United States Patent [19]

Wiig et al.

[11] **3,802,699**

[45] **Apr. 9, 1974**

[54] **CONVEYING APPARATUS WITH OVERLAPPING MEANS FOR STACKING PURPOSES**

[75] Inventors: **Chester M. Wiig,** Lincolnwood; **Edward Poczatek,** Norridge; **Earl L. Valin,** Chicago, all of Ill.

[73] Assignee: **F. J. Littell Machine Company,** Chicago, Ill.

[22] Filed: **Mar. 22, 1971**

[21] Appl. No.: **126,663**

[52] **U.S. Cl.** **271/64,** 271/197, 271/202, 271/209

[51] **Int. Cl.** **B65h 29/60**

[58] **Field of Search** 271/64, 76, 74, 75, 46, 271/86; 83/88

[56] **References Cited**

UNITED STATES PATENTS

346,411	7/1886	Metzger et al.	271/75
3,096,978	7/1963	Jendrusch	271/46
3,218,897	11/1965	Geigenmiller et al.	271/64 X
3,322,424	5/1967	Taylor	271/76 X
3,536,323	10/1970	Turner	271/74

FOREIGN PATENTS OR APPLICATIONS

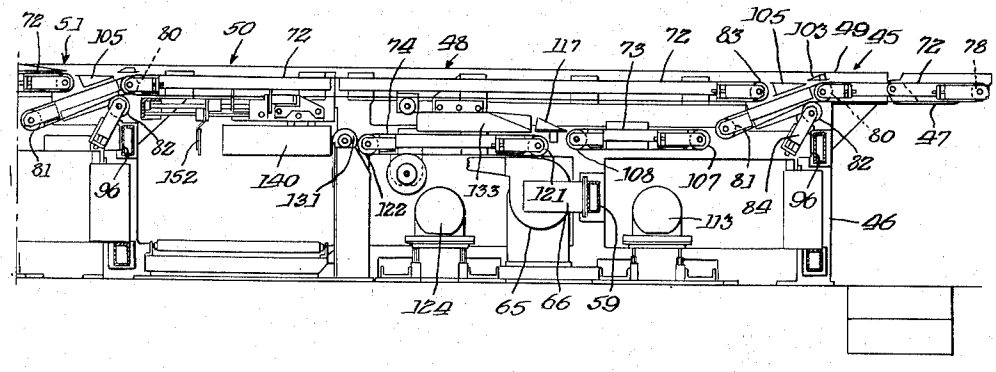
542,244	12/1931	Germany	83/88

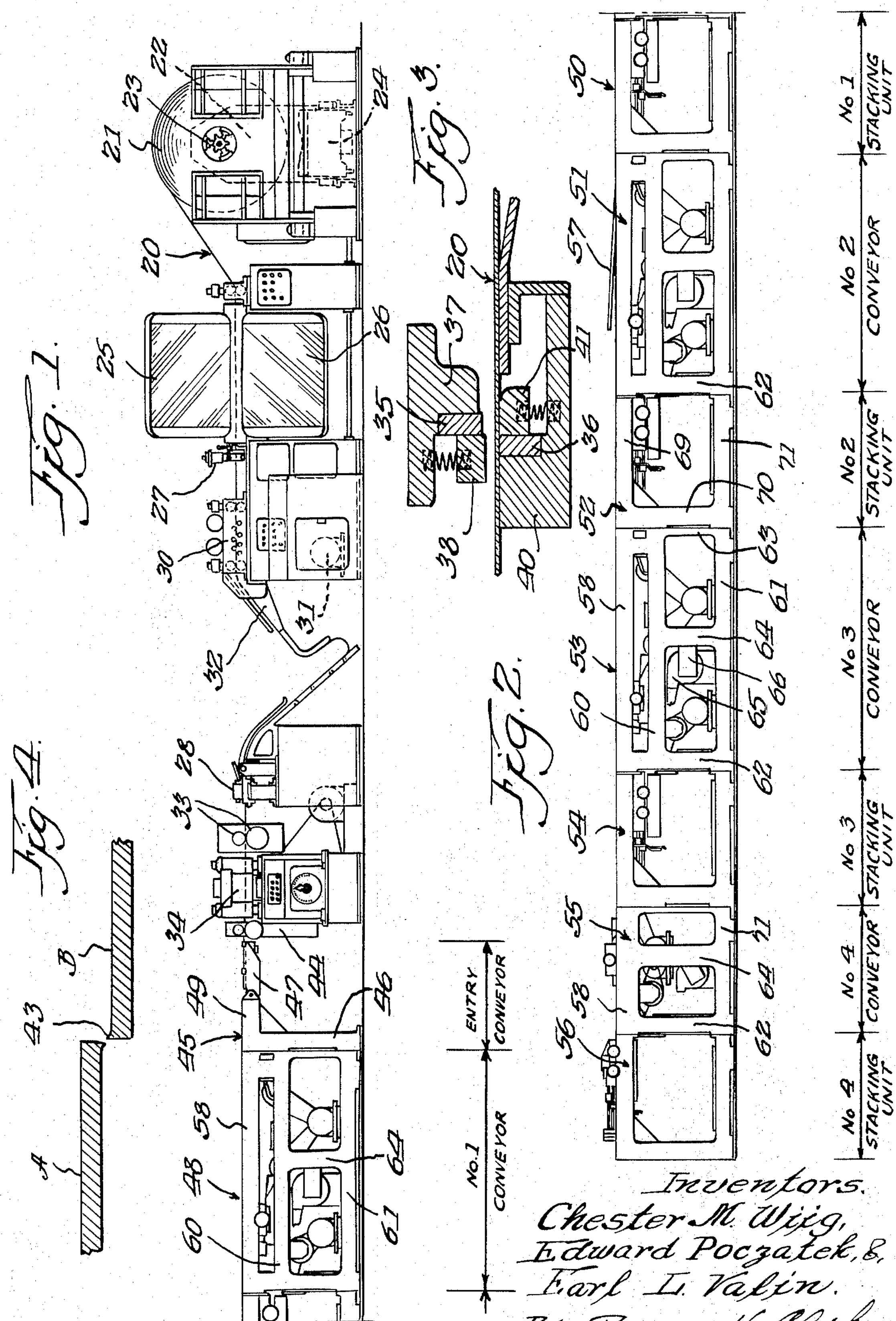
Primary Examiner—Evon C. Blunk
Assistant Examiner—Bruce H. Stoner, Jr.
Attorney, Agent, or Firm—Russell H. Clark

[57] **ABSTRACT**

In producing cut sheets of the desired lengths from coil stock such as tin plate or aluminum, the coil is first reel supported, and then uncoiled and passed through a straightening machine and inspected visually and electronically for defects before it is fed to a reciprocating shear which cuts the web into sheets. Belt conveyor means of novel construction is provided for moving the cut sheets to stacking areas, the same incorporating vacuum means and magnetic means for holding the cut sheets on the belts, a tubular cantilever support for the hollow belt supporting box-like arrangements to facilitate the repair or replacing of worn belts, and fast moving belts which eject the cut sheets onto slow moving belts so that discharge of the sheets into the stacking areas can take place at a speed which permits stacking of the sheets without damage to their leading edge.

7 Claims, 21 Drawing Figures





Inventors.
Chester M. Wigg,
Edward Poczatek, &
Earl L. Valin.
By: Russell H. Clark
Atty.

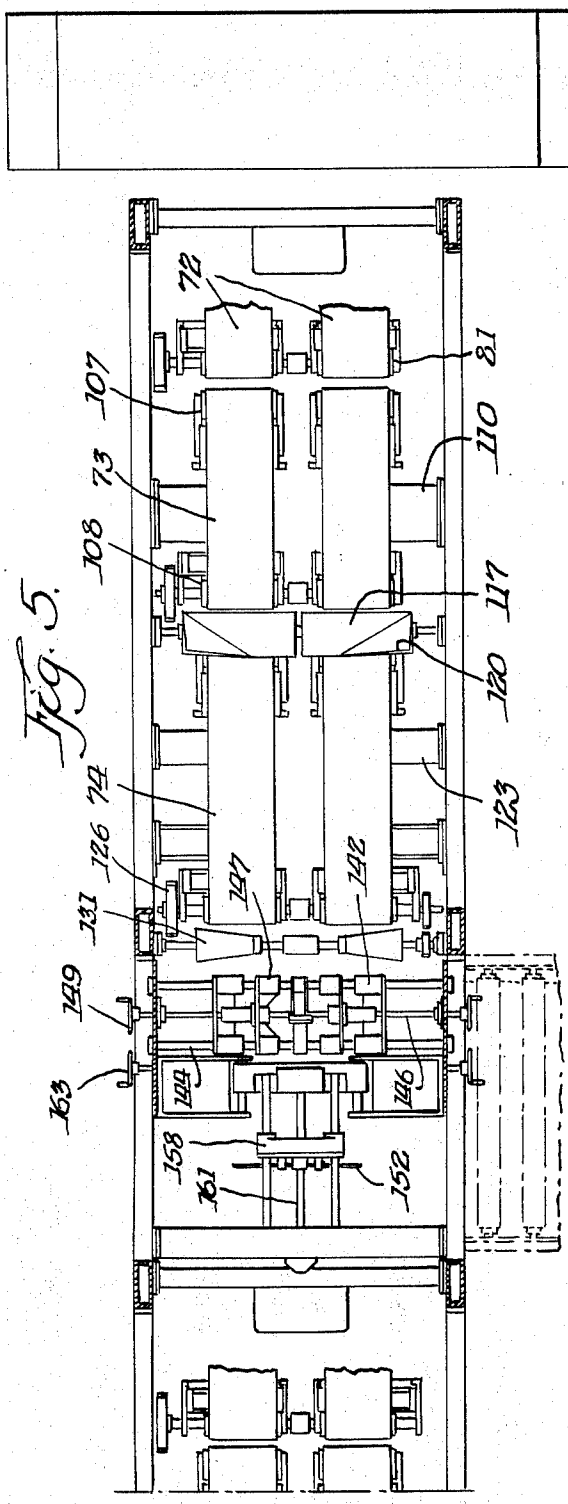


Fig. 5.

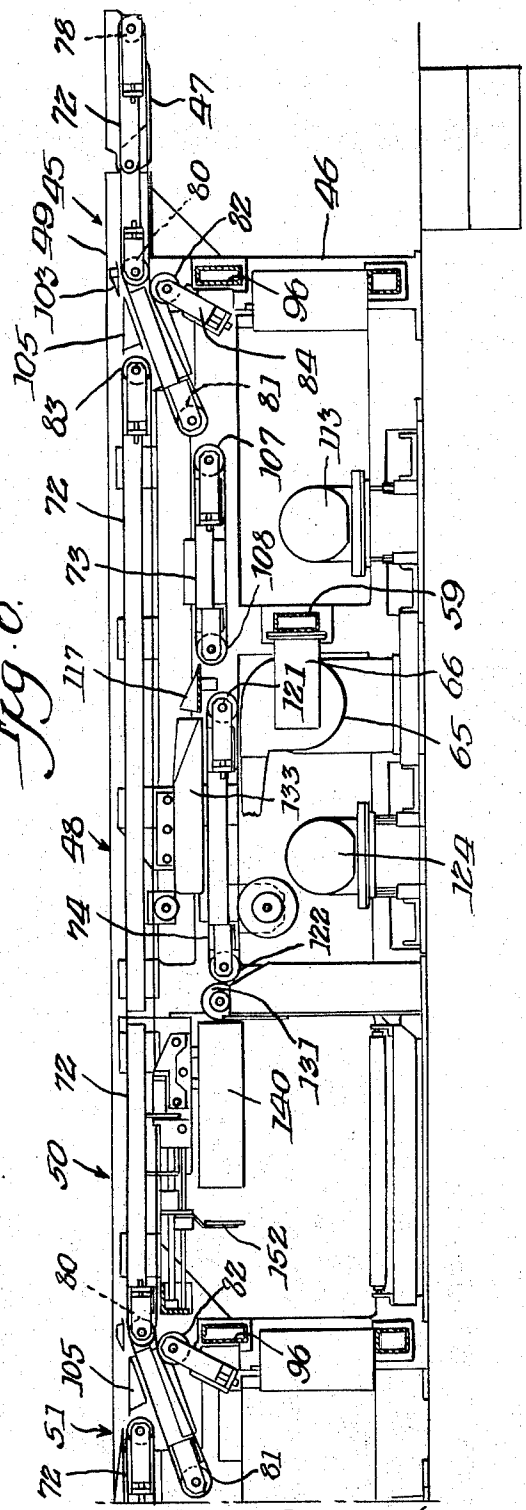


Fig. 6.

Inventors.
Chester M. Wipp,
Edward Poczatek &
Earl L. Valin.
By. Russell H. Clark Attys.

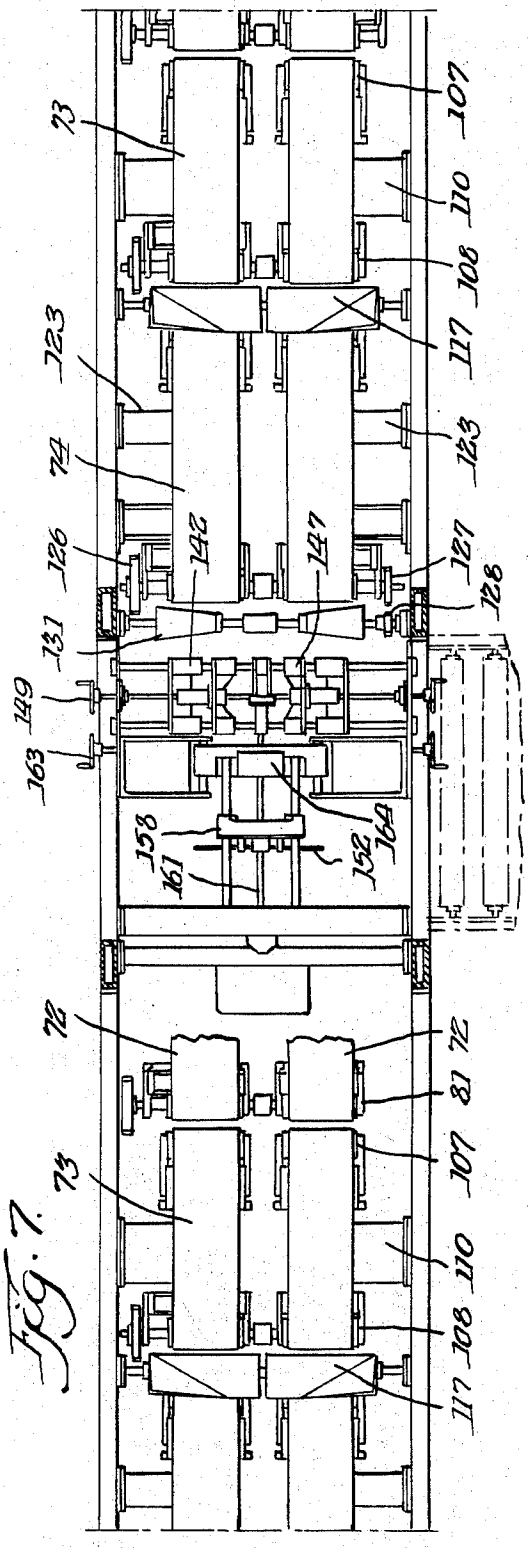


Fig. 7.

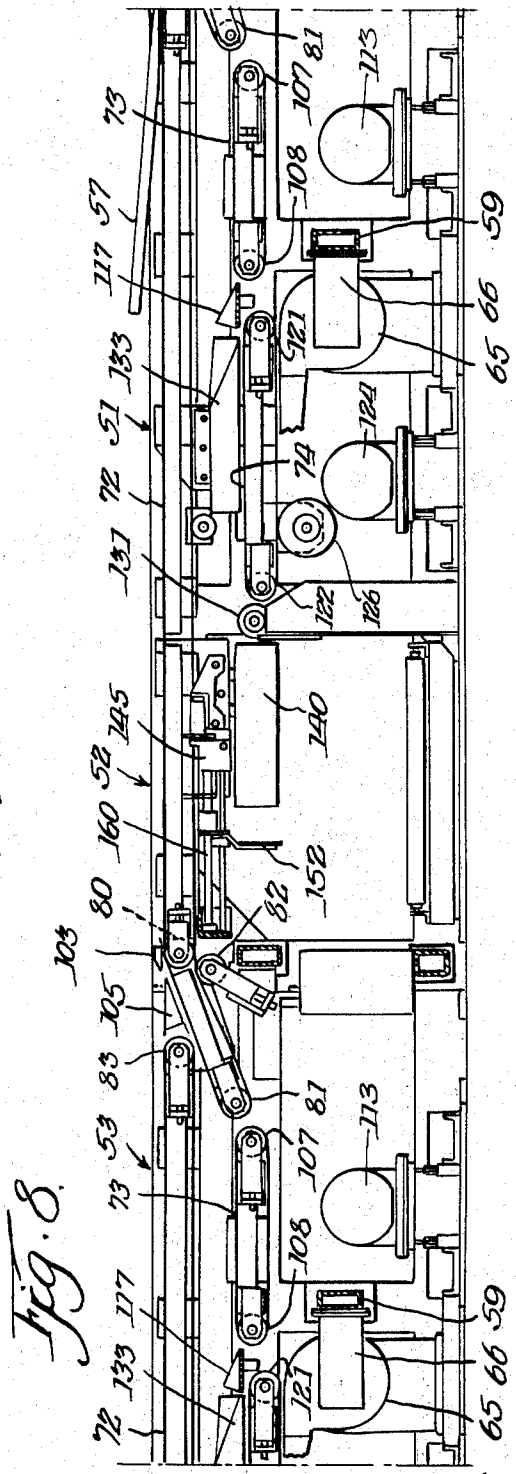


Fig. 8.

Inventors.
Chester M. Wijg,
Edward Poczatek, &
Earl L. Vatsin.
By Russell H. Clark
Atty.

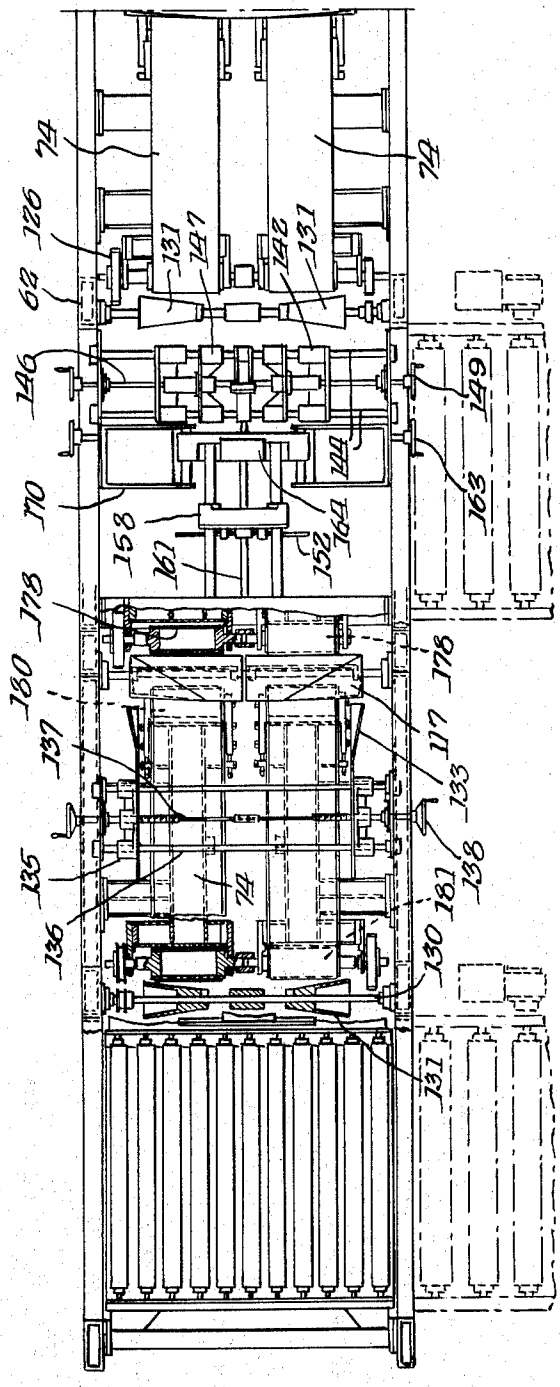


Fig. 9.

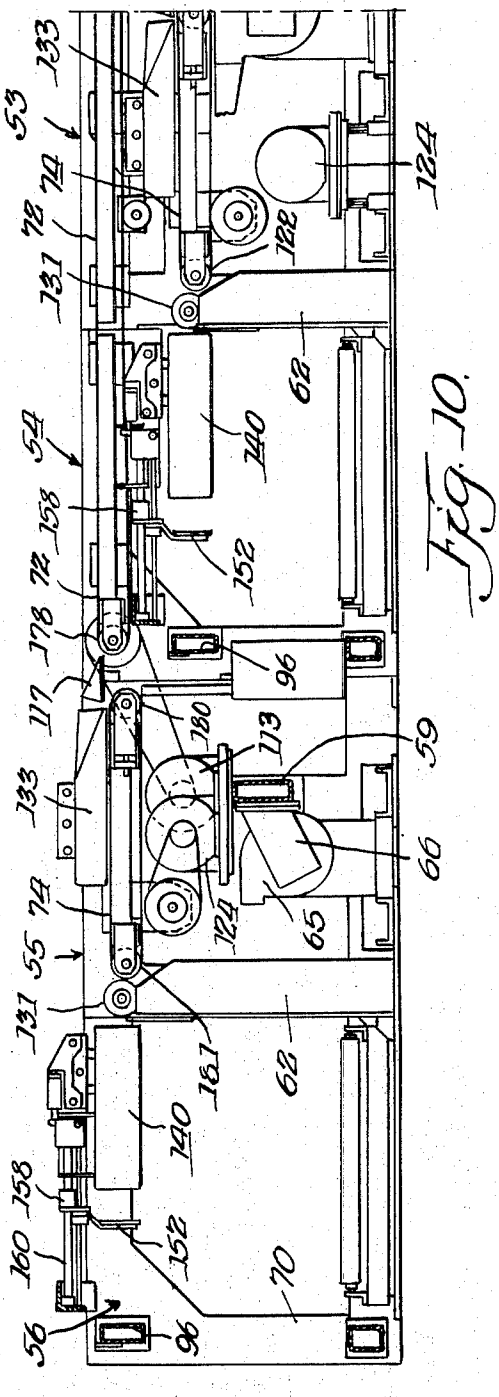


Fig. 10.

Inventors.
Chester M. Wijg,
Edward Poczatek, &,
Earl I. Valin.
By Russell H. Clark
Atty.

Fig. 11

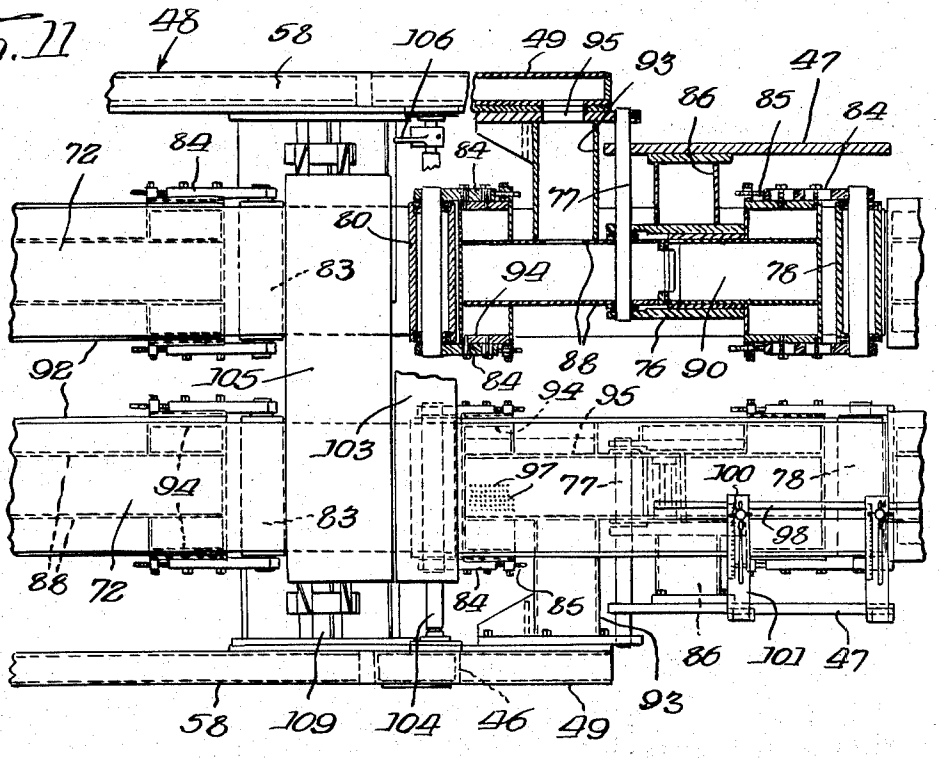


Fig. 19.

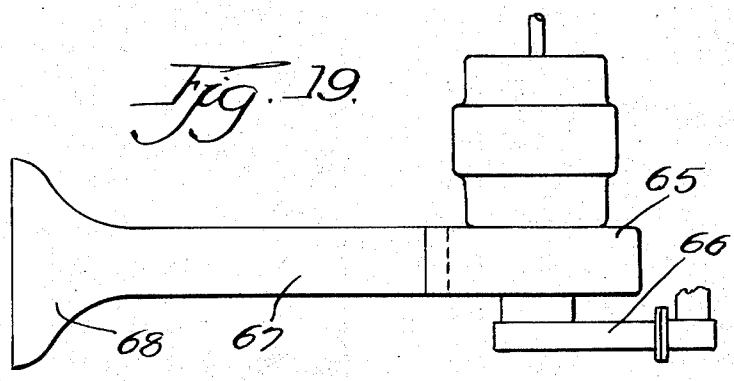


Fig. 20.

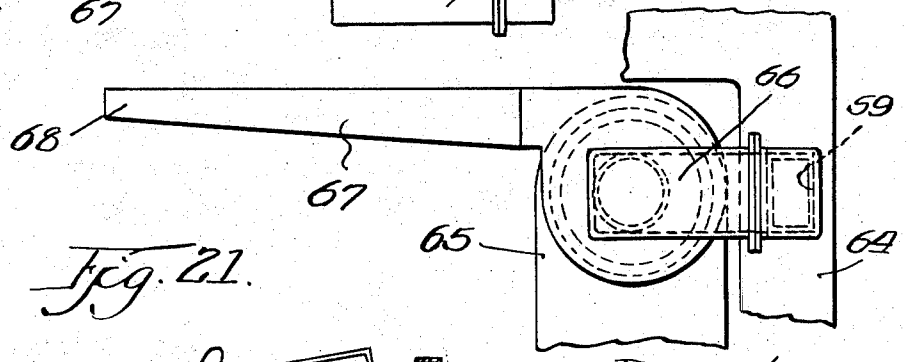
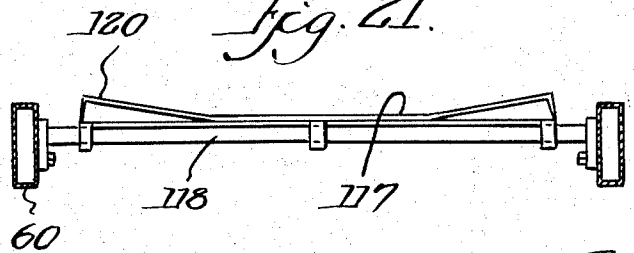


Fig. 21.



Inventors.
Chester M. Wijg,
Edward Pozgatek, &
Earl L. Valtin.
By: Russell H. Clark
Atty.

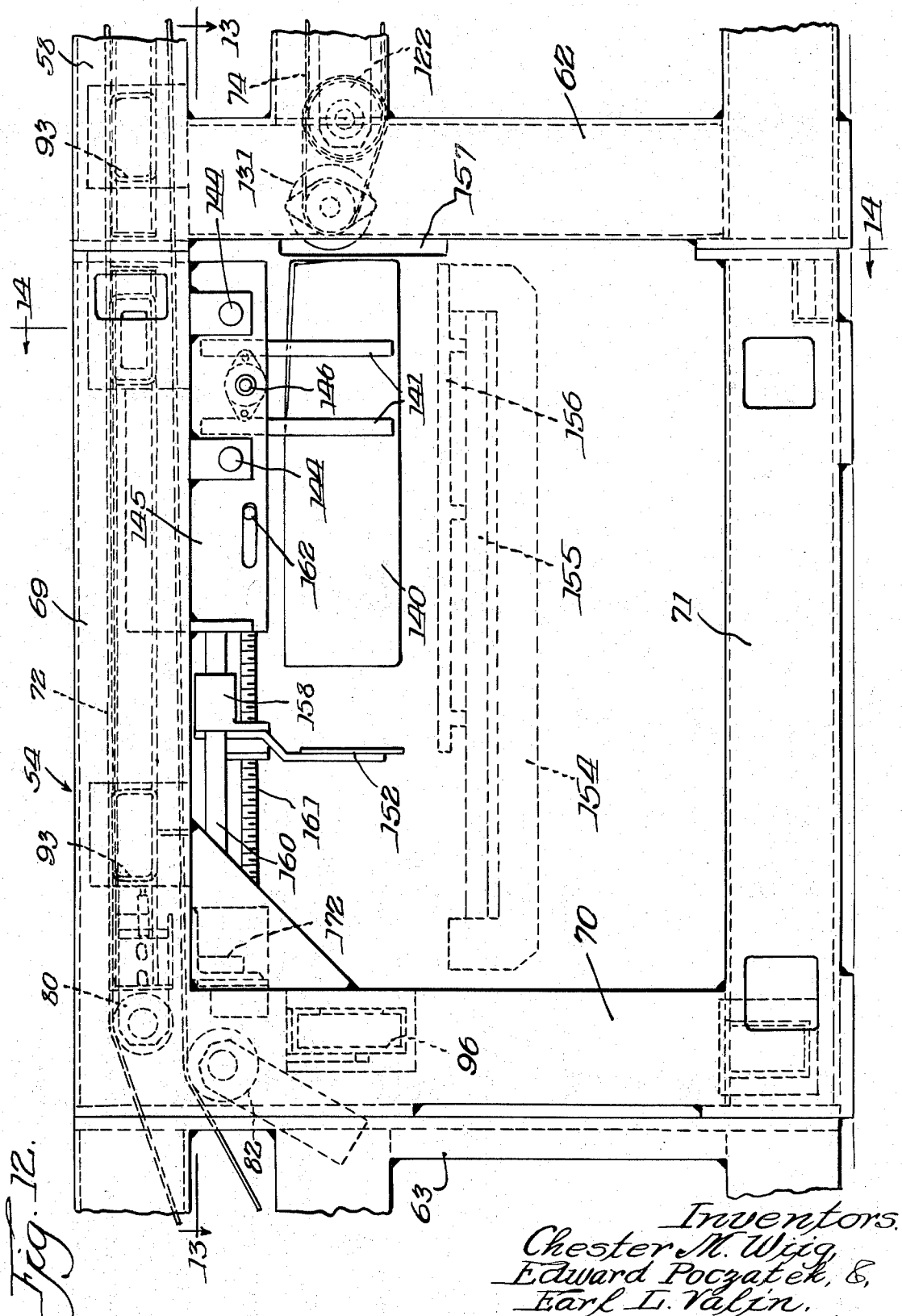


Fig. 12.

Inventors.
Chester M. Wijig,
Edward Poczatek, &
Earl I. Valpin.
By. Russell H. Clark Atty.

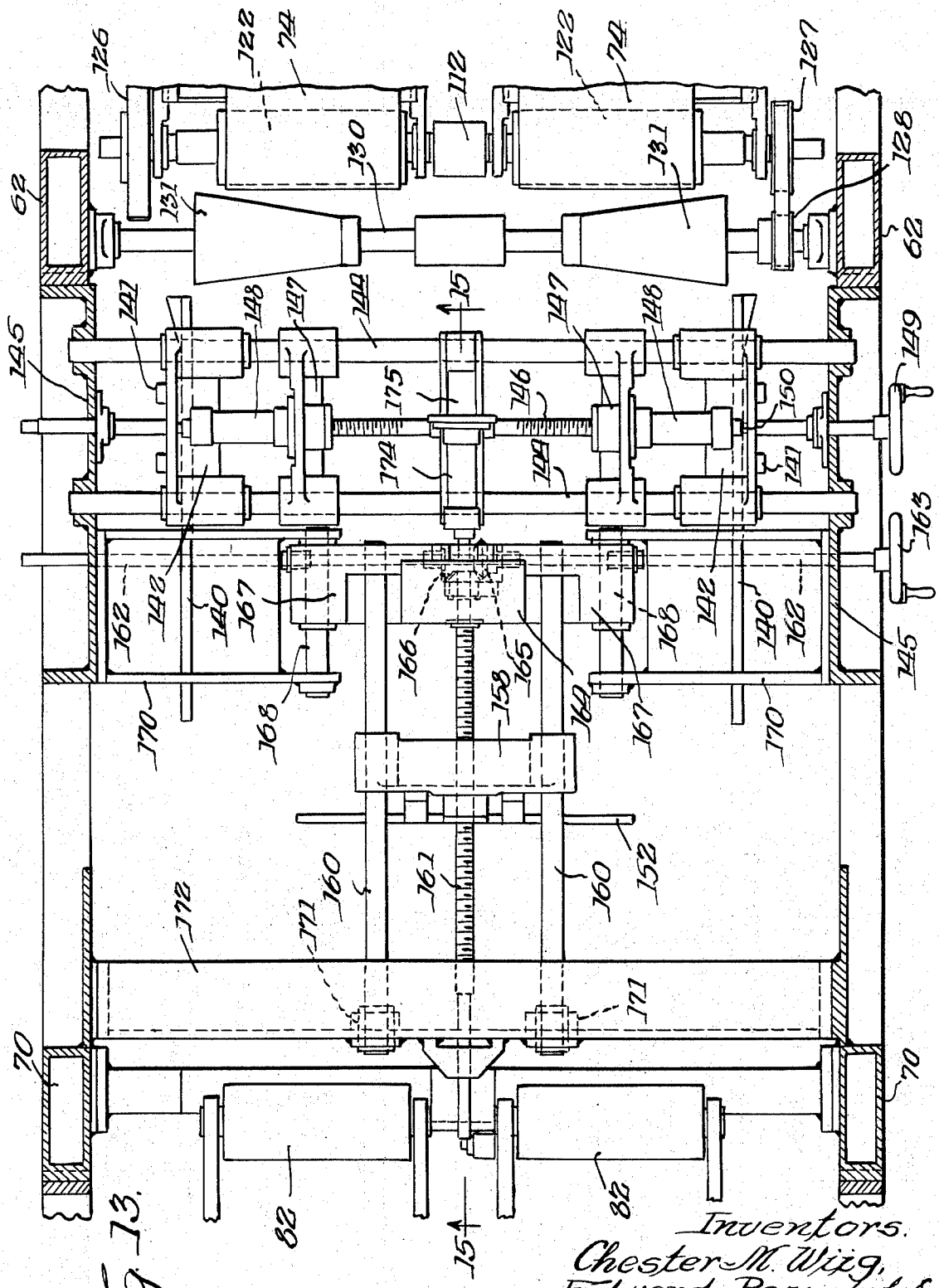


Fig. 13.

Inventors.
Chester M. Wijg,
Edward Poczatek, &
Earl I. Valin.
By Russell H. Clark Atty.

Fig. 14.

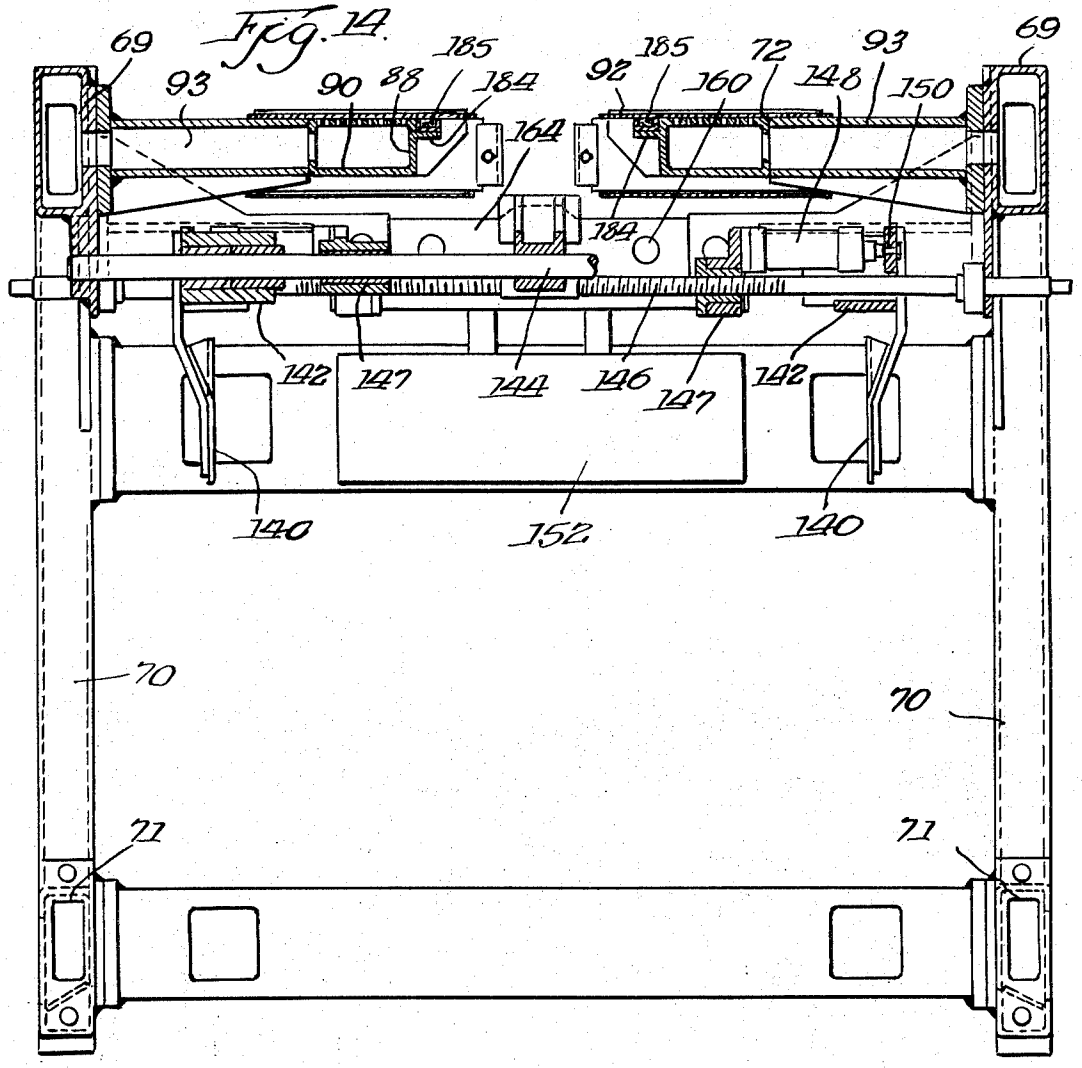


Fig. 15.

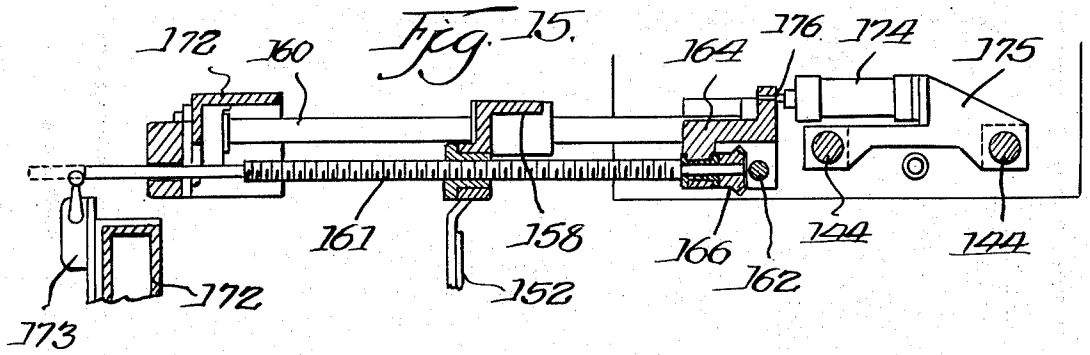
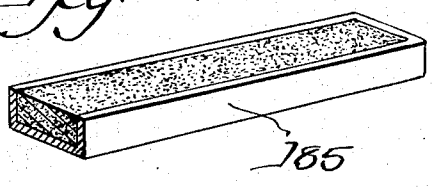


Fig. 18.



Inventors.
Chester M. Wijg,
Edward Poczatek, 6,
Earl I. Valin.
By. Russell H. Clark Atty.

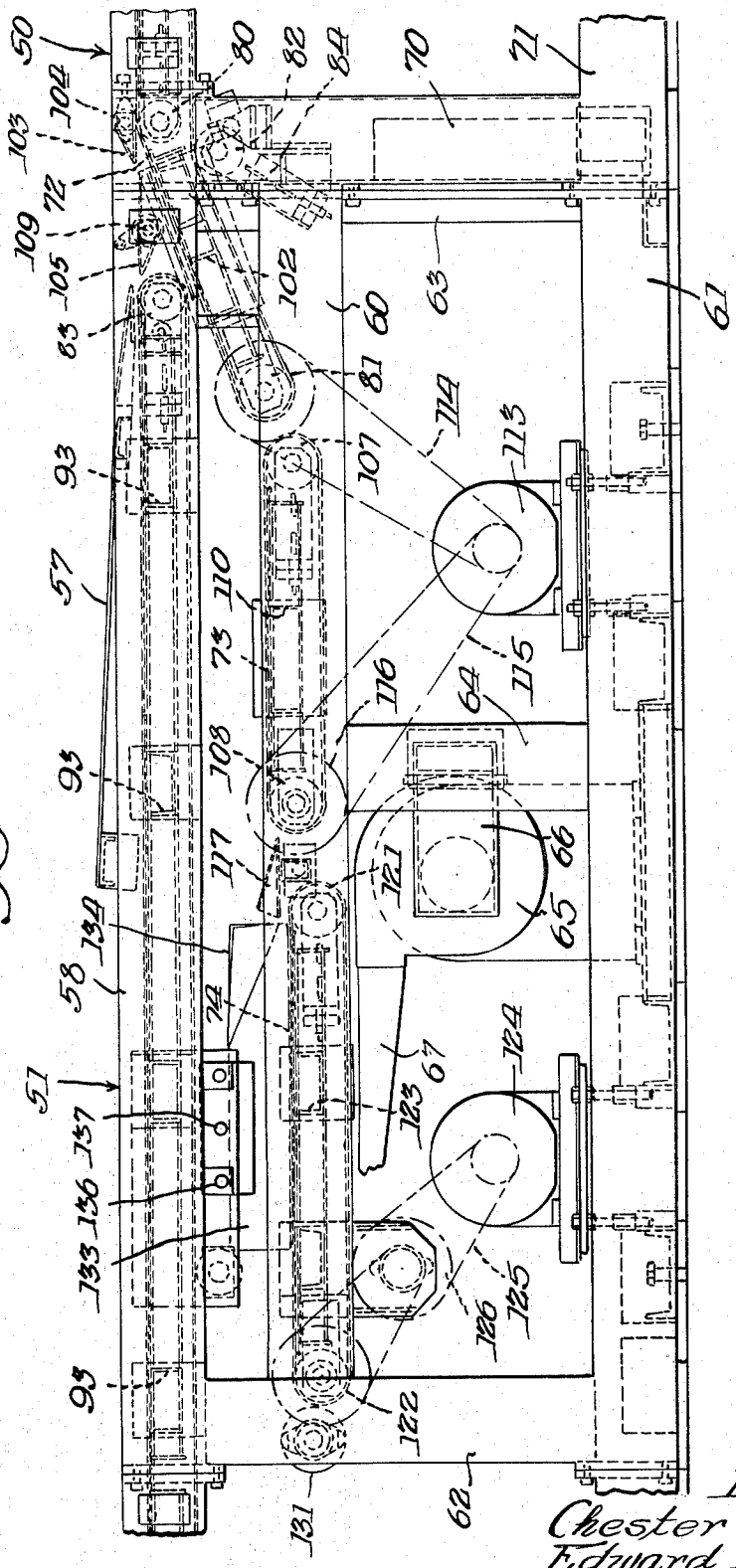


Fig. 16.

Inventors.
Chester M. Wijg.
Edward Pozatek, 6.
Earl I Valpin.
By. Russell H. Clark Atty.

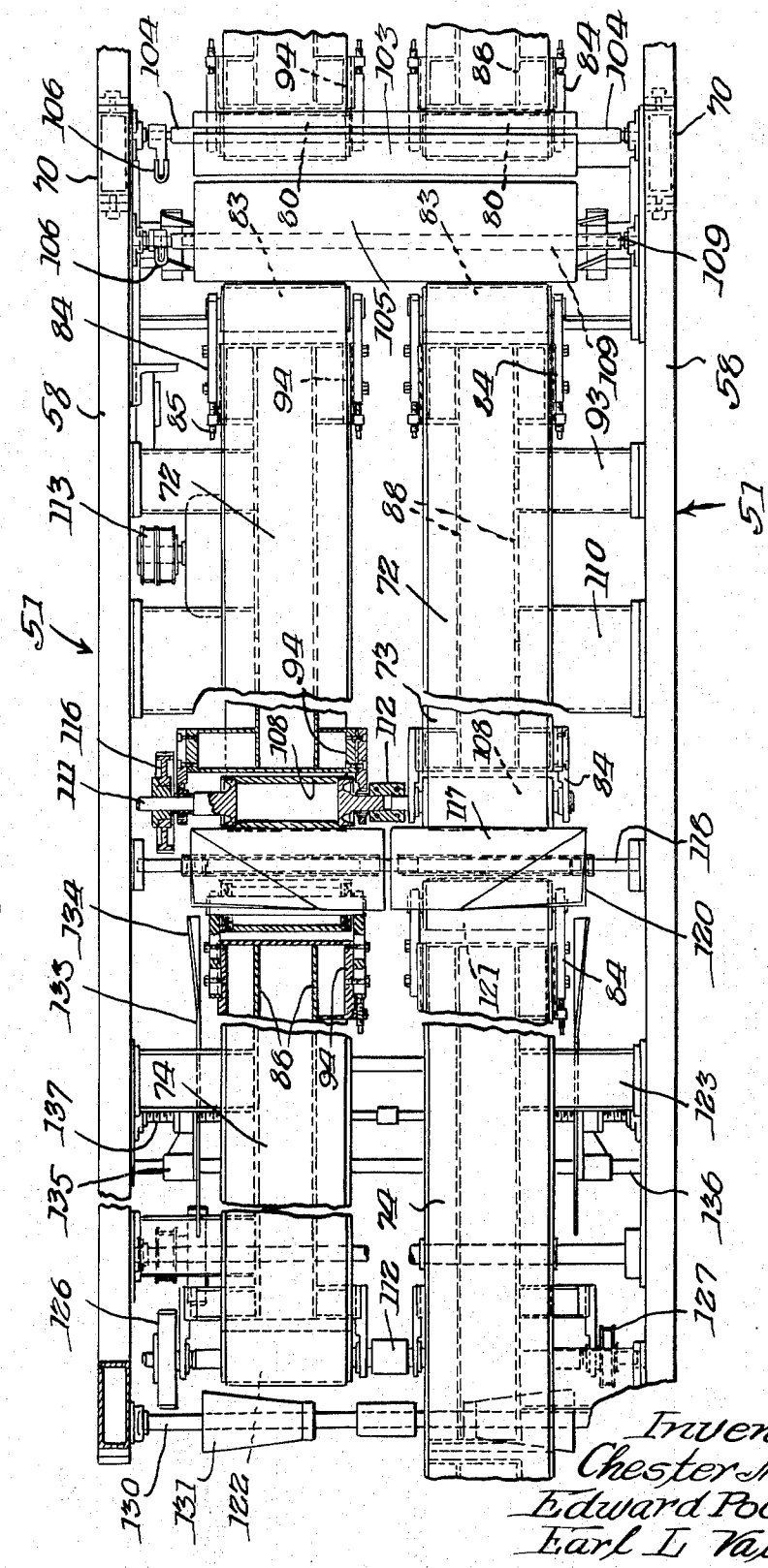


Fig. 17.

Inventors.
Chester M. Wijg,
Edward Poczatek, &
Earl I. Valin.
By Russell H. Clark
Atty.

CONVEYING APPARATUS WITH OVERLAPPING MEANS FOR STACKING PURPOSES

The invention relates to new and improved apparatus for producing cut sheets of the desired length from coil stock and has reference more particularly to apparatus having a number of control stations for uncoiling metal stock, for straightening the same, inspecting the stock while in the form of a continuous web, cutting to the precise feed lengths to form the sheets and then conveying the cut sheets to stackers for the prime and for the reject sheets respectively.

For uncoiling the metal stock from a coil, the same is supported for rotation by the horizontally disposed arms of a reel and which are hydraulically or mechanically expanded to lock the coil in position for rotation and to control its pay-off. The reel is quickly and safely loaded with the help of a track mounted loading car which raises the coil into loading position and then moves the coil onto the coil supporting arms. To speed operation and minimize down time, a reserve coil can always be in readiness on the loading car. The coil supporting reel keeps the stock under controlled tension as it unwinds to the straightener and then to the feeding means.

Upon leaving the straightening rolls, the web is passed between angled mirrors for visual inspection of the top and bottom surfaces of the web. A gauge thickness detector is next in line for indicating thickness deviations above or below acceptable standards and then immediately in advance of the shearing knives the web is passed through an electronic pin hole detector. When a mirror reveals an imperfection a touch of the reject button actuates an electronic memory classifier which directs the particular faulty sheet into a reject stacker. The thickness gauge and also the pin hole detector connect with the electronic memory classifier.

The feed length of the cut sheets is preferably determined by the diameter of the feed rolls. To change feed length the rolls in use can be exchanged for another set of rolls of larger or smaller diameter. During a part of the shear cycle the feed rolls are stationary and it is during this part of said shear cycle that cutting action occurs. A take away roll on the outgoing end of the shearing device assures smooth and fast removal of the cut sheets from the shearing device and their entry onto the conveyor belts of the stacking mechanisms.

The invention contemplates improvements in belt conveyors and has for one objective the provision of vacuum means or magnetic means under the conveyor belts for maintaining the cut sheets in position on the belts as they are carried at high speed from the shearing device to the stacking areas. When aluminum is being cut, the magnetic means are not effective so that reliance is placed on the vacuum. However for thin metal sheets of iron which may or may not be tinned, the magnetic means are highly efficient.

Another object of the invention resides in the provision of conveyor belts which are perforated with a plurality of small openings and wherein the top surfaces of the supporting side frames for the belts are also perforated. As a result, the vacuum which is developed within the side frame chambers can be made effective for holding the metal sheets on the moving belts.

In connection with the foregoing the invention contemplates a tubular frame type of construction for the present belt conveyor which will provide the necessary

ducts for the vacuum chambers and for the electrical wiring and which will also give a smooth, clean and low silhouette appearance to the complete machine.

A further object of the invention is to provide conveyor belt structure for a sheeting line having diverting means for diverting the reject sheets from the main stream of prime sheets and for delivering the reject sheets into stacking areas designed to receive them.

Another objective of the present invention is to provide belt conveyor structure wherein the sheets are ejected from a relatively fast moving belt to a slower moving belt so as to result in an overlapping of the sheets and thus delivery to a stacker at a much slower speed and more particularly at a speed wherein the sheets can be stacked without damage to the leading edge of the sheet.

A more specific object of the invention resides in the provision of conveyor belt structure having main belts for carrying the sheets at a relatively high speed and also having secondary belts moving at a substantially slower speed and wherein the sheets are deposited onto the slow speed belts in overlapped relation and more particularly in such a relation where the overlap is at least fifty percent or more.

Another object is to provide conveyor belt apparatus for a sheeting line such as described wherein the sheets are automatically bent in a slight arc transversely of the sheet as they are ejected from the fast moving belts onto the slower moving belts in overlapped relation. The slight transverse arcing of the sheets strengthens them in a longitudinal direction and thus better control is obtained as the sheet is ejected and remains unsupported until it lands in overlapping relation on the slower moving belts.

A further object is to provide conveyor belt apparatus as described wherein stacker areas are provided for the prime sheets and for the reject sheets and wherein each stacker area contains a vertically movable support member for the sheets in combination with adjustable precision side guides and adjustable striker plate means against which the ejected sheets are caused to engage in advance of depositing them in a vertical pile on the support member.

Another object is to provide conveyor belts for a device as described which contemplates a cantilevered design wherein each belt supporting structure is supported from its side frame in a cantilever manner which permits of a simple method of mounting the belts for easy accessibility for repairs or for replacing a worn belt and wherein adjustable means for adjusting the tension of the belts individually are also easily accessible.

An additional object resides in the provision of mechanism for incorporation in a sheeting line wherein loaded pallets containing a full count of cut sheets will be automatically lowered and deposited on powered conveyor rollers for discharge from the stacking area.

In the drawings which illustrate an embodiment of the invention and wherein like reference characters are used to designate like parts.

FIG. 1 is a partial view in side elevation of the start end of a sheeting line for producing cut sheets from coil stock and which shows the coil supporting reel, the mirror arrangement, the gauge thickness and pin hole detecting means, the shearing apparatus and the forward

portion of the belt conveyor structure for the cut sheets;

FIG. 2 is a view in side elevation of the remainder of the belt conveyor structure not shown in FIG. 1, and which includes the reject stations and the stacker areas for the prime and for the reject sheets;

FIG. 3 is a longitudinal sectional view showing details of the shearing knives for cutting the web into sheets of predetermined lengths;

FIG. 4 is a sectional view taken longitudinally showing the rear cut edge of the forward sheet and the front cut edge of the next following sheet;

FIG. 5 is a top plan view showing the reject belt arrangement at the start end of the belt conveyor structure and which includes the first stacking area for rejected sheets such as may have pin hole defects or thickness variations beyond the acceptable limits;

FIG. 6 is a side elevational view of the start end of the belt conveyor apparatus showing in complete details the top belt arrangement and also the reject belt structure of FIG. 5;

FIG. 7 is a top plan view of a mid-portion of the belt conveyor structure, the same showing the second reject belt arrangement and a part of the third;

FIG. 8 is a side elevational view of a mid-portion of the belt conveyor apparatus showing in complete details the top belt mechanism and also the reject belt arrangement of FIG. 7;

FIG. 9 is a top plan view of the terminal end of the belt conveyor structure showing the last reject belt arrangement and the two stacking areas for the prime sheets;

FIG. 10 is a side elevational view of the terminal end of the belt conveyor apparatus as shown in FIG. 9;

FIG. 11 is a horizontal sectional view showing the details of the belt conveyor structure for the entry conveyor and which is substantially duplicated in other belt conveyor sections;

FIG. 12 is a side elevational view on a larger scale showing a stacking area with an adjustable striker plate and adjustable precision side guides;

FIG. 13 is a top plan view taken substantially on line 13—13 of FIG. 12 and showing structural details such as the belt pulleys for the slow speed belts, the cone-shaped arcing means for the sheets, the adjustable means for the precision side guides and the adjustable means for the striker plate;

FIG. 14 is a vertical sectional view taken substantially on line 14—14 of FIG. 12;

FIG. 15 is a vertical sectional view taken substantially on line 15—15 of FIG. 13;

FIG. 16 is a side elevational view of a mid-portion of the belt conveyor apparatus showing the top high speed belts, the lower high speed belts, the slow speed belts and the transverse arcing means;

FIG. 17 is a top plan view of the mid-portion of the belt conveyor apparatus shown in FIG. 16;

FIG. 18 is a perspective view of a length of a permanent magnet such as may be used as a substitute for the vacuum means for holding the sheets of ferrous material on the moving belts;

FIG. 19 is a top plan view of the motor driven fan for evacuating the ducts and chambers of its belt conveyor section;

FIG. 20 is a side elevational view of the fan structure shown in FIG. 19; and

FIG. 21 is a transverse sectional view showing the stationary arcing plate for arcing the sheets in a transverse direction as they are being deposited onto the slow speed belts.

Reference is made to FIG. 1 for an understanding of the several control units which have location in advance of the shearing apparatus and which accordingly have processing action on the continuous web **20.** A coil of said web such as **21** weighing several thousand pounds is conveniently supported for rotation by a centering reel **22** having horizontally disposed, expandable coil supporting arms **23** and a track mounted loading car **24.** A centering reel as shown in the Littell et al. U.S. Pat. No. 2,598,398 granted May 27, 1952 may have utility in the present sheeting line wherein it will be understood that the web is unwound from the coil in a controlled manner and fed to a mirror arrangement so that the web passes between an angled top mirror **25** and an angled bottom mirror **26.** The mirror arrangement enables the operator to inspect both the upper and lower surfaces of the web for any visual defects. When an imperfection is observed, the operator need only to touch a reject button to actuate an electronic memory classifier which will direct the faulty sheet into a reject stacker after shearing.

The numeral **27** indicates a thickness gauge for indicating thickness deviations above or below acceptable standards. The gauge thickness device and also the pin hole detector **28** connect with the electronic memory classifier which automatically directs cut sheets into prime or reject stackers. Between the thickness gauge **27** and the pin hole detector **28,** the web passes through a straightening device **30** having a plurality of rollers including pinch rolls and straightener rolls. The device has its own power motor **31** for rotating the rolls at a selected speed to produce a constant flow of straightened material free of any damaging marks.

From the straightener **30,** the web passes over the loop forming device and then through the pin hole detector **28** in advance of the high speed roll feed **33** and shearing device **34.** The feeding of the web is controlled by the feed rolls **33** having a pre-determined diameter and rotary speed so that each revolution of the rolls will move the stock in a forward direction and between the upper and lower platens of the shearing device **34.** The platens are suitably backed by bolster plates and the said platens carry cutting knives such as **35** and **36,** FIG. **3.** The top platen **37** fixed to the upper bolster is mounted for vertical reciprocation as is also the knife **35** and the resilient pressure pad **38** carried thereby. However the base platen **40** is stationary and the same provides the necessary support for the travelling web. This base platen is provided with the cutting knife **36** and with the spring backed pressure pad **41.** The action of the cutting knives and pressure pads when the upper bolster, platen and knife are caused to reciprocate is to sever the web transversely and in a manner which prevents the formation of a sharp raised edge on the rear of the cut sheets. This is best illustrated in FIG. **4** wherein it will be seen that the forward sheet A may have a sharp edge on its under surface with the following sheet B having a sharp edge **42** on its upper surface. When the web is cut in the manner as shown in FIG. **4** and which results from knife structure as shown in FIG. **3,** then the cut sheets can be overlapped as contemplated by the invention and the overlapped sheets will not be scratched or will their

surface be damaged by any sharp point or edge on the under sheet.

Feeding accuracy is assured by a gradual and smooth accelaration and deceleration of the feed rolls **33** on each revolution. During a portion of the shear cycle the feed rolls are stationary and it is during this part of the shear cycle that cutting occurs. A programmed take away roll **44** FIG. **1**, on the outgoing end of the shear **34** provides smooth and fast removal of the cut sheets from the shear to the improved belt conveyor structure of the invention which apparatus will now be described in detail.

An entry conveyor **45** precedes the first conveyor unit **48** as will be evident from FIG. **1**, the said entry conveyor consisting of side frames **46** generally in the shape of an inverted L and having articulated side frames elements **47.** High speed belts are carried by the entry conveyor, FIG. **6** and said belts receive the cut sheets from the shearing device and move them to the first conveyor **48** which incorporates additional high speed belts and also a diverting plate in combination with high and low speed belts see FIG. **5**, whereby the rejected sheets diverted by the diverting plate are caused to slow down in speed before they are ejected onto the pile of reject sheets in the first stacking unit **50**, FIG. **2.** The belt conveyor of the invention is thus built up of belt conveyor units which alternate with stacking units. Thus it will be understood that second conveyor **51** FIG. **2**, is substantially similar in construction and in mode of operation to the first conveyor **48** and also to the third conveyor **53**, and wherein the first, second and third stacking units **50, 52,** and **54** respectively are likewise similar in the structure involved and in their mode of operation. Conveyor number four identified as **55** and the stacking unit number four namely **56** are somewhat different in design from the conveyors and stacking units which precede them since these pieces of equipment comprise the terminal units of the belt conveyor apparatus. Also a desirable addition is incorporated in the conveyor **51**, namely the inspection table **57** together with diverting means therefor as will be presently described, whereby a sheet or several sheets can be diverted from the main stream of prime sheets carried by the top belts and visually inspected by the operator while on the table **57.**

It is evident from the foregoing that the invention contemplates modular structure in design wherein the conveyor sections and the stacking units are respectively similar, using identical and interchangeable parts and having individual drive motors. Also the frame elements of the conveyors and stacking units are tubular to thus provide the ducts necessary for the vacuum chambers and for the electrical wiring and cables.

The frame structure of the respective conveyor belt sections and also the stacking units is illustrated in FIG. **2** wherein the belt conveyors such as **53** which is representative have spaced substantially rectangular side frames with each side frame including a tubular top frame element **58**, a tubular lower frame element **60** and a tubular base frame element **61.** The same are joined by vertical standards **62** and **63** at respective ends and by an intermediate standard **64** and by several transverse tubular connecting elements **59.** See FIGS. **6** and **8.** The left hand standard **62** is tubular as is also the intermediate standard **64** and it will be understood that the inside ducts thereof communicate with those of the upper frame elements **58** and **60**, but not with the base frame element **61.** The standard **63** at the right hand end of each belt conveyor section is substantially solid and in most cases this solid standard is bolted to a stacking unit. The tubular frame elements **58,60** and the tubular standards **62** and **64** all communicate and the ducts thereof are closed at one end and at the base frame element **61.** The ducts and chambers thus provided are evacuated by a vacuum-producing motor driven fan **65** for each section and this produces the vacuum which assists in maintaining the metal sheets on the moving belts as the sheets are carried thereby. The tubular base frame elements **61** provide passageways for the electrical wiring and the ducts may extend from section to section including the stacking units.

The inlet end **66** of the fan **65** connects with the intermediate standard **64** and the outlet end of each fan may have a long nozzle **67**, FIGS. **19** and **20**, with a horizontal flaring end **68** for discharging the exhaust air into a stacking area to facilitate the descent and precise stacking of the cut sheets on their supporting pallet.

The frame of the stacking units such as **52** which is representative is substantially U-shaped and the same is placed on its side so that the open end of the U is conveniently bolted to the tubular standard **62** of a preceding belt conveyor unit. The numeral **69** indicates the hollow tubular top frame element and **70** the left end tubular standard. The tubular base frame element is numbered **71** and the duct of this base element communicates with the duct in the base element **61** for receiving the electrical wiring. Also the duct in element **58** of the adjacent following belt conveyor section which is **53** will communicate with the top hollow frame element **69** so that the ducts and chambers will be evacuted by the fan **65** of said section. This is necessary since the high speed top belts **72** of the entry conveyor **45** FIG. **6**, enter the first conveyor unit **48** and then they are inclined downwardly for the first reject belt structure. The top high speed belts start again in the conveyor section **48** and continue over the stacking unit **50** and into the second conveyor unit **51** where said high speed belts are similarly inclined downwardly for the second reject belt structure, FIG. **8.** In conveyor **51** the high speed belts start again and the structure is repeated for the stacking unit **52** and the third belt conveyor **53.** The top high speed belts **72** from the third conveyor **53** pass over the stacking unit **54** and then terminate, FIG. **10.** The belt conveyor unit **55** has only slow speed belts **74** and which discharge the sheets into the last stacking unit **56.** The top high speed belts in all figures are indicated by **72** and all slow speed belts by the numeral **74.** The entry conveyor starts the movement of the cut sheets on the high speed belts and this structure is shown in FIG. **11** which will now be described.

The top horizontal frames **49** of the entry conveyor **45** are tubular and the side frame elements **47** are supplemented by additional frame elements **76** which are securely connected by the rod **77** to the tubular frame elements **49.** It will be observed that two connecting rods **77** are employed for two high speed top belts **72** which pass around the right end rollers **78** and over the top intermediate roller **80**, then the belts incline downwardly and pass around the left end rollers **81** with the bottom run of the belts passing over the intermediate rollers **82** to return to **78.** The rollers **83** start the high speed belts **72** again in the first conveyor section **48** and said belts continue to the rollers **81** FIG. **6**, at the

right hand end of conveyor **51**, the said supporting structure for the high speed belts **72** being duplicated at the right end of the conveyor sections **48,51** and **53**. The rollers **78** are journalled by the adjustable side brackets **84** and this adjustable bracket arrangement is repeated for the top intermediate rollers **80**, the end rollers **83** and for the bottom intermediate rollers **82**. By loosening the two bolts the side brackets can be adjusted by the threaded screw **85** to adjust the tension on the belts and then the bolts are tightened. The supporting box frame structure for the belts **72** is carried in a cantilever fashion from the side elements **47** and from the hollow top elements **49** respectively. The additional frame units **76** are positioned inwardly from **47** and the same are supported by the tubular members **86** in each unit. Each member **86** thus helps to support from its frame element **47** not only the additional frame elements **76** but also the supporting means **87** for the rollers **78** and the track structure for the top high speed belts including the side members **88**, the bottom member **90** and the top, relatively wide, perforated member **92**.

The track structure on which the high speed belts are each supported extends into and between the tubular frame elements **49** where the said structures are additionally supported in a cantilever manner by the tubular members **93** from the tubular side frames **49**. At this left end the supporting means **94** for the top intermediate rollers **80** are provided, and it will be noted that the tubular members **93** communicate by means of openings **95** with the hollow interior of **49** which in turn communicates with the ducts in side frame elements **58** and **60** of the first conveyor **48**, all as described in regards to FIG. **2**, wherein it was pointed out that the ducts were evacuated by the fan **65**. The standards **46** of the entry conveyor **45** connect with each other and with **49** by means of the transverse tubular member **96**, FIG. **6**. Accordingly a vacuum is produced in both track structures which are sealed at each end and wherein a plurality of small openings **97** are formed in the top plate **92** of each and in the belts **72** respectively so that the cut sheets are maintained in place as the sheets are moved by the said belts at high speed.

It will be understood from the foregoing that the top high speed belt structure is repeated for each side frame with each structure being supported inwardly from its side frame in a cantilever manner. This enables the operator to remove and replace a worn belt in a convenient manner. Also the cut sheets are held to the belts at the side edges by the vacuum means and each belt has its own independent belt tensioning means. The initial delivery of the cut sheets onto the top high speed belts **72** is controlled in a transverse direction by the adjustable side guides **98** shown in FIG. **11**. The said guide members depend from the adjustable hand wheels **100** which ride in slots in the inwardly extending supports **101**.

The belts **72** incline downwardly as the top run leaves the rollers **80** and the belts then pass around the end rollers **81**, FIG. **6**. Track supporting structure such as has been described is provided by each side frame of the belt supporting sections for this inclined run of the belts and the interior ducts of the same are of course evacuated by the vacuum means since the box like supporting frame structures are supported and connected to their side frames by the tubular members **102** FIG. **16**. The above comprises the initial portion of the reject belt arrangement since the sheets on the belts **72** to be rejected are deflected downwardly by the reject plate **103** which extends from side frame to side frame being pivotally supported for said rotatable reject movement by the pivot rod **104**, FIG. **17**. If the cut sheets are not defective then the reject plate is not actuated and the sheets pass over the same and over the plate **105** and onto the next run of the high speed belts starting at the rollers **83**. The reject plate extends transversely across both belts **72** immediately above the rollers **80** and said plate is actuated for a reject movement by power cylinder means, the piston end of which has operative connection with the linkage arm **106** fixed to the pivot shaft **104**. This first reject structure associated with the first conveyor **48** may be for sheets having pin hole defects or for sheets which do not conform to acceptable standards of thickness. Whatever may be the defect, the memory classifier associated with the thickness gauge detecting means or with the pin hole detecting means will energize the proper electronic circuit means to cause actuation of the reject plate **103** when the cut sheet containing the defect reaches the said reject plate.

Reference is again made to FIGS. **5,6,16**, and **17** which best illustrate the construction for supporting and journalling the lower high speed belts **73** which receive the rejected sheets from the belts **72** and eject the sheets onto slower moving belts **74** for overlapping purposes. The rollers for the belts **73** are indicated at the right hand end by numeral **107** and at the left hand end by **108**. The box like frame structure for supporting the belts **73** is the same as for the top high speed belts **72** namely an arrangement of side plates **88**, a bottom plate **90** and a top perforated plate **92**. Each box like structure is hollow and the same is evacuated by the fan **65**, it being observed that the tubular members **93** join with and support the frame structures for the top belts **72** from the side frame elements **58** of the side frames respectively the same as in the entry conveyor. Similar tubular members **110** support and connect the frame structures for the lower high speed belts **73** from the side frame elements **60** of the said frame members.

The members **84** are fixed to the supporting means **94** for the rollers **107** and **108** and the same cantilever arrangement is employed although the shaft **111** for the two rollers **108** is joined by the releasable collar **112**. The collar can be easily removed for the changing of a worn belt. The high speed motor **113** by belt **114** drives the rollers **81** and by a belt **115** passing around pulley **116** on shaft **111** said motor drives the rollers **108**. Thus the cut sheets from the incline part of the high speed belts **72** are discharged onto the lower high speed belts **73**, both belts being driven at the same speed by the same motor. From the lower high speed belts at rollers **108** the sheets are ejected onto a transverse arcing plate **117** FIG. **21**, which is stationarily positioned by supporting rod **118** just beyond the end rollers **108**. The arcing plate at **120** has its forward end corners bent upwardly and thus the sheets upon contacting the arcing plate as they move past the same are arced or bent transversely and this stiffens the sheets in a longitudinal direction. This is desirable since the sheets are discharged at high speed from the lower high speed belts **73** onto slow speed belts **74** in order to achieve a slow down of the sheets before they are deposited in the first stacking unit **50**.

The slow speed belt structure of the several belt conveyor sections includes the rollers **121** at the right hand end and the rollers **122** at the left hand end. The structure for supporting the rollers is similar to that as described for the high speed belts the same employing adjustable members **84** for belt tensioning and the box-like supporting arrangement for supporting the belts including side frames **88**, a bottom wall **90** and a top perforated wall **92**. Here also the chambers below the top perforated wall are evacuated since they communicate by means of the tubular frame elements **123** with the tubular frame portions **60** of the side frames of the belt conveyor sections.

The slow speed motor is indicated by **124** and said motor has belt **125** operative to drive pulley **126** to drive the shaft for the rollers **122**. A pulley **127** on the opposite end of said shaft has connection by means of an endless belt with pulley **128** on the shaft **130** and thus the slow speed belts **74** and the shaft **130** are driven by the motor **124**. Cone shaped members **131** are fixed on shaft **130** at respective ends and said cones revolve to assist in ejecting the sheets from the slow speed belts onto the pile in the stacking unit. Here again the cone shape of the members **131**, with their larger diameter at their outer ends, is such as to arc the sheets in a transverse direction to help strengthen the sheets in a longitudinal direction, a function similar to that performed by the stationary transverse arcing plate **117**. However at the location of the cones **131** the prime sheets at least will generally be overlapped and the transverse arcing cones **131** are driven so that they revolve at a circumferential speed somewhat greater than that for the rollers **122**.

The side guiding and initial delivery of the sheets centrally of the high speed belts is effected at the entry conveyor **45** by the members **98**, FIG. **11**. The sheets maintain their position on the belts since they are held to the belts by the vacuum means or by the magnetic means. To maintain side edge control, the invention provides preliminary side guides **133**, FIGS. **9,16**, and **17** and which are bent outwardly at their top rear corner as at **134** for a wide entrance opening for receiving the sheets as they leave the transverse arcing plate **117**. The sheets are ejected at some speed by the belts **73** onto the arcing plate **117** and into the air for a fleeting moment until they land on the slow speed belts **74** extending between the rollers **121** and **122** and driven by the motor **124**. In this descent of the sheets they are side guided by the longitudinal guide members **133** and as a result of this preliminary guiding the sheets are properly positioned on the slow speed belts. The members **133** are respectively located adjacent the outside edges of the two slow speed belts **74** and each member is fixed to supporting units **135** having transverse sliding movement on the rods **136** fixed to and extending between the elements **58** of the side frames. The threaded adjusting rod **137** which is journalled for rotation has threaded engagement with the supporting units **135**. The rod **137** can be rotated by the hand wheel **138** for the adjustment desired of the preliminary side guides.

In order to accomplish the slow down in speed of the sheets on the slow speed belts, the speed of the slow speed motors **124**, that is the effective speed, is adjusted to approximately 40 percent of the effective speed of the high speed motors **113**. This produces an overlap at least of the prime sheets and which is ameasure of the slow down. In actual practice an overlap ranging between 40 and 60 percent has been found to be satisfactory. An overlap of more than 50 percent is desirable since at times a sheet will be rejected for a defect and even if this should take place the prime sheets will still have some overlap and therefore some protection when discharged onto the pile in the stacking unit. A sheet without slow down from the high speed belts could be projected by the rotating cones **131** at considerable speed such as might damage its front leading edge upon contact with the striking plate **152**.

Rotating cones **131** are located immediately in advance of each of the stacker units **50,52,54** and **56** and as the sheets are ejected by the cones a precise side guiding is effected by the precision guide members **140**, as best shown in FIGS. **12** and **14**. Each member **140** is supported in depending relation by fingers **141** from an overhead supporting unit **142** having spaced collars which ride on the spaced supporting rods **144**. The rods are supported by and they extend between the depending plates **145** which are in turn securely fixed to the tubular frame elements **69** of the stacking units. The threaded adjusting rod **146** is journalled for rotation by the plates **145** and the units **147** have threaded relation with the rod, the said units being mounted on the spaced rods **144** for slidable movement. A power cylinder **148** is carried by each unit **147** and the piston end of the same is connected at **150** as shown in FIG. **14** with an overhead supporting unit **142**. A precise adjustment of the guides **140** can be made by the operator by rotation of the threaded rod **146** to move the units **147**. Said units through the connecting piston structure will move the overhead supporting units **142** and adjust the precision guides as desired. The adjustment here is precise there being only a few thousands of an inch clearance on respective sides to produce a pile of the cut sheets having exact side registering edges. In fact the guides **140** are so close to the side edges of the pile at the top that it is difficult to remove the pile. This accounts for the piston connection **150** which operatively joins the units **142** with the units **147** and wherein the power cylinders can be rendered operative to move units **142** with respect to units **147**. When the feeding of the sheets into the stacking area has been stopped, the cylinders **148** are then energized to move the piston rod thereof outwardly. The supporting units **142** are movable on the rods **144** and so the units together with the precision guides **140** are caused to move outwardly away from the pile to free the same for removal from the stacking area.

FIG. **12** shows the striker plate **152** as located adjacent to and forwardly of the precision guides **140**. The sheets upon being ejected by the transverse arcing cones **131** pass through the passageway formed by the spaced guides **140** and the leading edge of the sheet will thereupon contact the striker plate **152**. The sheet will then descend in a flat-wise manner and the same is deposited on the pile. As previously explained the exhaust air from the fan **65** is directed by the nozzle **67** to this area of the stacking units and the stream of air issuing from the nozzle will facilitate the descent of the cut sheets in a flat-wise manner onto the stacking pile. FIG. **12** also shows in dotted lines the vertically movable support **154** for the pile of cut sheets and which journals the rollers **155** on which is located the pallet **156**. The sheets are deposited on the pallet after being side registered by the precision guides **140**, front registered

by the striker plate **152** and registered at their rear end by the back plate **157.**

The striker plate is fixed to and the same depends from a supporting unit **158** having a pair of collars which ride on the supporting rods **160.** The unit centrally thereof has threaded engagement with a threaded adjusting rod **161,** so that upon rotation of the said rod **161** the striker plate can be moved forwardly or rearwardly as the operator may desire. The rod **161** is rotated by the operator by rotating the actuating rod **162** having the hand wheel **163,** the said actuating rod being journalled by the plates **145** at their outer ends and by the central unit **164** at their inward ends. At said inward end each rod **162** carries a bevel gear **165** which meshes with a similar bevel gear **166** FIG. **15,** fixed to the end of the threaded rod **161.** The central unit **164** includes a pair of collars **167** which ride on the short stub rods **168** and it will be observed that adjacent the collars **167** the central unit has a fixed connection with the ends of the rods **160.** Structure such as **170** which is suspended from the plates **145** is provided for mounting and supporting the short rods **168** which are thus stationary being a part of the frame structure. However the central unit **164** is movable since the collars **167** will slide on the short rods **168.** With this movement of the central unit the rods **160** will also move and likewise the supporting unit **158** and thus the striker plate **152.** The rods **160** are carried at one end by the central unit and said rods at their opposite ends are mounted for sliding movement in the journals **171** carried by the frame member **172.** Of course the gear end of the threaded rod **161** is journalled by the central unit whereas the opposite end extends through the frame member **172** and beyond the contact a micro-switch **173** FIG. **15.** This constitutes an interlock preventing actuation of the sheeting line until the striker plates in the several stacking units are properly positioned for front registering the sheets.

The invention provides for bodily movement of the striker plate **152** and its supporting unit as above described since the plate must be moved forwardly away from the pile before the pile can be conveniently removed, and for this movement a power cylinder **174** is provided for the central unit **164,** as shown in FIGS. **13** and **15.** The cylinder is supported by the member **175** which in turn is mounted on the supporting rods **144.** The piston end of the power cylinder **174** is connected at **176** to the central unit **164** and upon actuation of the said cylinder movement of said unit can be effected. This movement of unit **164** carries with it the unit **158** and thus the striker plate **152** is also moved. However it is possible by said structure to precisely adjust the position of the striker plate when the gears **165** and **166** are in mesh. The power cylinders **148** and **174** are actuated at the same time when it is desired to remove the pile of stacked sheets from the stacking area. The power cylinders **148** move the precision guides outwardly away from the pile and the power cylinder **174** will move the striker plate forwardly to the left away from the pile, FIG. **12.**

The side frame for the belt conveyor section **55** is approximately square rather than rectangular FIG. **2,** although the same includes a tubular frame element **58** in combination with a tubular base frame element **61** and tubular standards **62** and **64.** This belt conveyor section carries only slow speed belts **74** passing around the rollers **180** and **181,** FIG. **10** and which are driven by the slow speed motor **124** in a manner as described, the motor driving the shaft mounting the rollers **181** and also driving the shaft **130** on which are mounted the transverse arcing cones **131.** The high speed motor **113** within the belt conveyor section has connection by means of the belt **114** with the end rollers **178** at this terminal end of the top high speed belts **72.** The sheets upon leaving the belts are transversely arced by the arcing plate **117** and then side registered by the preliminary guides **133** before being deposited in overlapping relation on the slow speed belts **74,** of this conveyor.

The last stacking unit **56** is similar in most respects to the units **50,52,** and **54** previously described. However in this unit the supporting and adjusting means for the precision guides **140** and for the striker plate **152** are located above the side frame elements **69.** The precision guides are suspended from units **142** and the same are adjustable by the threaded rod **146** all as described for FIG. **13.** Also the unit **158** supports the striker plate **152** in depending relation and the same is adjustable by menas of the threaded rod **161.** Both the precision guides and the striker plate can be bodily moved by power cylinder means such as **148** and **174** away from the pile to assist in removing the pile of stacked sheets from the stacking area.

The belt conveyor section **51** FIGS. **16** and **17,** is more properly termed an inspection conveyor since an inspection table **57** is positioned over the high speed belts **72** starting with the rollers **83.** The table **57** is fixed in position being suitably supported by the side frames in a slightly inclined manner. In this section the plate **105** is mounted for limited movement by the shaft **109** and provision is made for rocking the plate clockwise to a slight extent sufficient to deflect one or two of the sheets from the belts **72** onto the table for inspection. For actuating the plate **105** a power cylinder is employed having its piston end operatively connected to the linkage arm **106** fixed to shaft **109.**

The belt supporting box-like frame structures have been described as communicating with the tubular side frame elements which are evacuated by the fan **65.** The vacuum under the belts, which are perforated as is also the top plate **92** of the said belt supporting structures, functions as hold down means for the sheets maintaining them in position on the belts as they travel at considerable speed. For non-ferous sheets such as aluminum the vacuum is necessary. However when working on tin plate or other ferous material magnets can be employed as a substitute for the vacuum with a substantial saving in over-all power demand.

As shown in FIG. **14** the side wall **88** of each box-like belt supporting structure is provided with an inwardly directed ledge **184** extending for the length of the belt structure and which supports for its entire length a magnetic member such as **185** FIG. **18.** The member is preferrably composed of magnetic particles distributed in a ceramic material or the like and contained in a U-shaped metal trough. The ledges position the magnetic member **185** immediately below the top plate **92** and along the side edge of the belts. The magnetic attraction for the tin plate holds the sheets to the belts and does not materially interfere with belt movement.

The mode of operation of the present sheeting line has been briefly explained in connection with each unit as shown in FIGS. **1** and **2** wherein the centering reel **22** was described as supporting a coil **21** by means of the expandable coil supporting arms **23.** The continu-

ous web **20** is unwound from the coil and passed between the angled mirrors **25** and **26** which enables the operator to visually inspect both surfaces of the web for surface defects. After passing through the thickness gauge detecting means **27**, the web is straightened at **30** and then passed through the pin hole detecting means **28**. The shearing device cuts the web **20** into sheets of desired length and the cut sheets are thereupon fed to the pair of high speed belts **72** which start at the spaced rollers **78** of the entry conveyor **45**, FIGS. **6** and **11**. The first reject station is provided by the first conveyor **48**. If a sheet is to be deflected from the stream of sheets on the belts **72**, then the memory classifier will automatically cause actuation of the reject plate **103** in a counter-clockwise direction to deflect the faulty sheet down onto the high speed belts **73** which pass around the rollers **107** and **108**. From said belts the sheets are deposited on the slow speed belts **74** which pass around the rollers **121** and **122**, and thus the speed of the sheets is considerably reduced. From the slow speed belts **74** the sheets are ejected by the cone-shaped arcing members **131** to between the precision guides **140** and between the striker plate **152** and the back plate **157**, all as best shown in FIGS. **10** and **12**. It thus follows that as the pile of precisely registered sheets are stacked on the pallet **156**, the vertically moveable supporting member **154** is gradually lowered. When the pile has reached a desired height the discharge of sheets into the stacking area is stopped and the pile is removed thus rendering the stacking area operative once again for stacking the cut sheets.

The sheeting line as shown in FIGS. **1** and **2** consists of two stacking areas for reject sheets and two stacking areas for prime sheets. All belts are supported on box-like supporting structures as best shown in FIGS. **11** and **14** and which are in turn respectively supported in a cantilever manner from a side frame member. The top and the intermediate ducts and chambers of the side frame members are evacuated by the fan **65** to in turn evacuate the said box-like supporting structures and the vacuum thus produced assists in holding the sheets on the belts. The permanent magnets **185** extend under the belt supporting structures' top plate **92** being supported by ledges **184** for the length of the top plate. The said magnetic means will also assist in holding plates and sheets of ferrous material on the belts. The ducts in the base of the belt conveyor side frames and in the side frames of the stacking units provide convenient passages for the electric wiring.

The main objective of the invention is accomplished by the high speed belts in combination with the slow speed belts. The sheets can be cut at a high speed for a high production capability and then the slow speed belts reduce this speed considerably so that the sheets can be discharged against the striker plate without danger of damaging the leading edge of the relatively thin sheets.

What is claimed is:

1. In apparatus for producing sheets of predetermined length from a coil of stock material, the combination with cutting mechanism for cutting the continuous web of said stock material into sheets of desired lengths, of a belt conveyor section having spaced side frames, a top high speed belt arrangement supported by the side frames and including a first pair of high speed belts for moving the sheets longitudinally of the section, an additional high speed belt arrangement provided by the belt conveyor section and located below the top high speed belt arrangement and providing a second pair of high speed belts for continuing the movement of certain sheets longitudinally, a slow speed belt arrangement located fowardly of and in horizontal alignment with the second high speed belt arrangement and providing a pair of slow speed belts, a transverse arcing plate located between the additional high speed belt arrangement and the slow speed belt arrangement, power means for moving the respective belts, whereby the sheets from the second pair of high speed belts are caused to contact the transverse arcing plate upon leaving the said belts and are arced transversely and are then deposited on the slow speed belts in overlapping relation, duplicate belt supporting structures being provided for both the high speed and also the slow speed belt arrangements respectively, each belt supporting structure generally consisting of spaced side walls, a connecting bottom wall and a connecting top plate on which the belt moves, each belt supporting structure being located inwardly and being supported in a cantilever manner from its respective side frame, a pair of supports extending from the side walls at the ends of each belt supporting structure for journalling a roller, and the top plate of each belt supporting structure and also the belt passing over the same having a plurality of small openings therein, respectively.

2. Apparatus for producing sheets of pre-determined length from a coil of stock material as defined by claim **1**, wherein the side frames each include tubular frame elements, wherein each belt supporting structure is supported in said cantilever manner from its respective side frame by tubular members which are integral with the side frames, and wherein their hollow passages communicate with those in the side frames.

3. In apparatus for producing sheets of predetermined length from a coil of stock material, the combination including an entry conveyor having side frames and providing a first pair of high speed belts for initially receiving the sheets, a first belt conveyor section having side frames in juxtaposed relation with the entry conveyor and also having a second pair of high speed belts for receiving the sheets from the entry conveyor, a pair of slow speed belts provided by the first belt conveyor section and located below the second pair of high speed belts, a pair of vertically spaced rollers journalled at the end of the entry conveyor adjacent the first belt conveyor section, terminal rollers for the first pair of high speed belts provided by the first conveyor section and located in substantial horizontal alignment with the slow speed belts, said first pair of high speed belts having their top run passing over the upper of the spaced rollers and then inclining downwardly to pass around the terminal roller with their return run passing over the lower of the spaced rollers, a third pair of high speed belts provided by the first belt conveyor section and having location in horizontal alignment with the slow speed belts and extending between the said terminal rollers and the start rollers of the slow speed belts, a transverse arcing plate between the third pair of high speed belts and the said slow speed belts for arcing the sheets transversely as they leave the high speed belts and are deposited in overlapping relation on the slow speed belts, a shaft journalled for rotation in the side frames of the first belt conveyor section and located beyond but adjacent the terminal rollers of the slow speed belts, and a cone shaped mem-

ber on the said shaft adjacent each end thereof, each cone shaped member having its end of larger diameter disposed outwardly.

4. Apparatus for producing sheets of pre-determined length from a coil of stock material as defined by claim **3,** wherein the side frames each include upper tubular frame elements, and additionally including other tubular frame elements integral with those of the side frames and extending inwardly for supporting the means for supporting the belts from their particular side frame in a cantilever manner, and wherein the hollow passages of the said other tubular frame elements communicate with those in the side frame.

5. Apparatus for producing sheets of pre-determined length from a coil of stock material as defined by claim **3,** wherein duplicate belt supporting structures are provided for both the high speed belts and for the slow speed belts respectively, wherein each belt supporting structure generally consists of spaced longitudinal side walls, a connecting bottom wall and a connecting top plate on which the belt runs, wherein each belt supporting structure is located inwardly and is supported in a cantilever manner from its respective side frame, and wherein the top plate of each belt supporting structure and also the belt passing over the same have a plurality of small openings formed therein, respectively.

6. In apparatus for conveying sheets of material following a cutting operation thereon, the combination including a belt conveyor section having side frames, a pair of high speed endless belts extending between spaced rollers journalled by the side frames of the belt conveyor section for moving the sheets longitudinally, a pair of slow speed endless belts extending between a second set of spaced rollers also journalled by said side frames and disposed in substantial horizontal alignment with the high speed belts, said slow speed belts receiving the sheets from the high speed belts and continuing their longitudinal movement, a transverse arcing plate between the high and the slow speed belts for arcing the sheets transversely as they leave the high speed belts and are deposited in overlapping relation on the slow speed belts, a shaft journalled for rotation in the side frames of the belt conveyor section and located beyond but adjacent the terminal rollers of the slow speed belts, a cone shaped member on the said shaft adjacent each end thereof, each cone shaped member having its end of larger diameter disposed outwardly, and means for driving the said shaft to rotate the cone shaped members at a circumferential speed somewhat greater than that of the terminal rollers of the slow speed belts.

7. Apparatus for conveying sheets of material following a cutting operation thereon as defined by claim **6,** wherein duplicate belt supporting structures are provided for the high and also the slow speed belts respectively, wherein each belt supporting structure is located inwardly and is supported in a cantilever manner from its respective side frame, wherein each side frame includes an upper tubular element, and additionally includes other frame elements which are tubular and integral with the side frames respectively and which extend inwardly for supporting the belt supporting structures from their particular side frame in said cantilever manner, and wherein the hollow passages of the other tubular frame elements communicate with said upper tubular frame element.

* * * * *