends of which fit into corresponding sockets in the ends of the heads and are removably secured by the screws 33. These spaced bars each carry a plurality of suction cups 34, the number and size of which may vary with the character of the sheets being handled.

One of these suction cups is shown in detail in Fig. 7. It is made of rubber or its equivalent, and is held in place by a tube 35 extending through the bar 32 and provided at its lower end with a head 36 embedded in the body of the cup, a passage 37 being provided in said body of the cup establishing communication between the passage in the tube and the hollow of the cup. The cup is drawn securely in place by a nut 38 secured on the upper end of the tube 35, the end of which projects slightly above said nut. The top of the tube 35 is ground or otherwise formed to provide a valve seat, and a hinged valve member 39 carrying a packing 40 in one end thereof in position to fit the valve seat on the tube is loosely pivoted adjacent its other end on an operating shaft 41 mounted in brackets 42 and adapted to operate all the valve members on one bar 32. The valve member 39 is normally pressed to its seat to close the end of the tube by a spring 43 having one end thereof seated in a socket in said member and the other end bearing against a Z-shaped bracket 44 secured to the top of the bar 32.

The valve members are mounted to turn freely on the shaft 41 to insure a proper seating of all of them, but they are all, that is, all those on one bar 32, actuated from said shaft, through short actuator bars 45, pinned to the shaft. One of these bars is associated with each of the valve members 39, and has a pin 46′ projecting laterally therefrom under the member 39. There is sufficient lost motion between these pins and their associated members 39 to insure a proper seating of all the valves when the shaft is in inoperative position. A similar shaft 41 is associated with each bar and they are interconnected to be rotated together and to the same extent for operating all the valves 39 substantially simultaneously.

To this end each shaft is provided with arms 46, 47 pinned thereto and extending in the same direction, these arms being interconnected at equal distances from the axis of the shafts, by a link 48. The arm 46 is extended upwardly, and provided with an anti-friction roller 47′ at its end, this end being adapted to engage a stop 49 secured to the top of one of the uprights 12, which through the continued feeding movement of the carrier arms 22, causes the shafts 41 to be rocked and the valve members 39 to be simultaneously operated to admit air to the suction cups and thus release the sheet carried thereby. The stop member 49 is preferably somewhat yielding so as to permit smooth actuation of the valve mechanism, under all conditions of operation. A tension spring 50 returns the valve operating shafts to inoperative position.

It is necessary and desirable that the lifting head H carrying the cross heads supporting the spaced parallel bars 32 carrying the suction cups be in substantially the same horizontal position when in its raised position delivering the sheet to the feed rolls 15 as it is in its lowered position engaging the top sheet on the stack S.

This condition I achieve by rigidly pinning to the trunnion shaft 29, on an intermediate portion thereof between the adjacent cross head 30 and the trunnion 26 supported in the adjacent lifter arm 22, a bell crank lever 51 having the angularly offset arms 52 and 53. On the same axis with the carrier arm 22 a normally non-rotating disc 54 is carried by the pedestal 29. Points on said disc having the same angular relation as the arms 52 and 53 of the bell crank and spaced from its axis a distance equal to the length of said bell crank arms, are connected to the ends of said bell cranks, respectively, by the parallel connecting rods 52′, 53′. It will be seen that, by this arrangement, as the lifter arms are swung about their pivots to raise and lower the lifter head H, the head will always be maintained substantially horizontal by the lazy tong principle of parallelism, except as will be described hereinafter.

It will be understood, of course, that such a parallel link mechanism is associated with each lifter arm 22.

In the lifting of a sheet from the top of the pack, it sometimes happens, because the steel sheets are usually covered with oil to prevent rust, or from other causes that two sheets will stick together and be peeled together from the stack. To avoid this and to insure the peeling of one sheet at a time, I

provide for a sudden oscillation of the head H of the lifting mechanism on its axis at the beginning of the lifting stroke.

To this end, I have provided mechanism for oscillating the disc 54 through a small arc, and thus, through the connecting rods, the head H carrying the suction cups is likewise oscillated, to give a quick jiggle to the end of the sheet being grasped by the suction cup, which shakes off any other sheet sticking to it and thus facilitates the peeling of the sheet from the stack.

This mechanism I will call the jiggle mechanism. Its prime mover is a compressed air cylinder 55, the piston 56 of which is connected to a gear sector 57 loosely turning on a main shaft 58 journalled in bearings 59 arranged on the pedestals 60. This sector gears with a pinion 61 on shaft 62 carrying discs 63 at its opposite ends. These discs are provided with eccentric pins 64 which are connected with eccentric pins 65 on the respective normally non-rotating discs 54 by connecting rods 66'. Referring to Fig. 2, admission of air to the cylinder 55 operates to the gear sector to turn the shaft 62 a complete revolution thus causing oscillation of the head, successive positions in the oscillation being shown in dotted lines in Fig. 2. A spring 66 wound around the jiggle shaft 62 and secured at one end to the shaft and at the other end to a fixed part of the frame returns the parts to their original position when the air back of the piston in cylinder 55 is released.

At each end thereof the main shaft 58 is provided with a gear 67, each of which meshes with a gear 68 fast on the short hollow shafts 69 to which the lifter arm 22 are secured. The gear ratio is such that the oscillation of the main shaft through a relatively small arc, moves the lifter arms through their range of movement.

For actuating the main shaft in one direction a main air operated cylinder 70 is provided, the piston 71 of which is connected by a connecting rod 72 to an arm 73 secured to the main shaft 58. A spring 74 attached at one end to the arm 75 on the shaft 58 cushions the return of the lifter arms and head to their lowered position after the air back of the piston 71 is released.

Another but lighter spring 76 acting in opposition to spring 74 serves to return the lifter arms and head to their lowered position. The action of the air and springs in both directions is cushioned by an oil cylinder 77, whose piston is connected to the main shaft through an arm 78 on the shaft, to render the movements smoother.

I may additionally cushion the end of the feeding stroke of the lifting mechanism by spring buffers 79 secured to the upper ends of uprights 12, which are adapted to be engaged by the enlargements 80 on the ends of the arms 22. A curved guide plate 87 covers the actuating mechanism, and guides the front end of the sheet between the rolls. This plate may be supported by brackets 88 secured to it and to the uprights 12. The actuation of the device is automatically controlled by electrical devices operated by circuits adapted to be made and broken through engagement or non-engagement of contacts with the sheet being fed.

One series of such contacts comprise a plurality of spring fingers such as finger 81 (Fig. 5) secured to but insulated from the tube 28 of the lifter head and having their resilient ends normally projected below the plane of the suction cups. These contacts are spaced from each other along the tube 28 and are alternately connected to the positive and negative leads 82 and 83 of an electric circuit including a battery 84 and an electromagnet 85 for controlling the air to the air operated jiggle and main cylinders 55 and 70.

Another series of contacts is formed by a plurality of spring fingers 86 supported under the guide plate 87 and insulated from their support. These fingers extend upward and toward the feed rolls adjacent the upper portion of the plate 87 so that the sheet being fed to the rolls, after it is released by the suction cups, drags over them and, since like the contacts 81, the alternate ones of the contacts 86 are connected to the positive and negative leads of the electric circuit, they cooperate with the contacts 81 to keep the circuit closed through the sheet from the moment the suction cups engage the sheet until the sheet has almost passed through the feed rolls.

A main starting and stopping switch 89 is provided in the circuit, this switch being shown in the open position in full lines (Fig. 5) and in dotted lines in the closed position. In addition, I may provide a cut-out switch, which is normally in the full line or open position shown in Fig. 5, but may be thrown to the dotted line position to short circuit the contact fingers, if it is desired to control the feed manually, or if it is desired to hold the lifter arms in raised position when not feeding a sheet.

When the electric circuit is closed, electromagnet 85 operates relay valve 90 to admit air to the pneumatic relay 91 which closes the exhaust valve 92 and opens the air inlet valve 93 and retains it open until the circuit is opened, so that air is continually supplied under pressure to the conduit supplying the jiggle and main air cylinders 55 and 70.

The action of this relay mechanism is entirely similar to that fully disclosed in the patent hereinbefore referred to, and need not be further described.

In the conduit supplying the main cylinder, I insert a slide valve 94' having a tor-

tuous passage 95. This valve normally breaks the continuity of the passage leading the air to the main cylinder 70 but is moved to operative position to complete the continuity of such passage through the tortuous passage 95 by a connection of said slide valve 94′ with the gear sector 57 through a link 96.

The valve 97 is normally open to admit the air to the jiggle cylinder 55, but may be closed if desired when air will be admitted to cylinder through the check valve 98 which prevents return flow of the air, and thus hold the jiggle mechanism out of operation, while permitting the operation of the main cylinder. This may be desirable when the sheets are easily peeled or if the feeder is used in connection with a machine in which the feeding of more than one sheet at a time is not undesirable.

The operation is as follows:—Assuming the arms 22 have just been lowered through the opening of the exhaust port of the relay mechanism and the action of the light return spring 76 to the lowered position, as shown in full lines of Fig. 1. Just prior to the engagement of the suction cups 34 with the sheet, the contacts 81 on the lifter head H engage the sheet and close the circuit, assuming the main starting switch is closed, for operating the relay to supply compressed air to the jiggle cylinder 55. The supply line 94 to the main cylinder is at this time cut off by the slide valve 94′. There is necessarily a momentary delay through the relay mechanism from the time the contacts 81 touch the sheet until the jiggle mechanism is operated, so that the lifter head H carrying the suction cups has full opportunity to descend, and through its momentum press the cups firmly into engagement with the top sheet *s*, as shown in the dotted lines (Fig. 7).

The head is thus firmly attached by the suction of the cups to the top sheet of the stack. The air now forces the piston of the jiggle cylinder outwardly to actuate the jiggle mechanism, which initially lifts the near edge of the sheet *s* to the position approximately indicated by the dotted lines at *s′*, returns the sheet end and head to horizontal, and then tips the head and sheet in the opposite direction, as indicated at *s″* and finally returns the head and sheet to the horizontal. This jiggling action tends to loosen the sheet from the stack causing relative longitudinal movement between it and the remaining sheets, and thus facilitates peeling it from the stack, as now the air is admitted, through a completion of the air passage to the main cylinder by the operation of the valve 94 by the jiggle mechanism, behind the piston of the main cylinder and moves it outward to swing the lifter arms 22 upwardly and toward the feed rolls 15. As the head approaches the feed rolls 15, the edge of the sheet *s* is guided between the rolls which at once draw it forwardly and feed it into the machine. The suction cups maintain their engagement with the sheet and the arms and sheet now move forwardly toward the rolls at the rate at which the sheet is being fed by the rolls. In this movement the upwardly extended arm 46 strikes the stop 49, as indicated in Fig. 1, and the valves 39 are simultaneously actuated through the valve release mechanism to admit air to the cups 34. Before any damage can be done by the sheet being drawn across the faces of the cups, and thus cutting them, the relatively flexible sheet falls away from the full line position shown in Fig. 1 to the dotted line position. Even if, in such dropping away, the contacts 81 are no longer engaged by the sheet, the relay operating circuit is still maintained closed by the contacts 86 which now engage the under side of the sheet, and will continue to so engage it until the sheet is almost wholly drawn between the rolls 15.

When the sheet leaves the contacts 86, the circuit is broken and the air exhaust at the relay mechanism opened, and the arms 22 and lifter head H are automatically returned to their lowered position to pick up the next sheet on the stack.

From the foregoing description it will be seen that the feeding of the sheets will continue automatically one at a time until the stack has been exhausted, and even if a sheet is dropped in the course of lifting it, there will be no material interruption in the feed, for as soon as the sheet is dropped it falls back upon the stack, being guided to it by the curved guide 80′, the circuit is opened, and the lifter arms 22 and head H are at once returned without completing their feed stroke, to again pick up the dropped sheet.

What I claim is:

1. A sheet feeding device, comprising means for transferring a sheet from a stack into a position where it is taken hold of by the machine itself, means for actuating said transfer means, and means controlled by contact of the transfer means with the sheet being fed for rendering said actuating means operative.

2. A sheet feeding device comprising means for lifting a sheet from a stack to present it to the machine being fed, means for actuating said lifting means, and means controlling said actuating means to cause it to automatically permit the lifting means to return to the stack for a sheet prior to the completion of a lifting stroke if the sheet is dropped back to the stack before it has been presented to the machine being fed.

3. A sheet feeding device comprising oscillatory means for gripping the top sheet of a stack at longitudinally spaced points, means for automatically oscillating said means to free its end adjacent the machine being fed from the other sheets, and means rendered

operative by said oscillating means to lift the sheet to present it to the machine being fed.

4. A sheet feeding device comprising sheet gripping means, jiggle means for loosening a sheet from a stack, and means controlled by the jiggle means for permitting the transfer of the sheet by said sheet gripping means to the machine being fed.

5. A sheet feeding device comprising a pair of spaced pivoted transfer arms, an oscillatably mounted head supported adjacent the free ends of said pivoted arms, said head carrying sheet gripping means spaced longitudinally of the sheet, means for oscillating said head after the sheet is gripped for loosening it from a stack, and means causing the movement of said arms transferring the sheet to the machine being fed.

6. A sheet feeding device comprising means for gripping a sheet, means for transferring said gripping means to present the sheet to the machine being fed, said transfer means being controlled by means including the sheet being fed as an element thereof.

7. A sheet feeding device, comprising oscillating feed arms for transferring a sheet from a stack to the machine being fed, means for gripping said sheet at longitudinally spaced points oscillatably mounted in said arms, and means for causing said oscillatable gripping means to pass the sheet into the machine being fed in substantially the same attitude in which it engages the sheet before the transfer and permitting said gripping means to retain engagement with the sheet until said sheet has been completely received for control by the machine.

8. A sheet feeding device comprising means for gripping the sheet at spaced longitudinal points, transfer means for moving said gripping means to present the sheet to the machine being fed, and oscillating means for forcibly impelling an adhering sheet from said first-mentioned sheet, said oscillating means being operable during an intermediate period in the operation of said transfer means, said oscillating means and transfer means being interlocked, whereby to preserve a definite sequence of operations.

9. A sheet feeding device comprising means for gripping a sheet, means for transferring said gripping means to present a sheet to the machine being fed, means for releasing said gripping means for taking control of the sheet and feeding it into the machine being fed before said transfer stroke has been completed, means operative in the continued transfer movement to release the gripping means, and means preventing the return of the gripping means to engage a suceeding sheet, until the first-named sheet has entered the machine being fed a predetermined extent.

10. A sheet feeding device comprising means for gripping a sheet, fluid actuated means for moving said gripping means to transfer a sheet to present it to the machine being fed, and means operable by disengagement of the gripping means with the sheet for returning said gripping means to gripping engagement with a succeeding sheet, and means for cushioning said transfer means at both ends of its stroke.

11. A sheet feeding device comprising a sheet gripping means, means for moving said sheet gripping device upwardly and forwardly to present a sheet to the machine being fed, feeding means for taking control of the sheet from the transfer means, and means for guiding the end of the sheet in said transfer to the feeding means, said guiding means being arranged to guide the sheet to cause it to return into position where it can be again gripped on the return stroke of the gripping means if it is released by the latter before it comes under the control of the feeding means.

12. A sheet feeding device, comprising means for gripping a sheet, means for transferring said gripping means to present a sheet to the machine being fed, means operable by disengagement of the gripping means with the sheet for returning said gripping means to position for engaging a succeeding sheet, means for automatically controlling said transfer means, and means for cutting out said automatic control and controlling the transfer means manually.

13. A sheet feeding device comprising means for transferring a sheet from a stack into position where it is taken hold of by the machine itself, means for actuating said transfer means, and electro-magnetic means controlled by contact of the transfer means with the sheet being fed, for rendering said actuating means operative.

14. A sheet feeding device comprising means for transferring the sheet from a stack into position where it is taken hold of by the machine itself, means for actuating said transfer means, and electro-magnetic means for rendering said actuating means operative, said electro-magnetic means being itself rendered operative by the closing of a circuit through the work, and a contact associated with said transfer means for engaging the work to close said circuit therethrough.

15. A sheet feeding device comprising a sheet gripping means, jiggle means including said sheet gripping means for loosening a sheet from a stack, means for causing said sheet gripping means to transfer said loosened sheet to the machine being fed, and means controlled by the jiggle means for preventing transfer of the sheet by the sheet gripping means until said jiggle means has operated to loosen the sheet from the stack.

16. A sheet feeding device comprising a sheet gripping means, jiggle means including said sheet gripping means for loosening a sheet from a stack, means for causing said

sheet gripping means to transfer said loosened sheet to the machine being fed, and means controlled by the jiggle means for preventing transfer of the sheet by the sheet gripping means until said jiggle means has operated to loosen the sheet from the stack, and electrical means for rendering said transferring means inoperative upon dis-engagement of the sheet by said sheet gripping means.

17. A sheet feeding device comprising a sheet gripping means, jiggle means including said sheet gripping means for loosening a sheet from a stack, means for causing said sheet gripping means to transfer said loosened sheet to the machine being fed, and means controlled by the jiggle means for preventing transfer of the sheet by the sheet gripping means until said jiggle means has operated to loosen the sheet from the stack, and electrical means operable by dis-engagement of the sheet gripping means with the loosened sheet for causing said sheet gripping means to return to the stack to again engage a sheet.

18. A sheet feeding device comprising a sheet gripping means, means for causing said sheet gripping means to engage the top sheet in a stack of sheets and transfer the same to a machine being fed, and means for causing said sheet gripping means to instantaneously recover the top sheet upon disengagement of the same by the sheet gripping means during any portion of the transfer period.

19. A sheet feeding device comprising a sheet gripping means, means for causing said sheet gripping means to engage the top sheet in a stack of sheets and transfer the same to a machine being fed, jiggle means for shaking loose adherent sheets from the top sheet, and means for causing said sheet gripping means to instantaneously recover the top sheet upon dis-engagement of the same by the sheet gripping means during any portion of the transfer period.

20. A sheet feeding device comprising oscillating feed arms for transferring a sheet from a stack to the machine being fed, means for gripping said sheet at longitudinally spaced points oscillatably mounted in said arms, and means for causing said oscillatable gripping means to pass the sheet into the machine being fed in substantially the same attitude in which it engages the sheet before the transfer, and permitting said gripping means to retain engagement with the sheet until said sheet has been completely received for control by the machine, and means for causing said gripping means to return to the stack to engage another sheet upon substantial consummation of the first sheet in the machine.

21. A sheet feeding device comprising means for gripping the sheet at spaced longitudinal points, transfer means for moving said gripping means to present the sheet to the machine being fed, and oscillating means for forcibly impelling an adhering sheet from said first-mentioned sheet, said oscillating means being operable during an intermediate period in the operation of said transfer means.

22. A sheet feeding device comprising a sheet gripping means, means for causing said sheet gripping means to transfer an engaged sheet to the machine being fed, means for forcibly impelling an adherent sheet from the sheet being transferred, said transferring means being substantially uninterrupted in its operation by said impelling means.

In testimony whereof I hereunto affix my signature.

C. LEVON EKSERGIAN.