June 27, 1961 R. E. CARREL 2,990,015

SUCTION BOX COVERS

Filed March 19, 1957 4 Sheets-Sheet 1

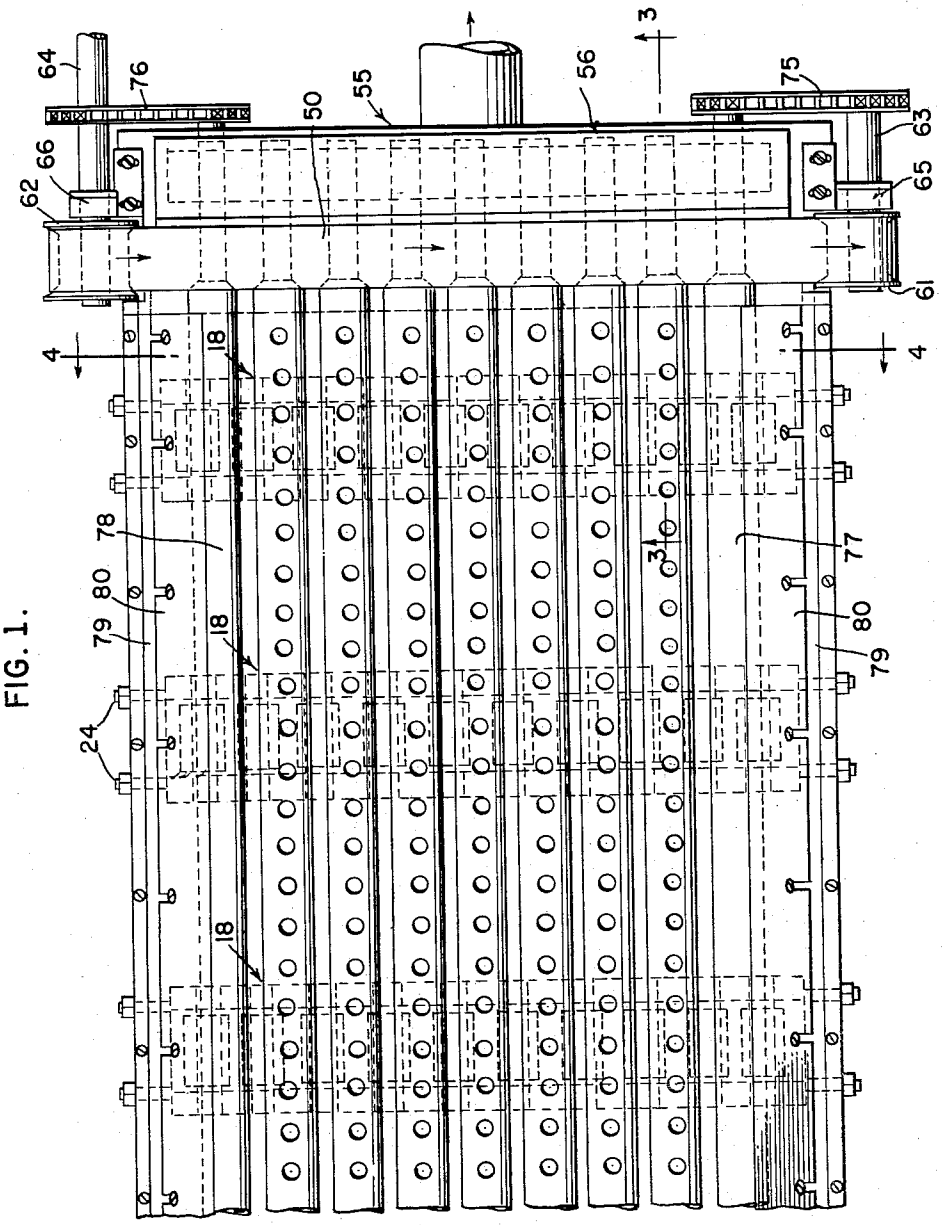


FIG. 1.

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FIG.2

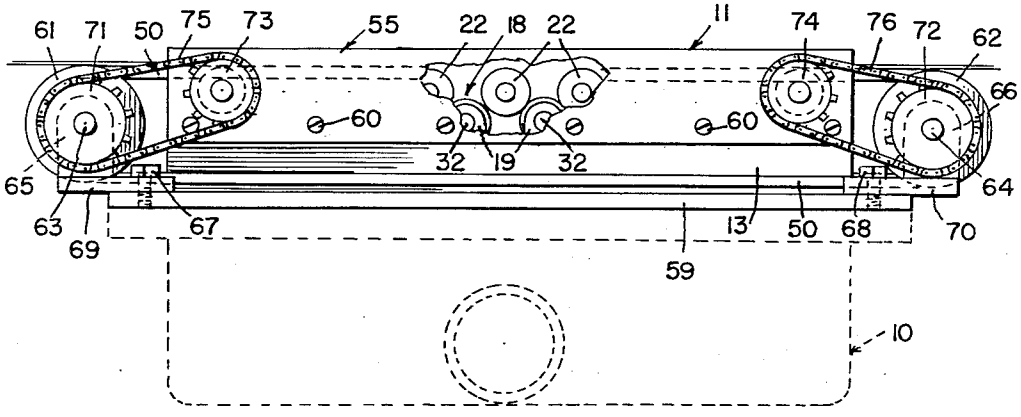
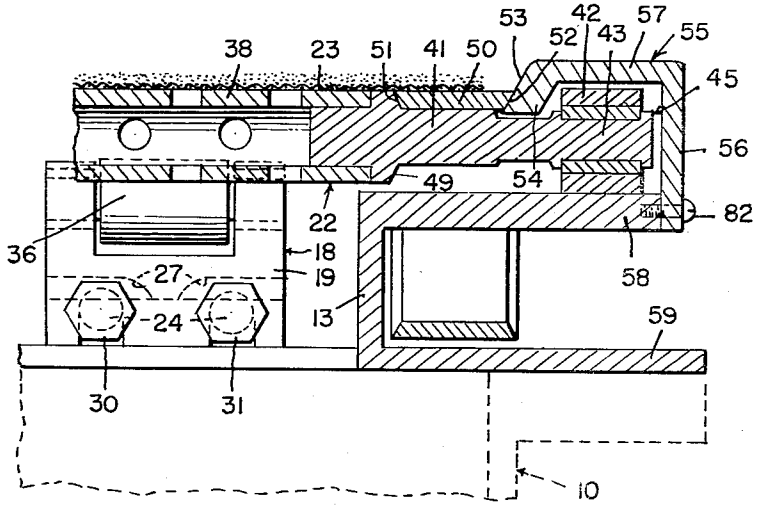


FIG.3



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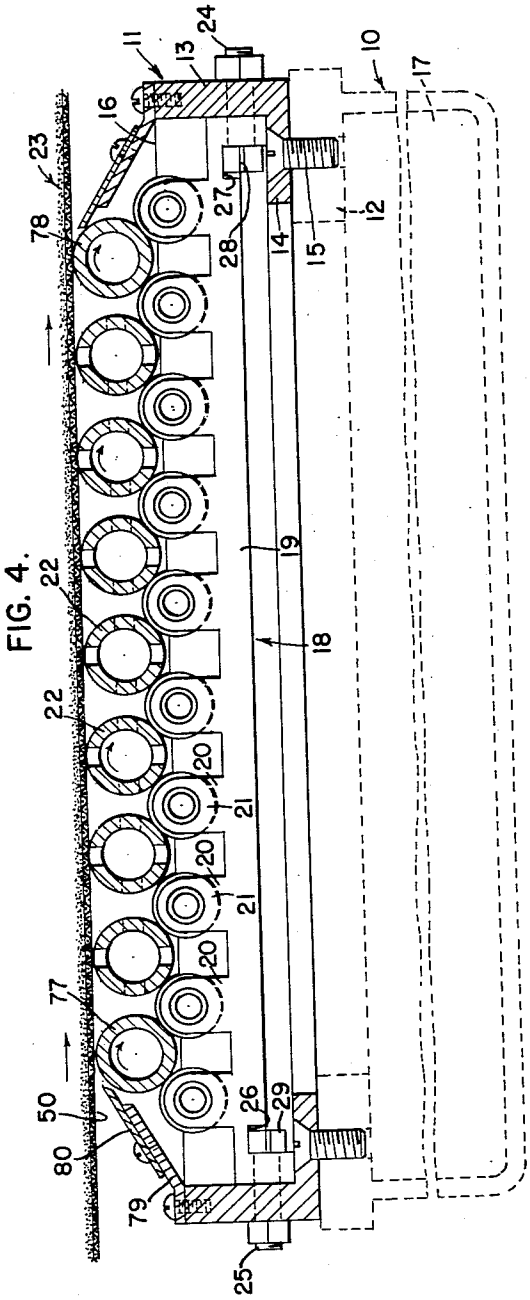


FIG. 4.

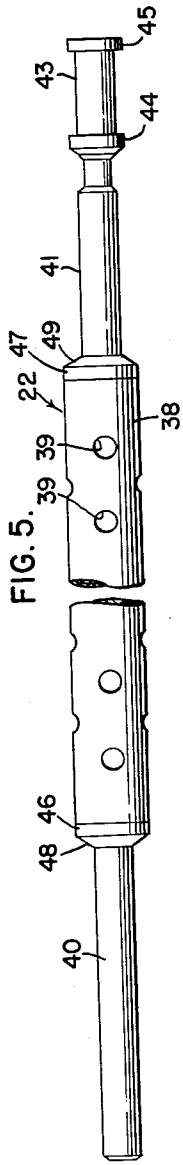


FIG. 5.

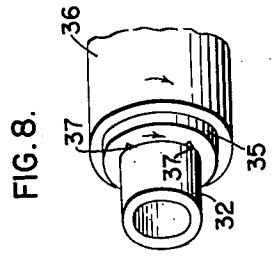


FIG. 8.

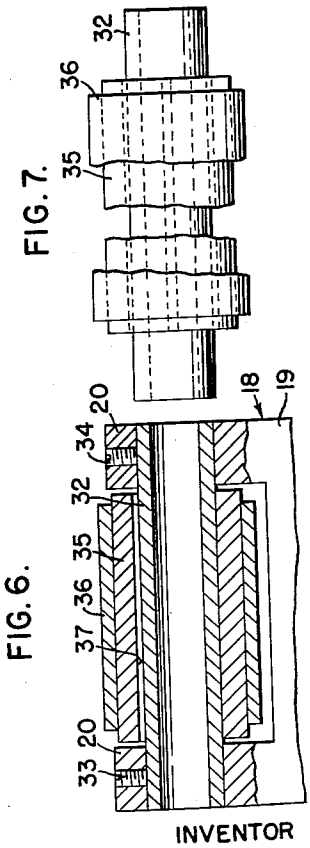


FIG. 6.

FIG. 7.

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FIG.9

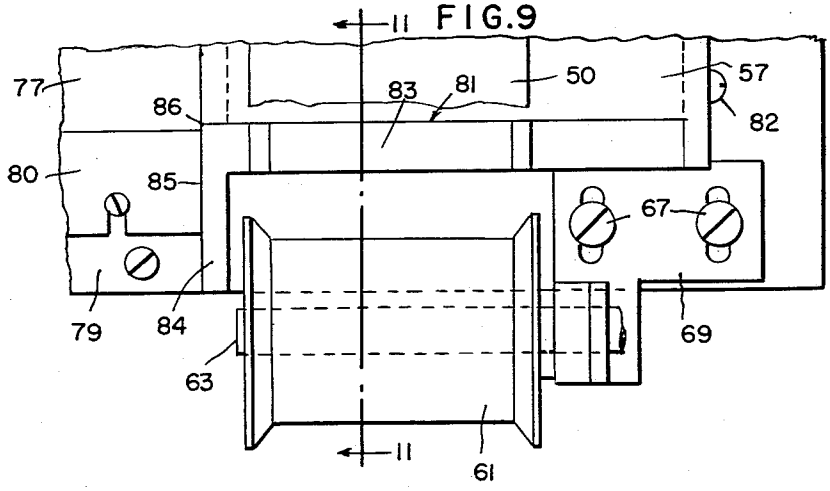
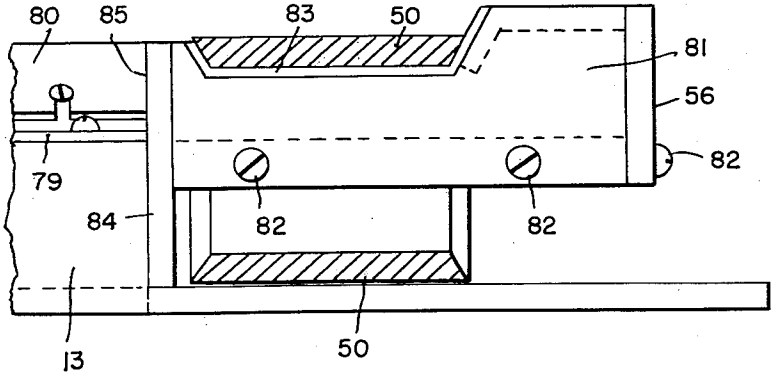


FIG.10



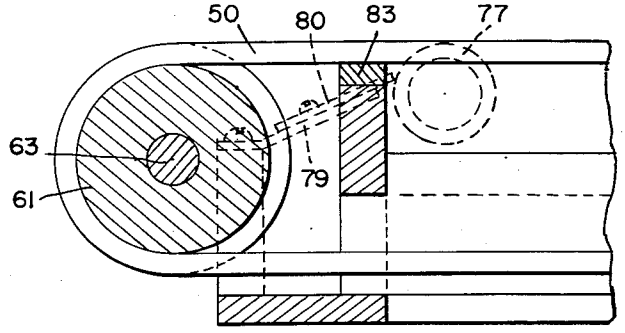
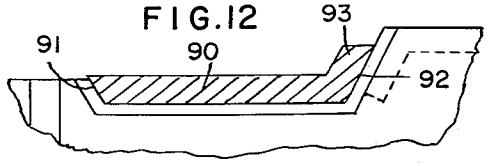


FIG.11

FIG.12



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2,990,015

SUCTION BOX COVERS

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Filed Mar. 19, 1957, Ser. No. 647,117
1 Claim. (Cl. 162—367)

The invention is of utility in any art in which a filter screen, driven over a suction box would be useful for thickening material or extracting liquid. For simplicity of exposition, however a paper-making machine will be referred to.

In the manufacture of paper and allied products, particularly on the wet end of a machine known as a Fourdrinier, difficulty has long been experienced with the rapid wear of the wire screens due to the friction between these screen belts and the suction boxes used to remove the water from the pulp. It is necessary, particularly on high speed machines, to renew these screen belts very often, and as the screen belts are expensive this is an important item in the cost of manufacturing paper. Furthermore, the extra power required to operate the Fourdrinier due to this friction is considerable.

A Fourdrinier screen is made in the form of an endless horizontal belt running over a driver drum, usually a suction roll, and idler drums to support and keep it tight. The top or tight side is further supported by free-running table rolls and by several flat boxes, which are boxes rectangular in section in which is maintained a partial vacuum. Paper pulp mixed with a large percentage of water is fed onto the wires at one end. Some of this water drains through the wires as it passes along over the table rolls and a large amount is drawn out by suction as the wires pass over the flat boxes. This screening and felting action forms the sheet of paper, which is further processed in subsequent operations. The tops of the flat boxes which are in contact with the wires are usually of hard wood, sometimes impregnated with a lubricant in the presence of water. The heavy suction pressure, however, between the rapidly moving wires and the top of the boxes produces a considerable drag, which results in friction and wear. All this is well known in the art.

Many attempts have been made to produce flat boxes equipped with rollers under the wires to overcome these difficulties. These devices have been only partially successful on slow moving paper machines, and nothing has been produced as yet that is satisfactory for high speed machines.

One of the principal troubles in making such a device lies in the fact that the flat box rollers supporting the wire must be close together, or too great a sag or deflection of the wire will occur between rollers. This requires rollers of small diameter arranged close to one another. It has heretofore been customary to support such rollers from end bearings only. As commercial paper machines a very wide, requiring rolls ranging from 8 feet to 20 feet or more in length, too great a deflection results when small diameter rollers are used. Difficulty has also been experienced in sealing the roller equipped boxes against air leakage.

Therefore, it is of primary concern in connection with this invention to provide improvements in suction box covers wherein the cover is so constructed as to minimize frictional drag upon the screen belt and wherein this is accomplished without sacrificing proper and effective support of the screen as it passes over the cover.

Another object of this invention is to provide improvements in suction box covers wherein the utilization of small diameter rollers is realized without sacrificing rigidity of the same in supporting the screen belt.

Another object of this invention in conformity with the preceding object for the utilization of end as well as intermediate support elements for the small diameter rollers so as to obviate sagging or undue deflection therein.

Still another object of this invention is to provide an improved seal for suction box covers to avoid undue wear upon the screen and to consequently impart greater longevity thereto.

Another object of this invention is to provide opposite side edge seals for screen belts which take the form of endless belts travelling with the screen belt and providing sliding sealed engagement with the suction box cover rather than relying upon a sliding engagement between the screen belt and a stationary seal member which would tend to produce abnormal wear upon the edges of the screen belt.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the present embodiment is, therefore, illustrative and not restrictive, since the scope of the invention is defined by the appended claims rather than by the description preceding them, and all changes that fall within the metes and bounds of the claim or that form their functional as well as conjointly cooperative equivalents, are therefore intended to be embraced by this claim.

In the drawings:

FIG. 1 is a plan view of a portion of the improved suction box cover constructed in accordance with this invention;

FIG. 2 is a side elevational view of the improved suction box cover with portions thereof broken away to show details of internal construction;

FIG. 3 is an enlarged sectional view taken substantially along the plane of section line **3—3** of FIG. 1;

FIG. 4 is an enlarged transverse sectional view taken along the plane of section line **4—4** in FIG. 1 and illustrating the mounting of and relative relationship of the supporting rollers;

FIG. 5 is a plan view of one of the supporting rollers;

FIG. 6 is an enlarged sectional view taken through one of the roller supporting elements and showing the details of construction thereof;

FIG. 7 shows one of the roller supporting elements in elevation with portions thereof broken away to further illustrate details of internal construction; and

FIG. 8 is a perspective view of one end of a roller supporting element.

FIG. 9 is a partial plan view of one corner of the assemblage and showing the sealing structure in this region;

FIG. 10 is a sectional view showing the corner of FIG. 9 partially in elevation;

FIG. 11 is a sectional view taken along the plane of section line **11—11** in FIG. 9 and further illustrating details of the seal assembly; and

FIG. 12 is a transverse sectional view taken through a modified form of belt construction.

Referring now more particularly to FIGS. 2 and 4, reference numeral **10** indicates in general the lower portion of a suction box which can be constructed in any conventional manner. That is, the structure designated by the reference character **10** designates the lower portion of a conventional suction box and forms no part of the present invention. However, the cover for the suction box assembly as is designated generally by the reference character **11** and which forms structurally the upper portion of the suction box and upon which the screen belt is supported as the same travels across the suction box assembly. It will be appreciated that the upper edge **12** of the conventional or lower portion of the suction box may take many different forms in accordance with the particular design of the original unit and that, therefore, the cover assembly **11** must, of necessity, be accommodated to fit upon such supporting ledge or shelf in accordance

with the particular design of the conventional unit. For the purpose of mounting the cover assembly on the particular type of lower portion of the suction box as is shown and illustrated in the drawings, the enclosing side wall **13** of the cover assembly is provided completely around its lower edge with an inwardly directed flange **14** with this flange resting upon the upper surface of the aforementioned shelf **12** and being rigidly affixed thereto by means of the fastening elements **15**. In FIG. 4, reference character **16** indicates the top edge of the enclosing side wall structure **13**, the same, of course, being open both at top and bottom so as to communicate with the suction box chamber **17** which is maintained under partial vacuum during operation of the machine.

As is shown most clearly in FIGS. 1, 3 and 4, the cover assembly is provided with a plurality of longitudinally extending and laterally spaced support assemblies **18** which extend between the fore and aft portions of the enclosing wall structure **13** and are rigidly secured thereto so as to form an integral part of the cover assembly. Each of these supporting assemblies includes a relatively rigid base portion **19** which is formed throughout its length and on opposite sides thereof with a plurality of vertically projecting ears **20** and each laterally spaced pair of such ears supports a trunnion member **21** so that there are provided a series of longitudinally spaced trunnion members on each support assembly with the several trunnions on each support assembly being disposed in transverse alignment so as to support the intermediate portions of a plurality of rollers as indicated most clearly in FIGS. 2 and 4, the latter rollers being indicated by the reference character **22**. These rollers **22** are of relatively small diameter so that they form rather closely spaced lines of support for the overlying screen belt **23** and, therefore, prevent sagging of the screen between adjacent rollers as the same is supported thereon. At the same time, the rollers are permitted to rotate, as hereinafter described, in accordance with the linear speed of the screen **23** so that at no time is there any real linear motion between the rollers **22** and the screen but rather only a rolling relationship so as to reduce to a minimum frictional drag of the screen upon the rollers. This permits the machine to be operated at a much greater speed and with less power loss and, furthermore, increases the effective life of the screen **23** since the same is not continually subjected to sliding frictional contact with any portion of the suction box cover which would tend to wear out the screen.

Each of the support members has its base portion **19** rigidly affixed to the opposite wall portions of the enclosing structure **13** preferably by means of the bolts **24** and **25** which project longitudinally from opposite ends of the base **19** and through the associated wall portions **13**. The undersurface of the base **19** at opposite ends thereof is cut away or notched as at **26** and **27** so as to receive the heads **28** and **29** of the bolts and the opposite ends of the base are provided with the notches **30** and **31** so as to permit the bolts to be initially inserted in place, see particularly FIG. 3. The bolts **24** and **25** are secured by suitable nuts on the outer side of the wall structure **13** as is shown most clearly in FIG. 4.

The various supporting assemblies **18** are spaced laterally throughout the center or intermediate portion of the suction box cover assembly and at a distance apart sufficient to provide the necessary support for the individual rollers **22** to prevent any undue sagging or deflection thereof caused by the weight of the screen **23** and the paper pulp or web on top of the screen.

The construction of each individual trunnion is illustrated most clearly in FIGS. 6 and 7. In these figures, it will be seen that the ears **20** are provided with aligned apertures for receiving the opposite ends of a hollow pin member **32** which is held rigid with the ears by means of a pair of set screws **33** and **34** which bear against the opposite ends of the pin as shown. The pin, therefore, forms a rigid journal for the remainder of the trunnion assembly which surrounds the same. The trunnion proper preferably embodies a cylindrical sleeve **35** of Teflon or the like preferably for the purpose of attaining a good bearing relationship upon the metal pin **32** and embracing the sleeve **35** is a resilient cover **36** which may take the form of a resilient rubber sleeve. Preferably, the inner surface of the Teflon or similar material sleeve **35** is provided with a plurality of longitudinally extending grooves **37** for the purpose of receiving lubricant during operation of the trunnions. It is important to note that each trunnion projects a slight distance above the associated ears **20** and for this purpose the uppermost edge of each ear is preferably formed of a uniform radius which is of slightly less than the outer surface of the cover member **36**. This is shown most clearly in FIG. 4.

Each of the rollers **22** is constructed in accordance with the showing of FIG. 5 wherein it will be seen that each includes an enlarged intermediate body portion **38** which is hollow and provided with a plurality of openings **39** in the surface thereof for the purpose which will be presently apparent. Preferably, the opposite ends of each body **38** receive journalling rods **40** and **41** each of which terminates in a portion of uniform diameter for reception within bearing blocks such as those illustrated generally by the reference character **42** in FIG. 3. On one of such journal members **41**, there is preferably provided at the opposite ends of the bearing surface **43** thereof a pair of radially projecting shoulders or collars **44** and **45** which serve to locate each roller axially and, of course, the corresponding journal blocks **42** must be of the split type to accommodate this end of the roller with the particular construction shown since the shoulders **44** and **45** are integral with the journalling portion **41**. The opposite end of each roller is similarly journalled but is free to shift axially to accommodate for longitudinal expansion and contraction of the rollers without buckling.

That portion of each journal end assembly **40** or **41** disposed most closely adjacent the associated end of the roller body **38** is provided with an enlarged shoulder portion **46** or **47** each of which has a frusto-conical outer face, as indicated by the reference characters **48** and **49**. The purpose of these frusto-conical faces is to engage against the beveled side edge of sealing belt members disposed along opposite sides of the machine, one of such belts being indicated by the reference character **50** in FIGS. 1–4. In FIG. 3, each belt **50** will be seen to be provided with the opposite side beveled edges **51** and **52**, the former of which engages against the aforementioned frusto-conical surface **49** on the journal end portion **41** of the associated roller assemblies **22** and the latter side of which engages against the outer inclined face **53** of a downwardly projecting lip **54** of the side piece indicated generally by the reference character **55**. Two such side pieces are provided for the cover and extend along the opposite longitudinal edges of the same. In the particular example shown, each such side piece includes a vertical wall portion **56**, an inwardly directed horizontal wall portion **57** and the aforementioned lip **54** which is integral with the inner edge of the wall portion **57**. For the purpose of mounting these side pieces and for providing a support for the aforementioned bearing blocks **42**, the side walls **13** of the cover are provided, along the opposite longitudinal sides of the cover with outwardly extending horizontal ledge portions **58** which are disposed in spaced parallelism above the underlying ledges **59** and overhang the same. The ledge portions **59** correspond to the previously mentioned flanges **14** which rest upon the upper surface of the lower portion of the suction box, the ledges or flanges **59** serving the same purpose. The side pieces **55** are secured as by fasteners **60** to the outer edge of the ledges **58** as is shown most clearly in FIG. 3 and the space between the ledge **58** and the underlying flange **59** serve to accommodate for the lower flight of the belt **50**, the same being of endless

form and being trained about the pulleys **61** and **62** at opposite ends of the suction box as is shown most clearly in FIG. 2.

Each pulley **61** and **62** is driven by a suitable means, being fixed to the shafts **63** and **64** respectively which are supported by means of the brackets **65** and **66**, suitably mounted as by fasteners **67** and **68** through their base portions **69** and **70**. Also fixed to the shafts **63** and **64** are a pair of sprockets **71** and **72** and trained about these sprockets and extending over corresponding sprockets **73** and **74** are endless chain members **75** and **76**. The two end rollers **77** and **78**, see FIG. 4, are imperforate throughout their main body portions and each has one journal end thereof elongated to project outwardly through one of the side pieces **55** and upon which the sprockets **73** and **74** are fixed. These two end rollers are therefore positively driven by means of the same shafts which drive the belt and all of the intermediate rollers are driven positively also by virtue of their engagement with the upper flight of the belt **50** and through intermediate supporting rollers **21**, all rollers being driven in the same direction.

It is to be noted that the screen belt **23** is of a width greater than the lengths of the main body portions **38** of the rollers **22** and that the opposite side edges extending laterally to overlap a substantial amount of the upper flight of the belt **50**, see particularly FIG. 3.

To provide seals at the opposite ends of the suction box, across the wall portion **13** at each end of the cover is mounted an angulated support plate **79** and affixed to each support plate is a flexible sealing strip **80** which projects beyond the free edge of the plate **79** and engages along the outer surface of an associated end roller **77** or **78**. It will be noted that the upper flights of the belts **50** pass over the lines of contact between the sealing strips **80** and the end rollers **77** and **78** so as to permit sealed engagement throughout the entire lengths of the end rollers such that the belts together with the sealing strips **80**, positively seal the assemblage around the entire periphery thereof.

As is shown most clearly in FIGS. 9, 10 and 11, a specially constructed sealing means is utilized to seal the corner regions of the cover assembly where the belt **50** passes outwardly fore and aft from the cover. In this construction, each corner of the cover is provided with a wall member indicated generally by the reference character **81** which extends inwardly from the previously mentioned vertical wall portion **56** as is shown most clearly in FIG. 10 and is so constructed as to fit snugly against the inner surface of the wall portion **56** and being secured to this assembly by means of suitable fasteners such as those indicated by the reference character **82**. The upper edge of this wall assembly **81** is notched in the manner shown most clearly in FIG. 10 with the opposite side walls defining such notch being angulated in accordance with the opposite beveled sides of the belt **50** and similarly to the angularity of the inner wall portions **53** and the angularity of the beveled surfaces **49** on the rollers. Preferably, the belt engaging surface of this notch is covered with strips **83** of bearing material such as Teflon or the like so as to minimize wearing of the undersurface and opposite sides of the belt.

Integrally formed with each of the wall assemblies **81** and at the inner side thereof is a laterally outwardly extending portion **84** which preferably terminates at the corresponding end edge of the cover assembly as is shown most clearly in FIG. 9. The inner face **85** of the wall extension **84** provides a seal in conjunction with the corresponding end edge of the supporting strip **79** and sealing strip **80** to seal along the associated side edges of these members so that the corners of the cover assembly are substantially completely sealed with the exception of very small areas located adjacent the corner edge portion **86** of the wall assemblies **81**.

Consequently, the assembly achieves a very effective seal throughout the entire region thereof without resorting at any time to any large areas of sliding frictional contacting surfaces which will unduly wear the component parts. As a matter of fact, the only parts which are subjected to sliding frictional contact at any point in the assembly are the belts **50** and then provision has been made to minimize the effect of this frictional contact by the provision of suitable bearing surfaces adjacent which the belt is contacted.

The modification shown in FIG. 12 illustrates one manner in which the belt can be constructed so as to provide a more effective outer side seal. In this figure, the belt is indicated by the reference character **90** and, as will be seen, its inner edge **91** is constructed in accordance with the showing of FIG. 10, whereas on its outer side **92**, the belt is provided with a longitudinally extending upraised portion **93** which effectively widens the outer sealing edge face portion **92** so as to establish a greater width of sealing engagement with the rollers and elements with which this side of the belt comes in contact.

I claim:

In a suction box for sealingly supporting a traveling conveyor screen against suction, in combination, a top structure having a forward transverse wall, a rearward transverse wall, and a pair of longitudinal side walls; a plurality of transversely extending screen supporting roller members including a forward terminal roller member and a rearward terminal roller member, each roller member having an intermediate screen supporting portion and reduced end portions defined by a bevelled shoulder; means for turnably supporting said roller members upon said side walls of the top structure comprising a shelf portion extending outwardly from the top end of each side wall of the top structure substantially along the length thereof, and journal means mounted on each shelf structure for turnably supporting the outer ends of the reduced end portions of said roller members; a forward and a rearward pulley carried by said top structure at each end of each side wall of the top structure; a pair of endless sealing belts each having a pair of longitudinal edges formed at opposite sides thereof, said longitudinal edges of each belt being bevelled opposite one another, each belt having carried along a respective side wall by a respective forward and a respective rearward pulley with the upper strand of each belt supported by respective reduced end portions of the roller members so that the top face of the belt is disposed substantially flush with the adjacent outer peripheral portions of the associated roller members such that the upper strand of each belt is adapted to sealingly support the respective edge portion of the associated screen with the screen being maintained in a flat condition throughout by the rollers and top sides of the upper strands of the belts, the return strand of each belt passing underneath the associated shelf, means for sealing the upper strand of each sealing belt against suction along the associated side of the top structure comprising a casing structure together with said shelf portion enclosing the adjacent journal means and having a longitudinal inwardly facing wall portion at each end thereof, and comprising a top wall portion overhanging said journal means and formed with a bevelled edge portion opposite to said bevelled shoulders so that the bevelled edges of said sealing belt engage said shoulders and said stationary bevelled edge portions; and transverse sealing means carried by each transverse wall of the top structure and extending substantially along the length thereof into sealing relationship with the respective forward and rearward terminal rollers, with each transverse means endwise confined between a pair of said inwardly facing wall portions opposite to one another in sealing relationship therewith, so arranged that said inwardly facing end wall portions together with said sealing belt and said terminal roller

members in contact with said screen define a suction area relative thereto.

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