Jan. 14, 1930. L. C. STEELE 1,743,734

SHEET FEEDING APPARATUS

Filed July 16, 1928 5 Sheets-Sheet 1

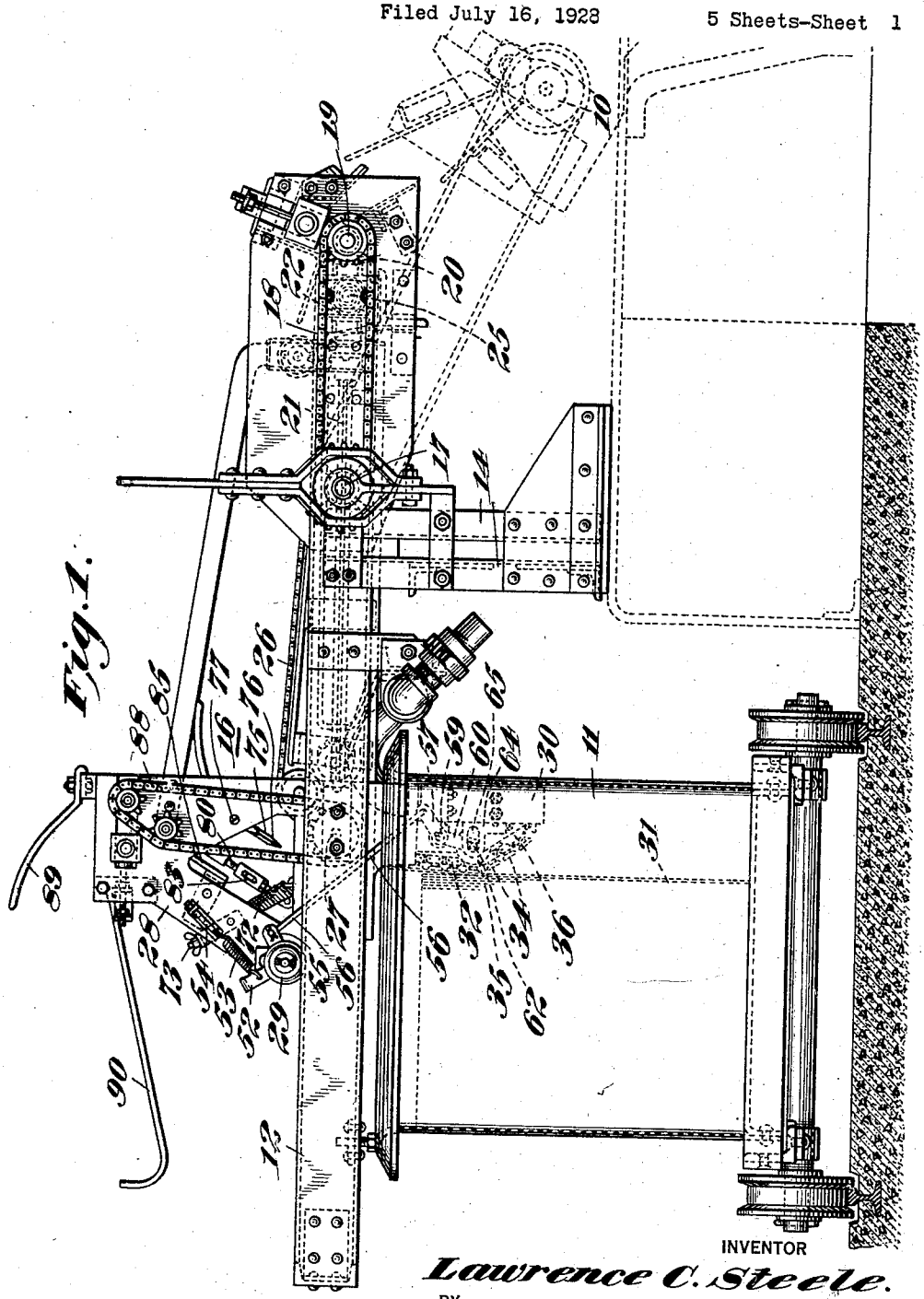


Fig. 1.

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SHEET FEEDING APPARATUS

Filed July 16, 1928 5 Sheets-Sheet 2

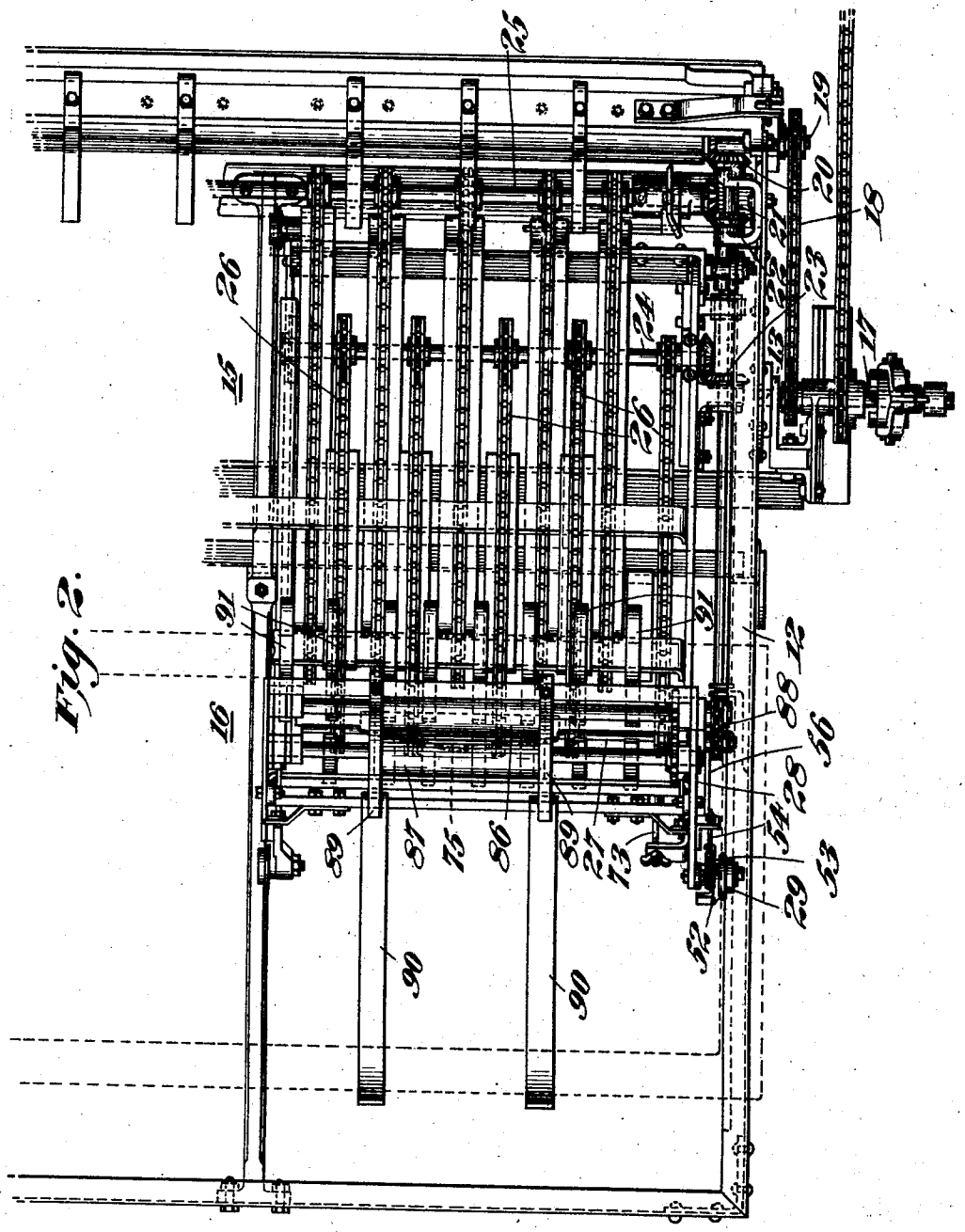


Fig. 2.

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SHEET FEEDING APPARATUS

Filed July 16, 1928 5 Sheets-Sheet 3

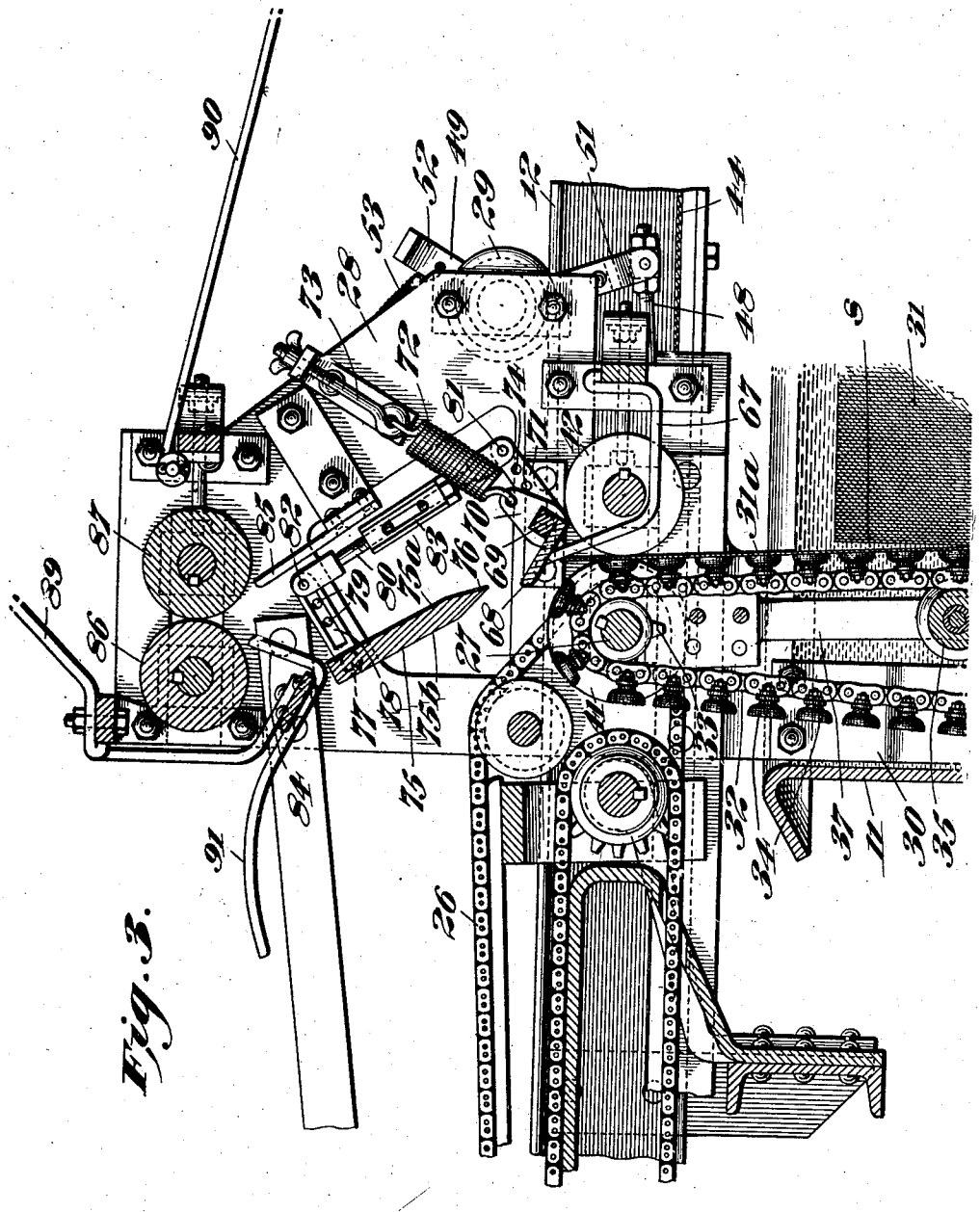


Fig. 3.

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SHEET FEEDING APPARATUS

Filed July 16, 1928 5 Sheets-Sheet 4

Fig. 7.

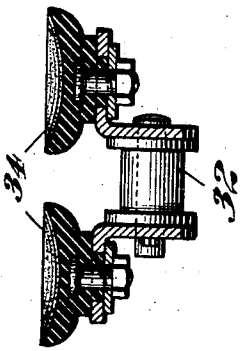


Fig. 9.

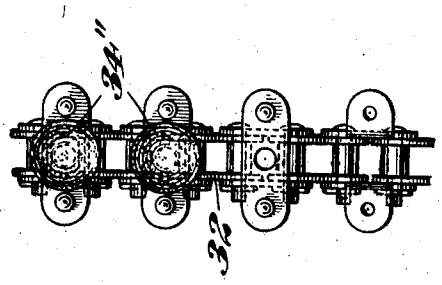


Fig. 8.

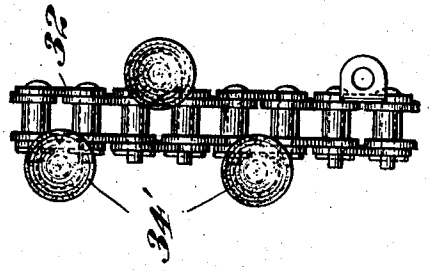


Fig. 6.

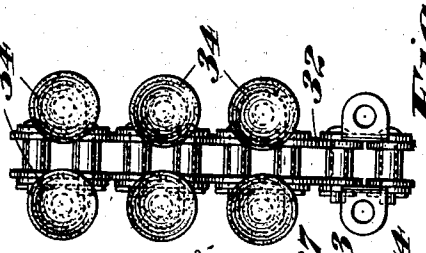
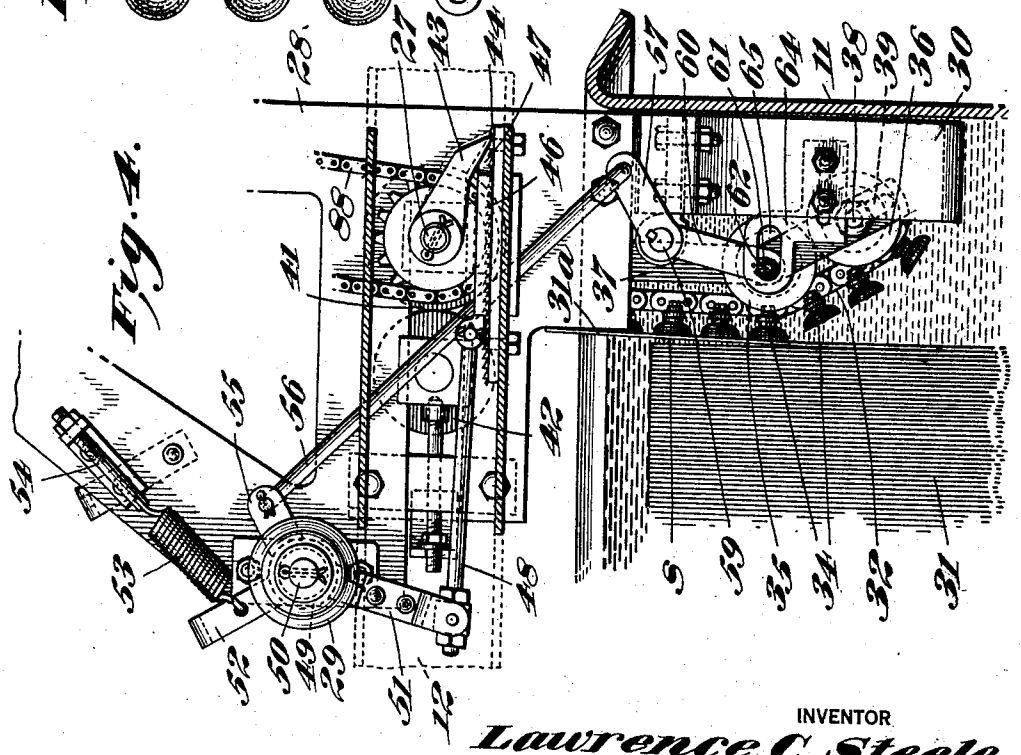


Fig. 4.



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SHEET FEEDING APPARATUS

Filed July 16, 1928 5 Sheets-Sheet 5

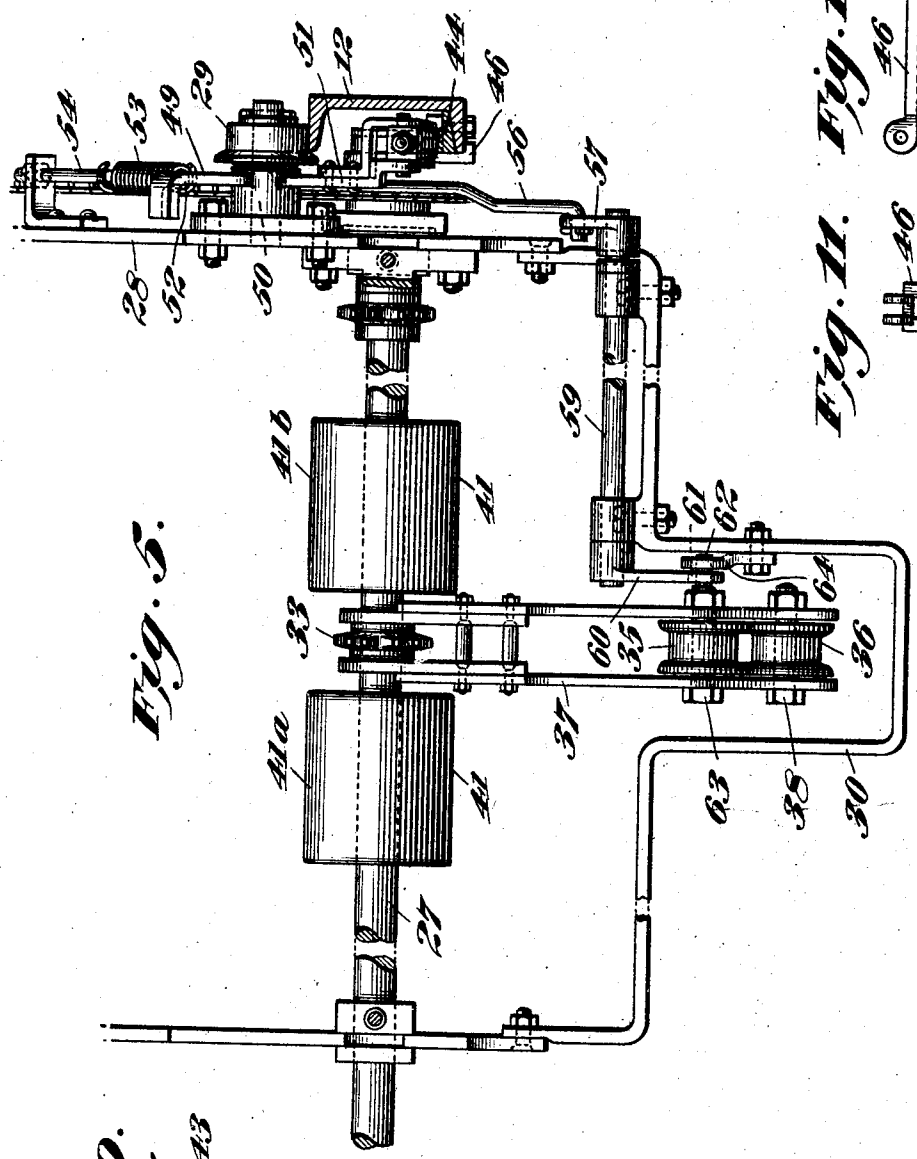


Fig. 5.



Fig. 12.



Fig. 11.

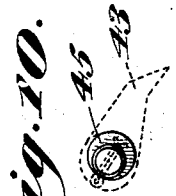


Fig. 10.

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Patented Jan. 14, 1930 1,743,734

UNITED STATES PATENT OFFICE

LAWRENCE C. STEELE, OF BROOKLYN, NEW YORK

SHEET-FEEDING APPARATUS

Application filed July 16, 1928. Serial No. 293,141.

My invention relates to apparatus for removing metallic sheets from a bosh and for feeding them in succession to a tinning machine, the apparatus being of the general type disclosed and claimed in my application, Serial No. 741,664, filed October 4, 1924, and which is characterized by the capabilities of removing sheets directly from a pickler bosh and of feeding them directly to the feed rolls of a tinning machine. An object of my present invention is to provide, in a feed mechanism of this character, an endless chain or belt having vacuum cups extending from the outer surface thereof for engaging and removing sheets in succession from a pack.

A further object of my invention is to provide mechanism for removing sheets from a bosh and feeding them to a tinning machine which incorporates endless belt or chain means having vacuum cups for engaging and removing sheets from a bosh together with pinch roll mechanism located adjacent to the discharge end of the endless belt or chain in order to positively and gradually strip sheets from the vacuum cups.

A further object of my invention is to provide automatic feeding mechanism for the sheet removal apparatus.

These and other objects will be apparent from the following description and accompanying drawings, forming a part of this application, in which:

Fig. 1 is a side elevation showing sheet removal apparatus with my improvement applied thereto;

Fig. 2 is a plan view of apparatus shown in Fig. 1;

Figs. 3 and 4 are detail sectional views of my improvement;

Fig. 5 is a detail view showing means for supporting and adjusting the vacuum cup chain;

Figs. 6, 7, 8 and 9 are detail views showing different types of arrangements of vacuum cups with respect to supporting chains, Fig. 7 being a sectional view taken along the line 7—7 of Fig. 6;

Fig. 10 is a detail view of the feed pawl and its associated eccentric; and

Figs. 11 and 12 are detail views of the pawl lifter.

Referring to the drawings more in detail, in Fig. 1, I show, in dotted lines, inlet feed rolls 10 of a tinning machine together with apparatus for removing sheets from a pickler bosh 11 and feeding such sheets in succession to the rolls 10. This apparatus includes a frame 12 pivoted, at 13, with respect to lateral supports or standards 14, the frame having extensible and contractible conveyor apparatus, at 15, as set forth in my application aforesaid, and my improved sheet removal apparatus, at 16. The chains of the extensible and contractible conveyor, at 15, and the moving parts of the sheet removal apparatus, at 16, receive power from a power shaft 17, the latter shaft being connected by means of sprocket gearing 18 to a shaft 19, which is connected, by means of bevel gearing 20, to a shaft 21, the latter shaft being connected by bevel gearing, at 22 and 23, to the cross shafts 24 and 25, respectively, the latter shafts being the power shafts of the telescopic conveyors. The power shaft 24 is connected by sprocket gearing 26 to the power shaft 27 of the sheet removal apparatus.

Referring now to the sheet removal and feeding apparatus, at 16, this constituting the subject matter of my present invention, it will be seen that this apparatus consists of a carriage 28 supported by rollers 29, the latter resting on side members of the frame 12. The carriage 28 is provided with a depending portion 30 which is adapted to extend within the pickler bosh 11 between one side thereof and a pack of sheets 31 arranged therein. The carriage 28 has the power shaft 27 journaled therein and it supports the sheet adhering and removal means, deflector apparatus responsive to resistance to flexure

whereby the feeding of doubled sheets or sheets which are too stiff to the tinning machine may be avoided, and automatic feeding mechanism actuated from the power shaft 27 for feeding the carriage toward the pack.

Referring to the sheet adhering and removal apparatus, this consists essentially of an endless belt or sprocket chain 32 engaging over a sprocket wheel 33 carried by the shaft 27 and vacuum cups 34, which extend outwardly from the outer surface of the belt or chain 32. In order that a part of the chain may be presented as a portion moving in a rectilinear path in front of the pack and in order that the cups may be urged toward the pack, I show the lower portion of the chain 32 passing over idler sheaves 35 and 36, the sheaves 35 and 36 being carried by a frame 37 suspended from and capable of moving angularly with respect to the power shaft 27. The sheave 35 is arranged above the sheave 36 and forwardly of the latter so as to define a rectilinear and upwardly moving portion of the chain which is so related with respect to the sheets of the pack 31 as to secure proper removal thereof. The lower sheave 36 is carried by an axle bolt 38 which may be adjusted in the slots 39 in order to secure proper adjustment of the chain 32.

To strip the sheets from the vacuum cups 34 and referring to Fig. 3, it will be seen that pinch rolls 41 and 42 are disposed adjacent to the upper end of the chain 32, the pinch roll 41 being made in two parts 41^a and 41^b, carried by the power shaft 27, and disposed at opposite sides of the driving sprocket 33 for the vacuum cup chain. The rolls 41 and 42 are arranged to strip an adhering sheet, 31^a in Fig. 3, from the vacuum cups and to feed the latter either to the deflector or to the conveyor apparatus. The driving roll 41 is of a radius greater than the maximum radius of the outermost portions of the vacuum cups 34 moving angularly with respect to the shaft 27 so that, as a sheet comes up, the upper edge thereof first contacts with the peripheries of the rolls 41^a and 42; and, since the latter sections are of greater radius than the radius of a cup with respect to the axis of the shaft 27, such sections tend to urge the plate rearwardly toward the bite of the rolls 41 and 42, thereby starting the stripping action and facilitating the removal and upward feeding of sheets by the pinch rolls 41 and 42.

Mechanism is provided for maintaining the sheet removing apparatus in operative relationship to the pack. This mechanism includes means for feeding the carriage relative to frame 12 as the sheets are removed from the pack, and also means for preventing the feeding action becoming excessive. The purpose, of course, is to maintain such a relationship between chain 32 and the pack 31 that the vacuum cups may be brought against the pack with sufficient pressure and yet not have it become excessive. To this end I provide an operatively driven feeding mechanism actuated from the power shaft 27, with means for occasionally interrupting the feeding action to prevent the movement of the carriage becoming excessive. Referring to Fig. 4, it will be seen that the drive shaft 27 is operatively related to a pawl 43 which engages with a rachet rack 44 carried by the frame 12. As shown in Fig. 10, the drive shaft 27 has an eccentric 45 mounted thereon which engages in a bearing carried by the pawl 43. With this arrangement, rotation of the drive shaft 27 results in reciprocatory actuation of the pawl 43; and, if the latter engages with the stationary rachet teeth 44, such pawl serves to impart forward feeding motion to the carriage 28 and toward the pack.

To automatically interrupt the forward feed of carriage 28 when it has proceeded to the desired extent, advantage is taken of the angular movement of frame 37 with respect to shaft 27; this relative angular movement being due to the pack 31 preventing the forward movement of frame 37 while frame 28 is being moved forward.

The pawl 43 is lifted to an inoperative position with respect to the ratchet teeth 44 in response to movement of the frame 37 angularly with respect to the shaft 27, such angular movement being resisted by a spring, or other suitable energy storage device, so that the resistance of such energy storage device not only controls the maximum pressure of the cups against the sheets but also serves as a source of energy to maintain engagement of such cups under pressure with the sheets during the intervals when the pawl is lifted.

Referring to Figs. 4, 11 and 12, it will be seen that a pawl lifter 46 is provided with an inclined lifter portion 47 for lifting the pawl 43 out of engagement with the ratchet teeth 44. This pawl lifter is operatively connected by means of a link 48 to a three-arm lever 49 pivoted at 50 on carriage 28, the link 48 engaging with the arm 51 thereof. The lever 49 has an arm 52 attached to one end of a spring 53, the other end of the spring 53 being connected to any suitable tension varying device 54. The third arm 55 of the lever construction 49 is connected, by means of a link 56, to a crank arm 57 carried by the shaft 59 (see Fig. 5) which has connected to its other end a crank arm 60 having a slot 61 therein for engagement about the pintle or extension 62 preferably extending from one end of the axle bolt 63 for holding the sheave 35 in place. In order to positively limit movement of the frame 37 and to properly hold the associated apparatus in position, I show a stationary adjustable bracket 64 connected to the depending portion 30 and hav-

ing an oblong slot 65 therein for engagement about the pintle or projection 62.

Assuming that the carriage 28 is being fed forward by engagement of the pawl 43 with the rachet teeth 44, and that the vacuum cups 34 are in initial engagement with sheets of the pack 31, such feeding motion will result in an increase in pressure of the cups against sheets of the pack. As the carriage 28 moves forwardly the resistance to movement of frame 37 produces a relative angular movement between them thereby producing a tilting of shaft 59 in a counter-clockwise direction, as viewed in Fig. 4, with resulting counter-clockwise movement of members 57 and 49. This of course results in spring 53 being placed under tension. When the tilting motions just referred to proceed to a predetermined angular extent the arm 51 will actuate the link 48 so as to move the pawl lifter 46 to such a position as to lift the pawl 43 out of engagement with the rachet teeth 44 thereby interrupting forward feeding of carriage 28. Obviously spring 53, being under tension, will maintain the pressure of cups 34 with the pack of tin plates. As the plates are removed and the thickness of the pack thereby lessened frame 37 will move forwardly, permitting spring 53 to produce a clockwise movement of lever 49 and a resulting gradual movement of link 48 and pawl lifter 46 out of its lifting engagement with pawl 43, whereby this pawl is again brought into feeding engagement with rachet teeth 44 to resume the forward feed of carriage 28.

Thus there is secured an intermittent feed of the carriage; the feeding movement continuing until the pressure of the cups on the pack reaches a certain amount, the feeding then being interrupted until the pressure has again dropped to the desired extent when the feeding action will again continue, and so on.

With apparatus of this character, it is desirable that the feeding of doubled sheets, sheets which are too thick, or sheets which are too hard or stiff shall be avoided. To this end, I provide on the carriage 28, and arranged above the pinch rolls 41 and 42, sheet deflector apparatus of the general type disclosed and claimed in my application, Serial No. 705,407, filed April 9, 1924. This apparatus includes a flexure responsive deflector plate 68 carried by an angularly movable shaft 69, the latter shaft having connected thereto lever arms 70 and 71 and a spring 72 having one end connected to the arm 70 while its other end is connected to any suitable tension varying means 73, the spring being effective to maintain the plate 68 in a position engaging the outer end of the stationary deflector 67, as indicated in Fig. 3. Arranged above and forwardly of the flexure responsive plate 68, there is a switch plate 75 having a sharp edge 76 and pivotally mounted at 77, the edge 76 and the leaving edge of the flexure responsive plate 68 being spaced apart and adapted for relative movement simultaneously in opposite directions. A crank arm 78 is connected to the switch plate 75, this arm being provided with a plurality of openings 79 arranged at different radial distances from the axis of the pivotal support 77. In like manner, the crank arm 71 is provided with a plurality of openings 74 arranged at different radial distances from the axis of the shaft 69. A variable length link 80 is adapted to be connected between the levers 71 and 78, the link having pins 81 and 82 to fit, respectively, in the openings 74 and 79 and having an intermediate turnbuckle 83 whereby its length may be varied.

As each sheet, for example, sheet 31[a] in Fig. 3, passes upwardly from the pinch rolls 41 and 42, it engages the stationary deflector 67, whereby it is given a slight deflection toward the conveyor apparatus and engages the movable deflector or flexure responsive plate 68. If a sheet offers sufficient resistance to flexure to initially overcome the spring 72, the deflector or flexure responsive plate 68 tilts backwardly, the spring 72 offering increased resistance as tilting proceeds. Due to the connecting linkage between the deflector or flexure responsive plate 68 and the switch plate 75, whenever the plate 68 moves angularly, the opposed edges of the plates 68 and 75 move in opposite directions. Hence, if the deflector or flexure responsive plate 68 moves sufficiently in a clockwise direction that a sheet is deflected on to the back surface 75[a] of the switch plate 75, such a sheet then passes along the back surface 75[a] and is directed by the stationary guides 84 and 85 into the bite of the rolls 86 and 87, the roll 86 being driven by sprocket gearing 88 from a shaft 27. After leaving the rolls 86 and 87 a sheet is deflected by the curved deflector 89 on to the catcher 90 from which sheets may be removed from time to time as desired. Should relative movement of the adjacent edges of the deflector or flexure responsive plate 68 and of the switch plate 75 not be great enough to direct sheets to the rolls 86 and 87, then such sheets will pass by the forward face 75[b] of the switch plate and be directed by the curved deflector 91 on to the conveyor apparatus by which they are carried to the tinning machine.

By adjusting the spring 72, the plate 68 may be rendered quite sensitive to flexure resistances; and, due to the linkage connection between the plates 68 and 75, any suitable ratio of angular movements of these plates may be had. Also, as the deflector or flexure responsive plate 68 is located quite near to the pinch rolls 41 and 42, the effect of the moment arm between the plate 68 and the bite of the pinch rolls is not very great and resistance to flexure therefore operates to

the best advantage to secure movement of the plate 68. With this arrangement of apparatus and by making proper adjustments of tension of the spring 72 and of the linkage between the flexure responsive deflector plate 68 and the switch plate 75, the maximum flexure resistance of plates fed to the tinning machine may be very accurately controlled and the discard of double plates or plates too thick or too stiff assured.

In the apparatus shown by the drawings, a single chain 32 is employed having vacuum cups 34 arranged thereon for engagement substantially medially of the plates of a pack. Any suitable arrangement of vacuum cups on the chain may be employed. In Figs. 6 and 7, I show pairs of vacuum cups 34 arranged in opposed relation and carried by the sides of the chain. In Fig. 8, cups 34' are carried at each side of the chain but they are staggered. In Fig. 9, a single row of cups 34'' is disposed substantially centrally of the chain.

An important feature of my invention is the disposal of the endless carrier with its vacuum cups in such a manner relative to the pack that the rectilinear path of feed of the plates from the pack is somewhat inclined to the face of the pack. As shown in Figs. 1, 3 and 4, sheave 35 is somewhat in advance of sprocket wheel 33, as a result of which the path taken by chain 32 between the sheave 35 and sprocket 33 is somewhat inclined to the face of the pack. As the chain moves over sheave 35 the suction cups successively engage the outermost sheet of the pack, passing forwardly in a straight path carrying the sheets. This rectilinear path being inclined to the face of the pack the upward movement of the chain with its suction cups gradually deflects the plate from the path, the space between the outermost plate and the pack gradually widening upwardly of the pack. This arrangement gives a distinct advantage. The space between the fed plate and the pack allows the entry of fluid therebetween. This greatly reduces the friction between the plate being removed and the pack, allowing the fed plate to be slipped easily from the pack and to be carried therefrom by the carrier.

From the foregoing, it will be apparent that I have provided apparatus for removing sheets from a pack which consists of a carriage movable transversely of the pack, the carriage being provided with sheet removal means capable of angular displacement relatively thereto, angular displacement of the sheet removal means taking place due to operation of the feed mechanism for the carriage, and such angular motion resulting in the storage of energy in a spring and, after it has proceeded to a predetermined extent, rendering the feed mechanism ineffective, whereupon the spring means is then effective to move the sheet removal means angularly in the other direction to maintain contact with the sheets of a pack until it is displaced relatively to the carriage to such a position that the feed mechanism is again rendered effective.

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

1. In mechanism for removing sheets from a pack to a metal coating machine, the combination of a carrier movable in a rectilinear path which is in a direction crosswise of the face of the pack and inclined thereto, and vacuum cups carried by and projecting laterally of the carrier and disposed in a series lengthwise of the path of movement of the carrier for successively engaging the sheets of the pack.

2. In mechanism for removing sheets from a pack to a metal coating machine, the combination of an endless carrier having a portion thereof arranged to move in a path having a direction crosswise of the face of the pack and inclined thereto, vacuum cup means on the carrier for successive engagement with sheets of the pack, means for operating the carrier to secure successive withdrawal of sheets from the pack, and means for moving the endless carrier toward the pack to maintain engagement of the vacuum cups with sheets thereof.

3. In mechanism for removing sheets from a pack to a metal coating machine, the combination of a support movable toward and from the pack, an endless carrier carried by the support and having a portion thereof arranged to travel in a path having a direction crosswise of the face of the pack and inclined thereto, vacuum cups carried by the endless carrier for engagement with sheets of the pack, means for operating the endless carrier to secure successive withdrawal of sheets from the pack by the vacuum cups, and means for moving the support to secure continuous engagement of the vacuum cups with sheets of the pack.

4. In mechanism for removing sheets from a pack to a metal coating machine, the combination of a carrier movable in a rectilinear path which is in a direction crosswise of the face of the pack, and vacuum cups carried by and projecting laterally of the carrier and disposed in a series lengthwise of the path of movement of the carrier for successively engaging the sheets of the pack.

5. In mechanism for removing sheets from a pack to a metal coating machine, the combination of a carrier movable in a rectilinear path which is in a direction crosswise of the face of the pack, a plurality of vacuum cups carried by the carrier for successive engagement with sheets of the pack, and means for moving the carrier toward the pack for

maintaining engagement of the vacuum cups with sheets thereof.

6. In mechanism for removing sheets from a pack to a metal coating machine, the combination of an endless carrier having a portion thereof arranged to move in a rectilinear path in a direction crosswise of the face of the pack and vacuum cups carried by the endless carrier and projecting laterally of the latter for successive engagement with sheets of the pack.

7. In mechanism for removing sheets from a pack to a metal coating machine, the combination of an endless carrier having a portion thereof arranged to travel in a path having a direction crosswise of the face of the pack, vacuum cup means on the carrier for successive engagement with sheets of the pack, means for operating the carrier to secure successive withdrawal of sheets from the pack, and means for moving the endless carrier toward the pack to maintain engagement of the vacuum cups with sheets thereof.

8. In mechanism for removing sheets from a pack to a metal coating machine, the combination of a support movable toward and from the pack, an endless carrier carried by the support and having a portion thereof arranged to travel in a path having a direction crosswise to the face of the pack, vacuum cups carried by the endless carrier for engagement with sheets of the pack, means for operating the endless carrier to secure successive withdrawal of sheets from the pack by the vacuum cups, and means for moving the support to secure continuous engagement of the vacuum cups with sheets of the pack.

9. In mechanism for removing sheets from a pack to a metal coating machine, the combination of a movable support, a drive shaft journaled therein, a sprocket wheel carried by the drive shaft, a guide wheel carried by the support and co-planar with the sprocket wheel, a sprocket chain engaging the sprocket wheel and passing over the guide wheel, vacuum cups carried by the chain, and means for moving the support.

10. In mechanism for removing sheets from a pack, the combination of a carriage, endless belt means having a portion thereof movable transversely of the path of movement of the carriage and substantially parallel to sheets of the pack, vacuum cups carried by the endless belt means, an adjusting idler engaging the endless belt means, and means for adjusting the idler.

11. In a device for removing and feeding sheets from a bosh to a tinning machine, the combination of guideways, a carriage movable along the guideways and having a portion adapted to depend within a bosh, endless belt means supported by the carriage, driving means carried by the carriage and engaging the endless belt means for operating the latter, guide wheel means carried by the depending portion and engaging the endless belt means in order that a portion of the latter may be caused to move in a path substantially parallel to sheets of the pack, vacuum cups carried by the endless belt means for engagement with sheets of the pack to secure successive withdrawal thereof, and means operated by the drive shaft to feed the carriage in a direction to maintain engagement of the vacuum cups with sheets of the pack.

12. In a device for removing sheets from a bosh and feeding them in succession to a tinning machine, the combination of a carriage having a portion adapted to depend within a bosh, a drive shaft carried by the carriage, endless carrier operated by the drive shaft, guide means for the endless carrier and carried by the depending portion for maintaining a portion of the endless carrier in a path extending in a direction crosswise of the face of the pack, vacuum cups carried by the endless carrier, and pinch rolls operated by the drive shaft for removing sheets adhering to the vacuum cups

13. In a device for removing metallic sheets from a pack resting on edge in a bosh and feeding the sheets to a tinning machine, the combination of a frame pivoted adjacent to the feed rolls of a tinning machine and having guideways extending outwardly therefrom, a carriage carried by the guideways and having a portion adapted to depend therefrom into a bosh, a drive shaft carried by the carriage, a sprocket wheel connected to the drive shaft, guide wheel means co-planar with the sprocket wheel and carried by the depending portion of the carriage, a sprocket chain engaging the sprocket wheel and passing over the guide wheel means, vacuum cups carried by the sprocket chain for engagement with sheets of a pack, pinch roll means operated by the drive shaft for removing sheets adhering to the vacuum cups, and means operated by the drive shaft for feeding the carriage toward the pack as sheets thereof are removed.

14. In a device for removing sheets from a pack to a metal coating machine, the combination of a carrier having a portion movable in a rectilinear path having a direction crosswise of the pack, adhesion means carried by the carrier adhesively engageable with one side of a sheet to carry the same, and means for stripping sheets from the adhesion means.

15. In a device for removing sheets from a pack, the combination of a drive shaft, a driving wheel carried thereby, belt means engaging the driving wheel, guide means for distending the belt means and cooperating with the driving wheel to provide a belt portion movable substantially parallel to the pack, adhesion means carried by the belt means, and roll means carried by the drive shaft at opposite sides of said drive wheel, said roll means being of greater radius than the radius of the outermost portions of said

adhesion means with respect to the drive shaft when said belt means and adhesion means move in a curved path about said drive wheel.

16. In a device for removing sheets from a pack, the combination of a drive shaft, a sprocket wheel carried thereby, a sprocket chain engaging the sprocket wheel, guide means for distending the sprocket chain and cooperating with the sprocket wheel to provide a chain portion movable substantially parallel to the pack, vacuum cups carried by the chain, and roll means carried by the drive shaft at opposite sides of said sprocket wheel, said roll means being of greater radius than the radius of the outermost portions of the vacuum cups with respect to the axis of the drive shaft when the cups move in a curved path about the sprocket wheel.

17. In a device for removing sheets from a pack, the combination of a driving shaft, a sprocket wheel carried thereby, a sprocket chain engaging the sprocket wheel, guide means for distending the sprocket chain and cooperating with the sprocket wheel to provide a chain portion movable substantially parallel to the pack, vacuum cups carried by the chain, roll means carried by the drive shaft at opposite sides of said sprocket wheel, said roll means being of greater radius than the radius of the outermost portions of the vacuum cups with respect to the axis of the drive shaft when the vacuum cups move in a curved path about the sprocket wheel, and second roll means engaged by the first roll means.

18. In a device for removing sheets from a pack, the combination of movable adhesion means, means for feeding the adhesion means in a direction transversely of the pack, and means responsive to displacement of the adhesion means relatively to the feeding means beyond a predetermined extent and in a direction transversely of the pack for rendering the feeding means ineffective.

19. In a device for removing sheets from a pack, the combination of a carriage movable transversely of the pack, movable adhesion means on the carriage for engaging sheets of the pack in succession for removing them, said adhesion means including a part movable relatively to the carriage, feed mechanism for the carriage, and means responsive to relative movement of said part of the adhesion means with respect to the carriage beyond a predetermined extent for rendering the feed mechanism ineffective.

20. In a device for removing sheets from a pack, the combination of movable adhesion means for removing sheets from the pack in succession, energy-storage means for maintaining engagement of the adhesion means with sheets of the pack, feed mechanism for feeding the adhesion means toward the pack and for supplying energy to the storage means in consequence of movement of the adhesion means relative to the feed mechanism brought about by resistance to movement of the adhesion means by the pack in the direction of feeding, and means responsive to said relative movement beyond a predetermined extent for rendering the feed mechanism ineffective.

21. In a device for removing sheets from a pack, the combination of a carriage, movable adhesion means on the carriage for removing sheets from the pack, energy-storage means tending to cause movement of the adhesion means relatively to the carriage toward the pack for maintaining engagement of the adhesion means with sheets thereof, feed mechanism for feeding the carriage toward the pack and for supplying energy to the storage means in consequence of movement of the adhesion means relatively to the carriage due to feed motion imparted to the latter, and means responsive to said relative movement beyond a predetermined extent for rendering the feed mechanism ineffective.

22. In a device for removing sheets from a pack, the combination of a carriage, movable adhesion means on the carriage for removing sheets from the pack, a spring tending to cause movement of the adhesion means relatively to the carriage and toward the pack to maintain engagement of the adhesion means with sheets thereof, feed mechanism for feeding the carriage toward the pack and for storing energy in said spring due to relative movement taking place between the carriage and the adhesion means due to the engagement of the latter with the pack, and means responsive to said relative movement beyond a predetermined extent for rendering the feed mechanism ineffective.

23. In a device for removing sheets from a pack, the combination of guideways extending transversely of the pack, a carriage supported by the guideways, adhesion means on the carriage for removing sheets from the pack and capable of displacement relative to the carriage, rachet rack means carried by one of the guideways, a reciprocatory pawl on the carriage and adapted to engage the rachet rack, means for operating the pawl simultaneously with operation of the adhesion means, a lifter for the pawl, and means responsive to displacement of the adhesion means relatively to the carriage for storing energy in the spring device and for rendering the pawl lifter effective.

24. In a feeding device for removing sheets from a pack resting on edge in a receptacle, the combination of a carriage movable transversely of the pack, a driving shaft journaled on the carriage, a sprocket wheel carried by the shaft, a sprocket chain engaging the sprocket wheel, guide means for maintaining the sprocket chain distended with a portion thereof substantially parallel to the pack and angularly movable with respect to

the carriage, yieldable means cooperating with the guide means and tending to move the chain toward the pack, vacuum cups carried by the chain for engagement with sheets of the pack, feed mechanism for feeding the carriage toward the pack, and means responsive to angular movement of the guide means relatively to the carriage to a predetermined extent to render the feed mechanism ineffective.

In testimony whereof I hereunto affix my signature.

LAWRENCE C. STEELE.