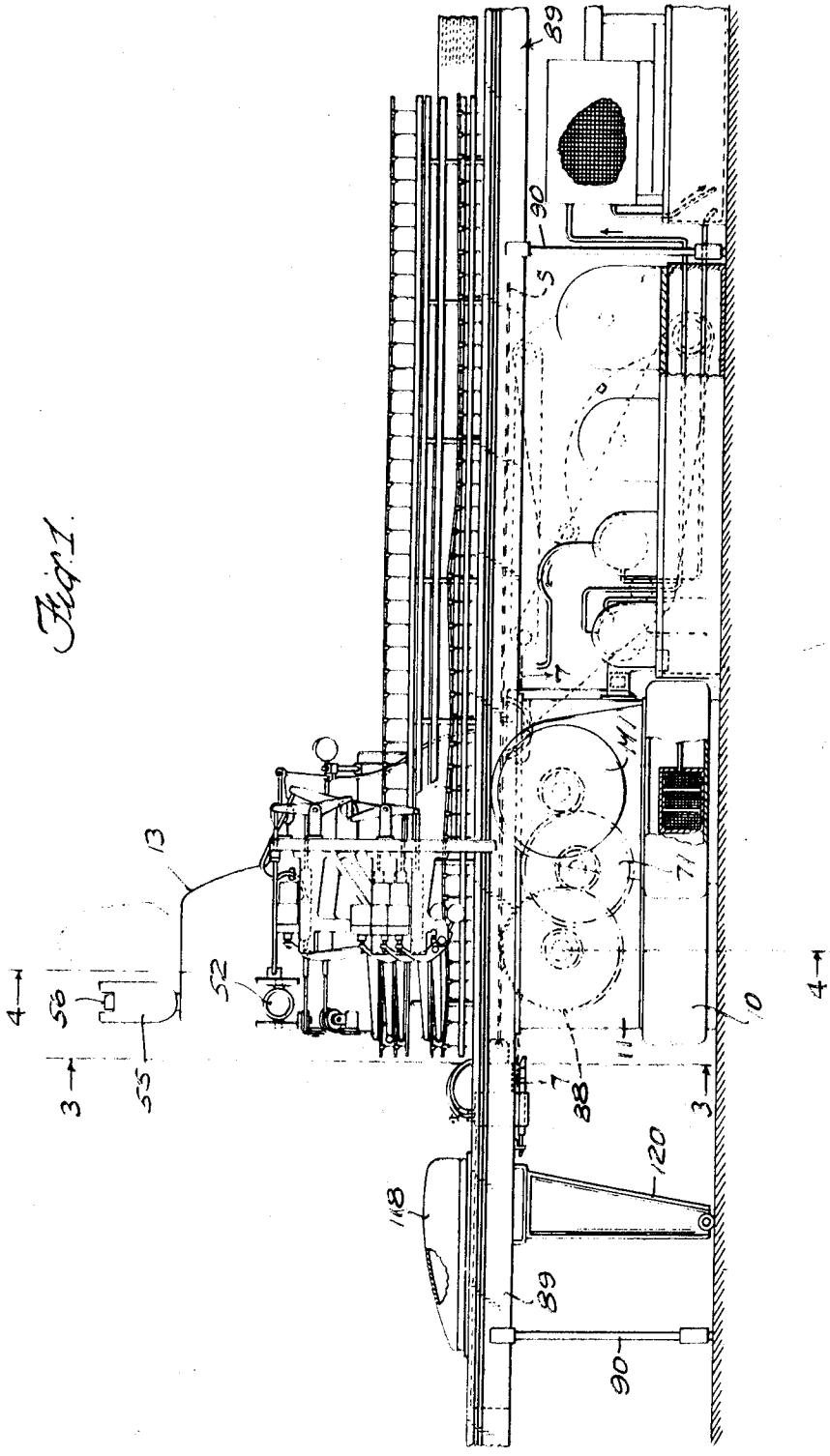
Feb. 2, 1960 F. ANDERSON 2,923,342

ELONGATED CHANNEL DRAW BENCH FOR SHEET SHAPING MACHINE OPERATING ON THE FORMING-BY-DRAWING PRINCIPLE AND HAVING LUBRICATING MEANS FOR A CARRIAGE SLIDABLE IN SAID DRAW BENCH

Original Filed Feb. 8, 1955

11 Sheets-Sheet 1

Fig. 1.



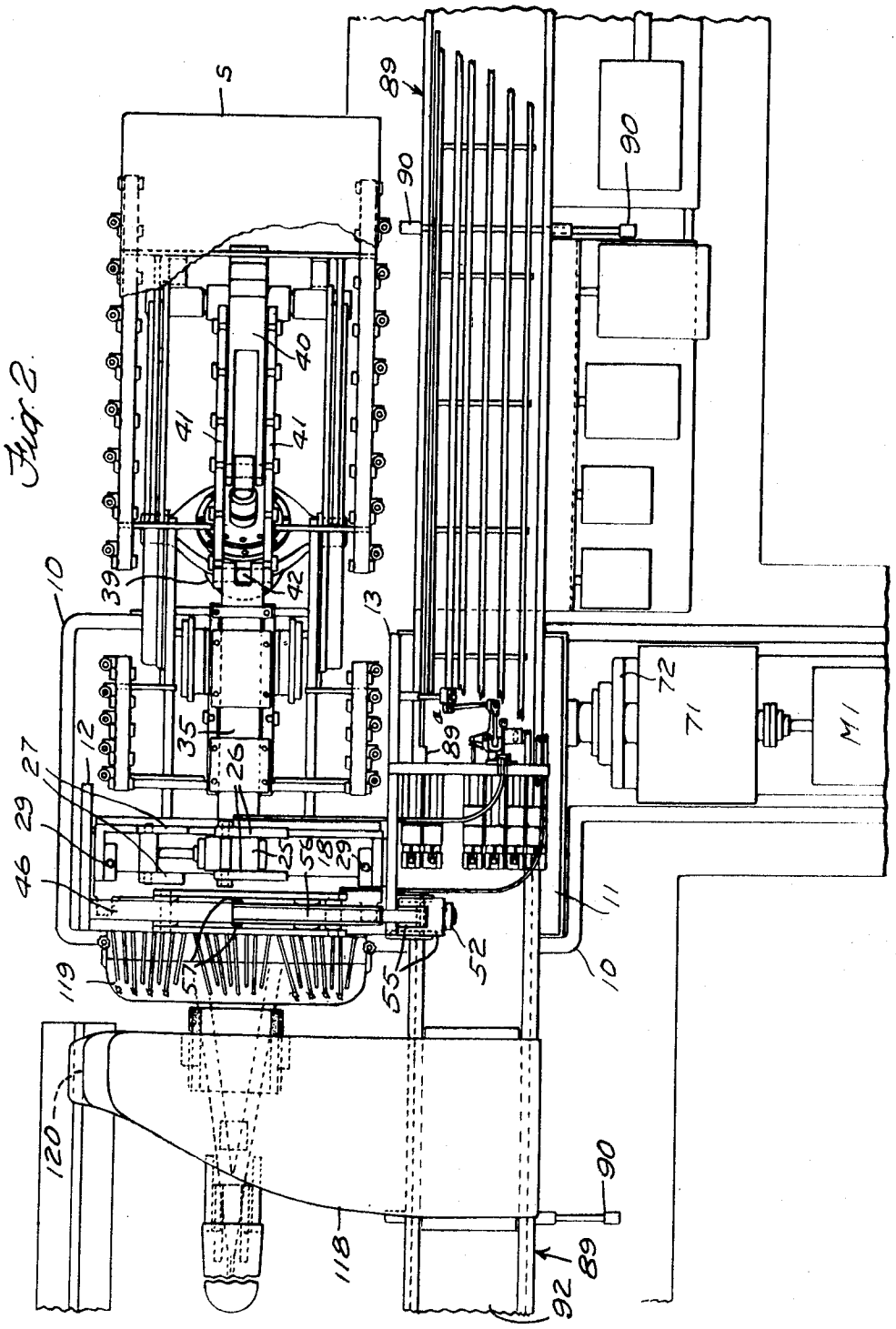
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Original Filed Feb. 8, 1955

11 Sheets-Sheet 2

Fig. 2.



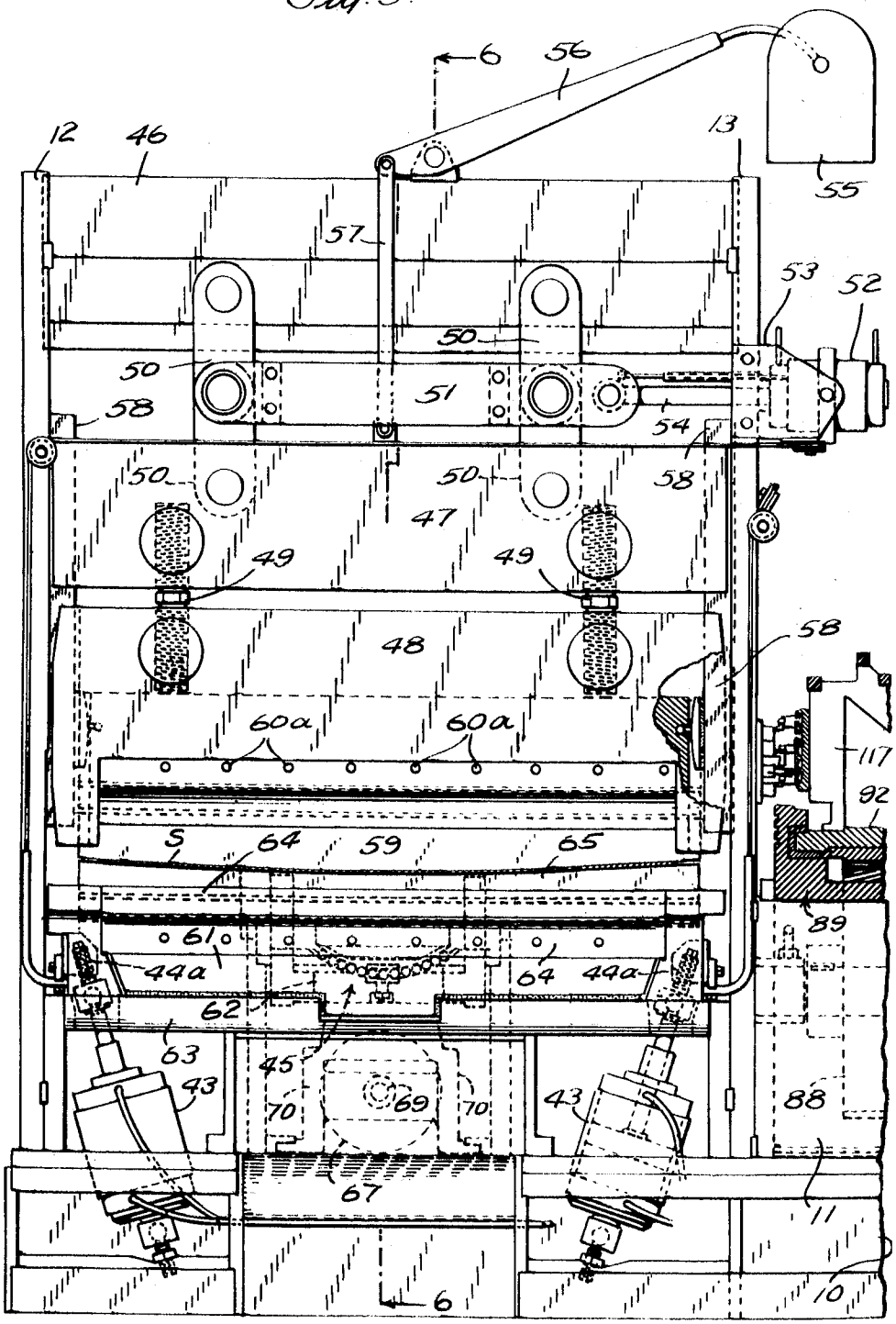
Feb. 2, 1960 F. ANDERSON 2,923,342

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11 Sheets-Sheet 3

Fig. 3.



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Original Filed Feb. 8, 1955

11 Sheets-Sheet 4

Fig. 4.

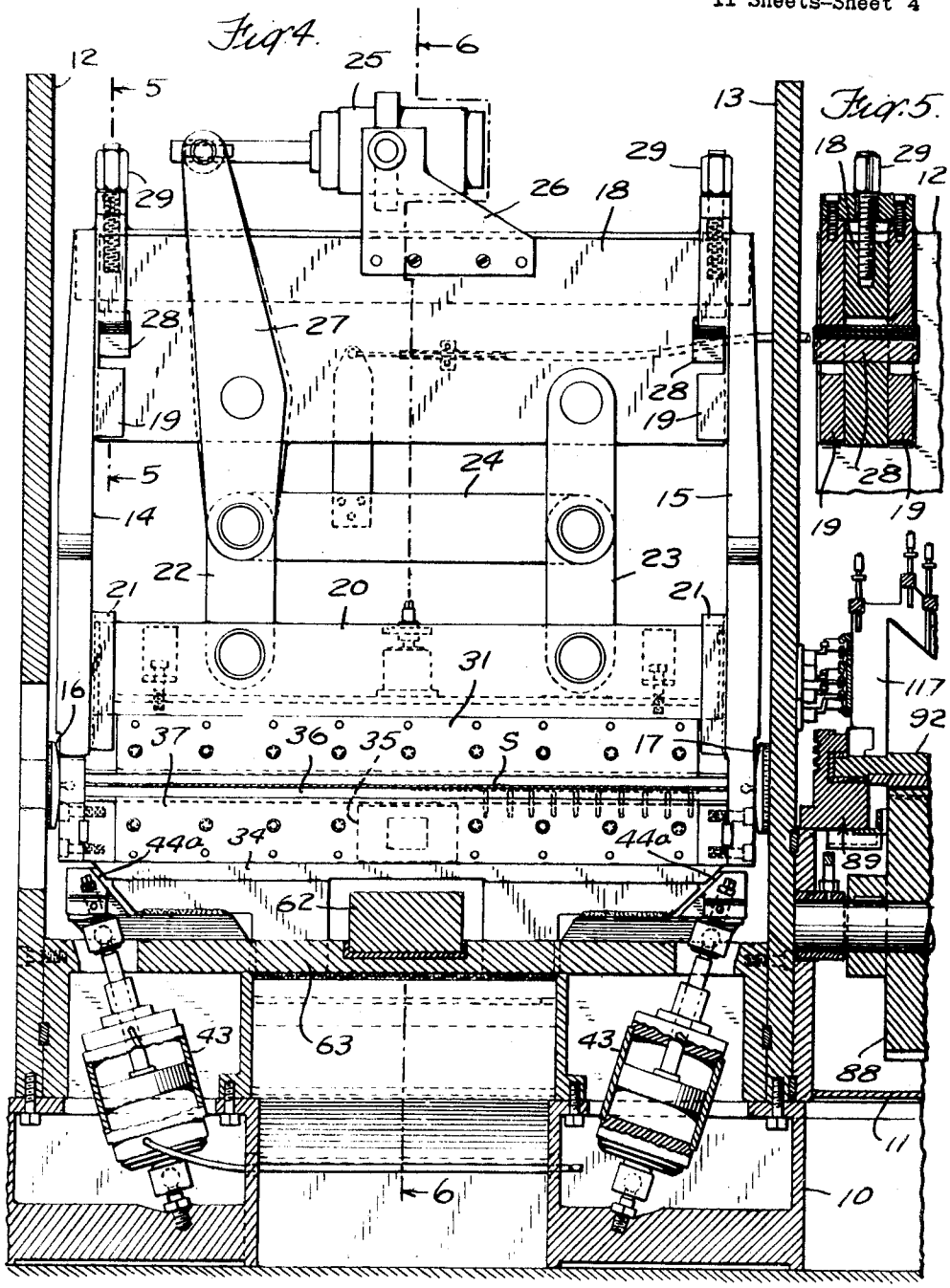


Fig. 5.

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ELONGATED CHANNEL DRAW BENCH FOR SHEET SHAPING MACHINE OPERATING ON THE FORMING-BY-DRAWING PRINCIPLE AND HAVING LUBRICATING MEANS FOR A CARRIAGE SLIDABLE IN SAID DRAW BENCH

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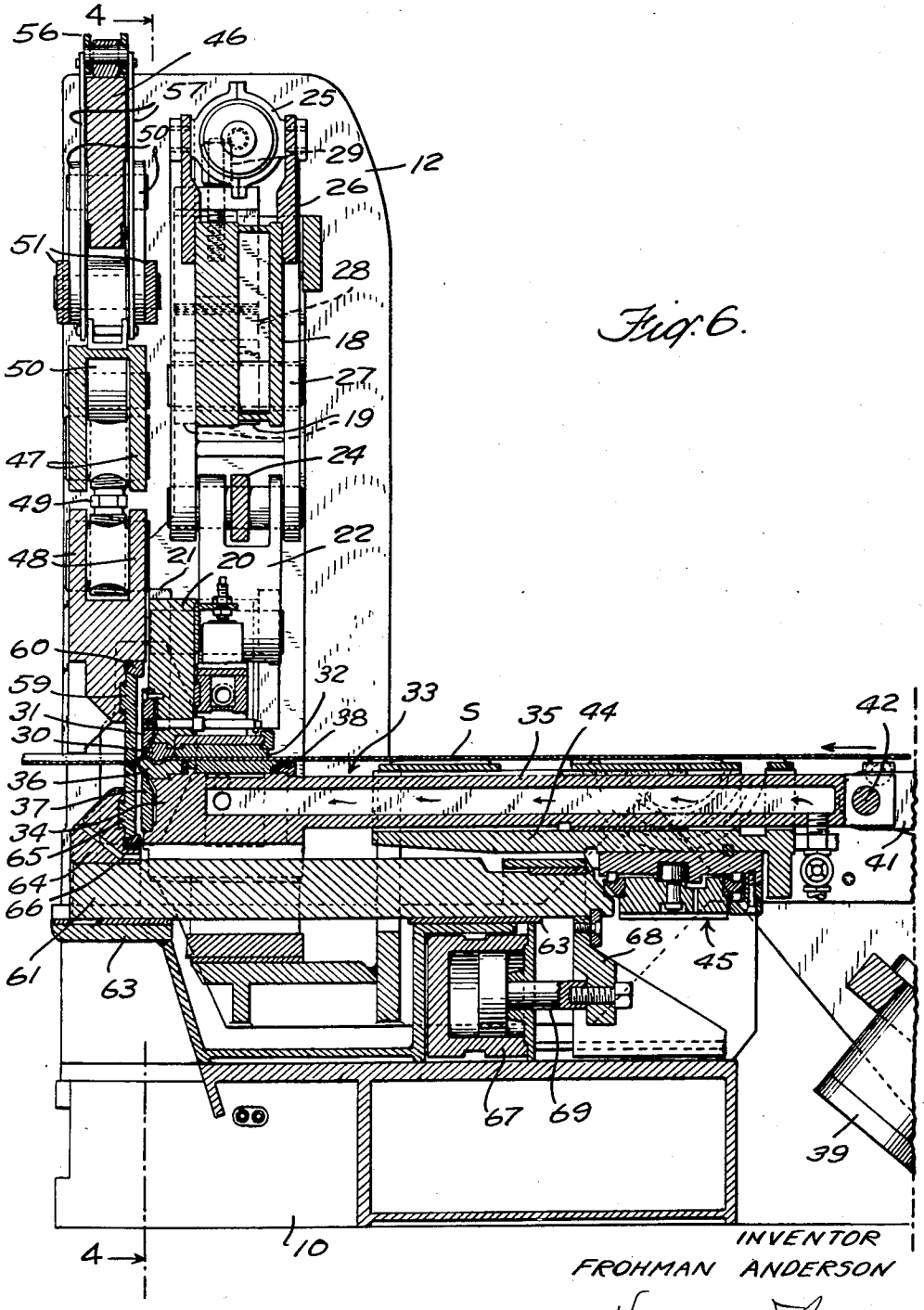


Fig. 6.

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ELONGATED CHANNEL DRAW BENCH FOR SHEET SHAPING MACHINE OPERATING ON THE FORMING-BY-DRAWING PRINCIPLE AND HAVING LUBRICATING MEANS FOR A CARRIAGE SLIDABLE IN SAID DRAW BENCH

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Fig. 7.

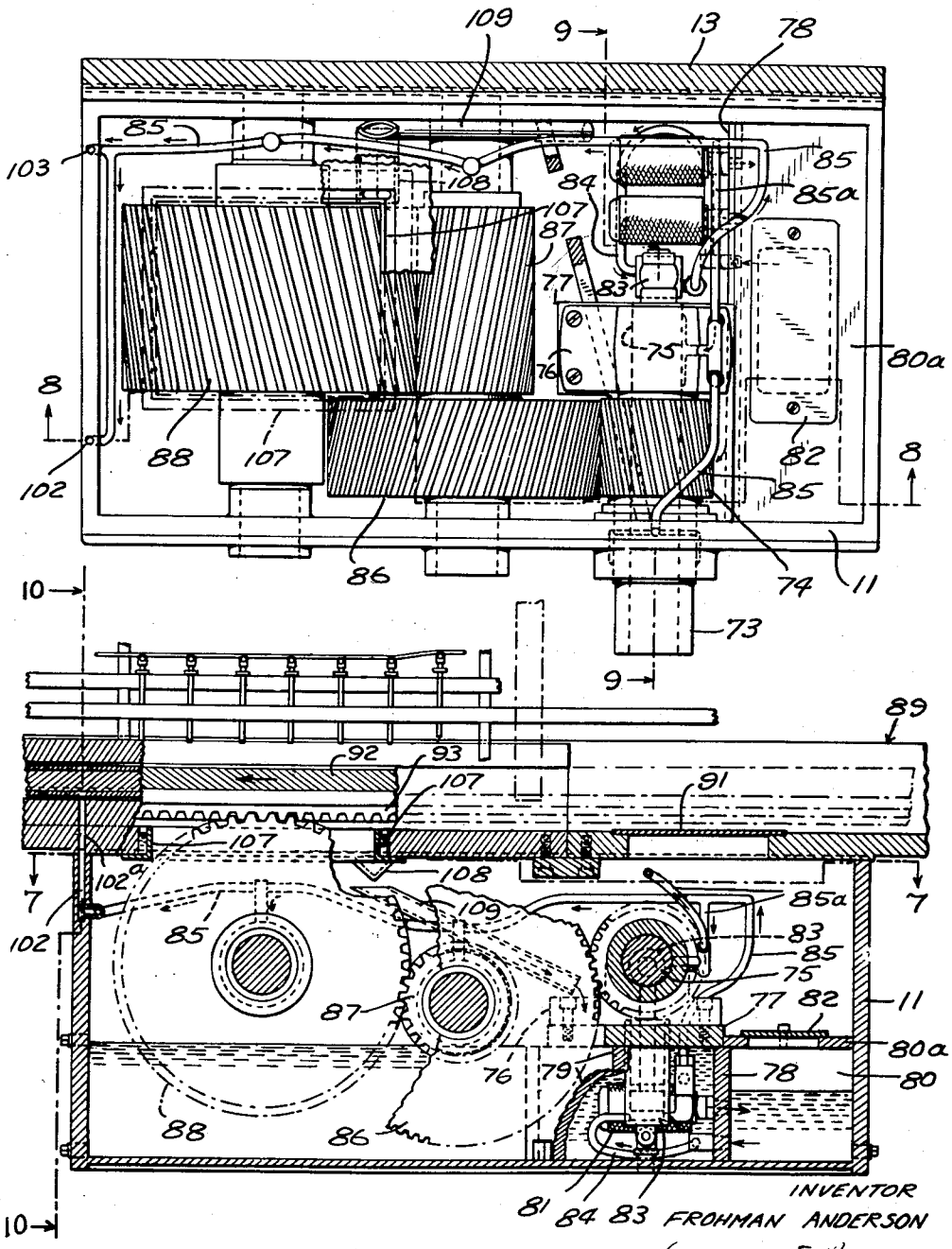


Fig. 8.

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ELONGATED CHANNEL DRAW BENCH FOR SHEET SHAPING MACHINE OPERATING ON THE FORMING-BY-DRAWING PRINCIPLE AND HAVING LUBRICATING MEANS FOR A CARRIAGE SLIDABLE IN SAID DRAW BENCH

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Fig. 9.

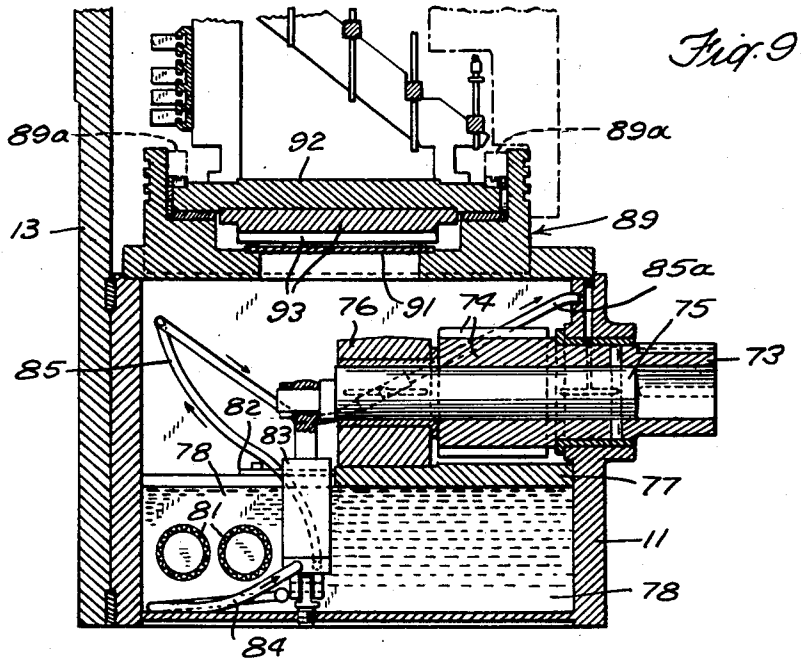
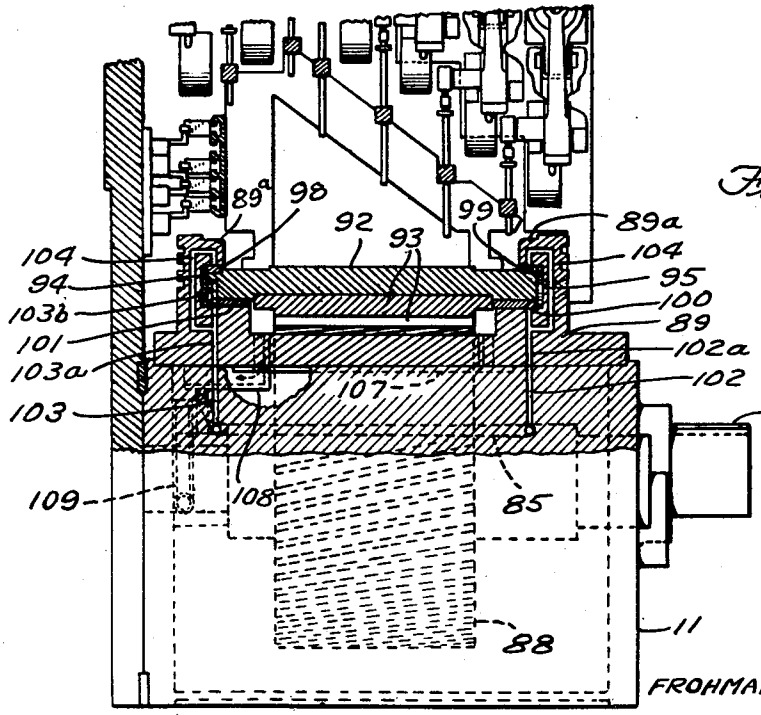


Fig. 10.



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ELONGATED CHANNEL DRAW BENCH FOR SHEET SHAPING MACHINE OPERATING ON THE FORMING-BY-DRAWING PRINCIPLE AND HAVING LUBRICATING MEANS FOR A CARRIAGE SLIDABLE IN SAID DRAW BENCH

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11 Sheets-Sheet 8

Fig. 11.

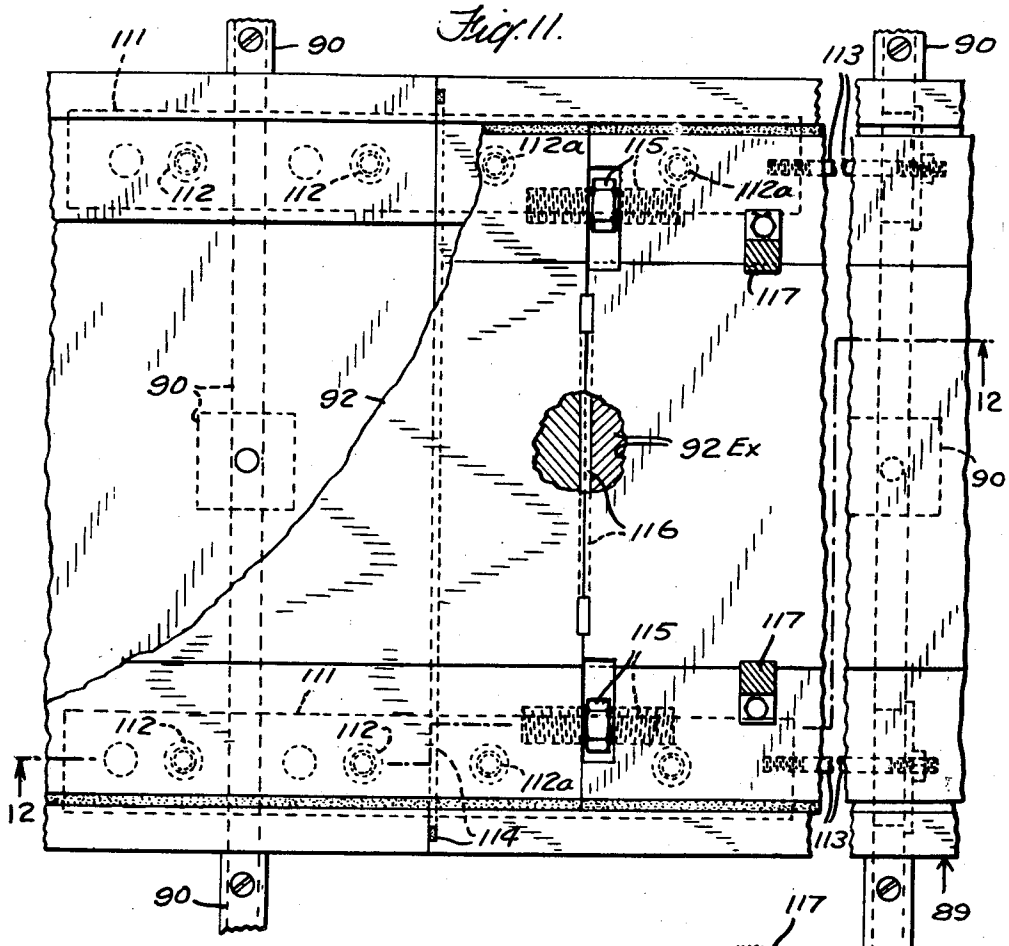
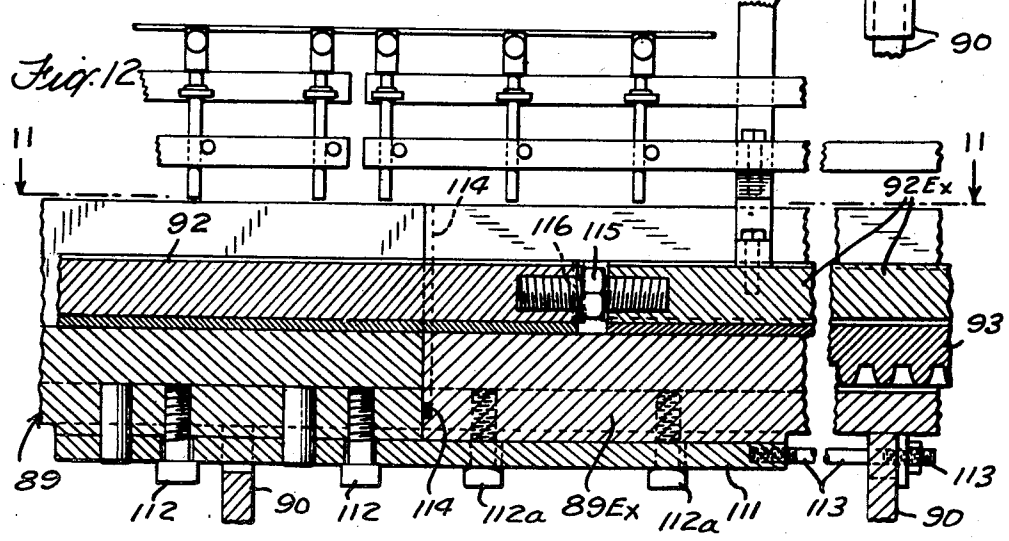


Fig. 12



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ELONGATED CHANNEL DRAW BENCH FOR SHEET SHAPING MACHINE OPERATING ON THE FORMING-BY-DRAWING PRINCIPLE AND HAVING LUBRICATING MEANS FOR A CARRIAGE SLIDABLE IN SAID DRAW BENCH

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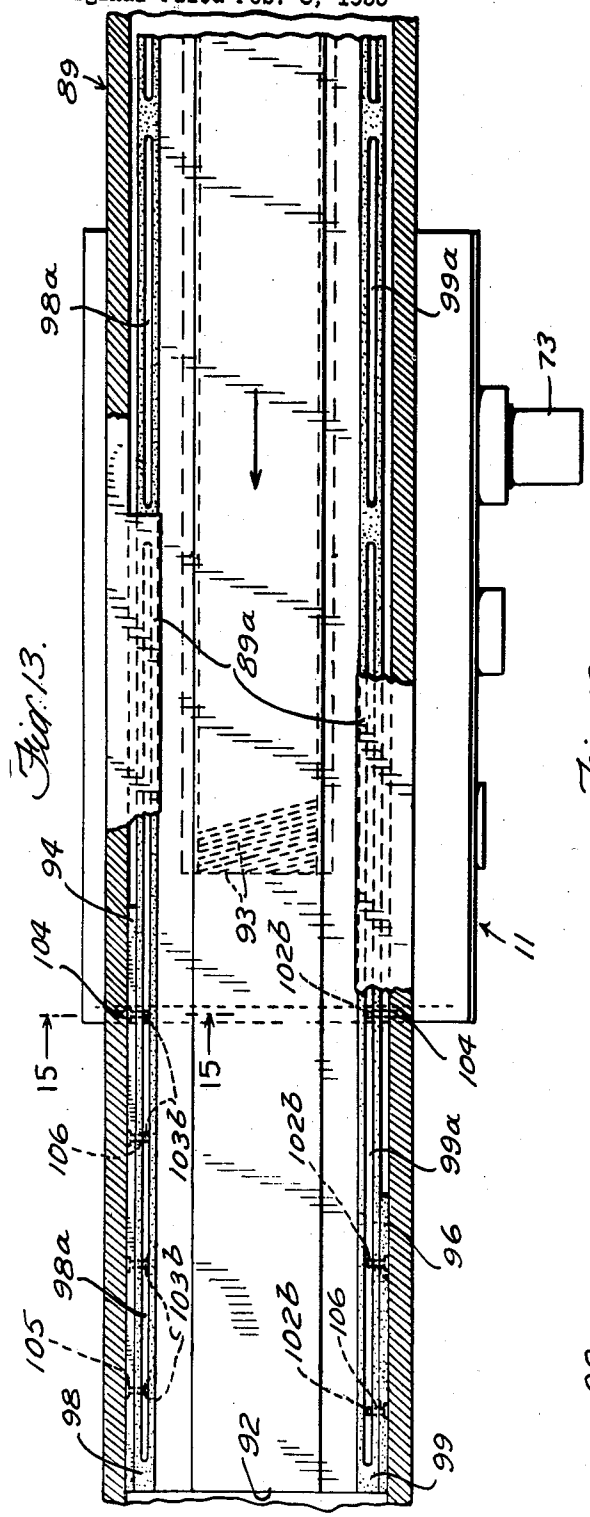


Fig. 13.

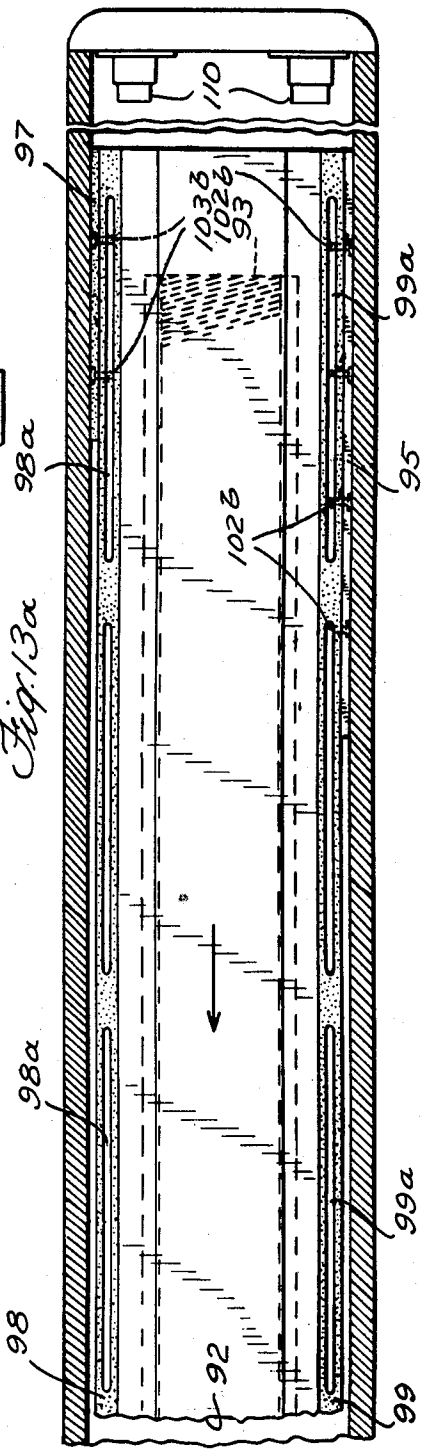


Fig. 13a

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Original Filed Feb. 8, 1955 11 Sheets-Sheet 10

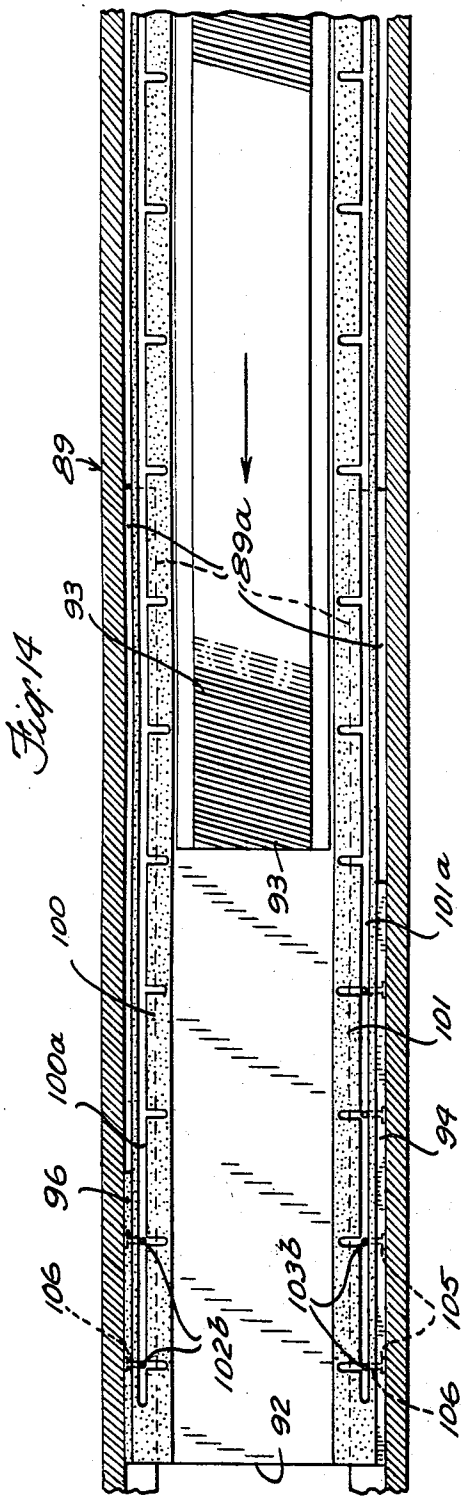


Fig. 14

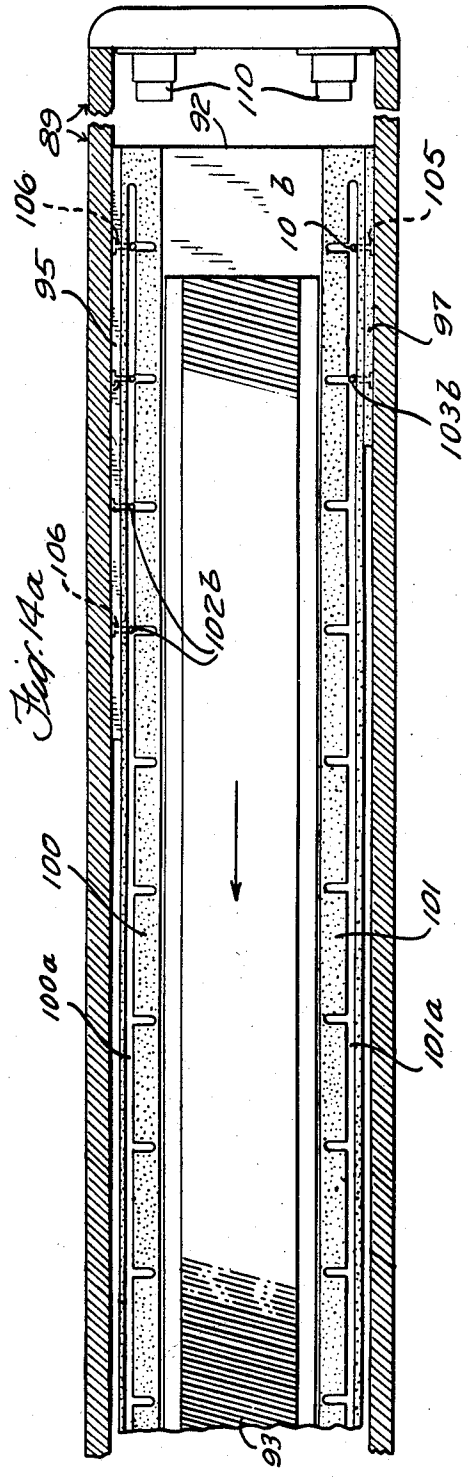


Fig. 14a

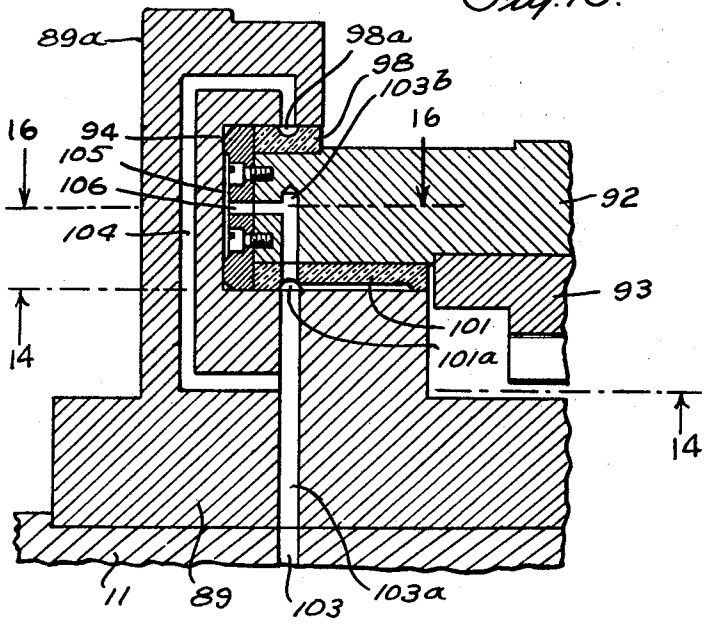
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11 Sheets-Sheet 11

Fig. 15.



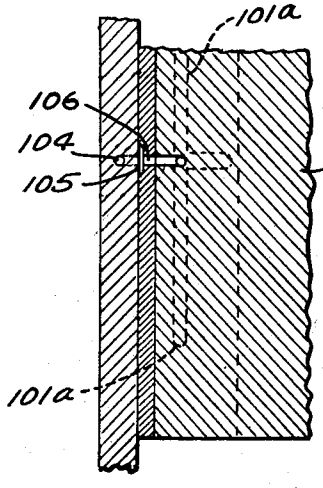


Fig. 16.

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United States Patent Office 2,923,342
Patented Feb. 2, 1960

2,923,342

ELONGATED CHANNEL DRAW BENCH FOR SHEET SHAPING MACHINE OPERATING ON THE FORMING-BY-DRAWING PRINCIPLE AND HAVING LUBRICATING MEANS FOR A CARRIAGE SLIDABLE IN SAID DRAW BENCH

Frohman Anderson, Las Vegas, Nev.

Original application February 8, 1955, Serial No. 486,773, now Patent No. 2,851,080, dated September 9, 1958. Divided and this application November 1, 1957, Serial No. 693,932

7 Claims. (Cl. 153—32)

This application is a division of application Serial No. 486,773, filed February 8, 1955, now Patent No. 2,851,-080, which relates to a machine for shaping metal sheets into compound curves by pulling the sheets edgewise from one end to the other over a series of forming elements the working faces of which differ in contour transversely of the sheets and are disposed in stepped relation, a restraining or hold-back force being exerted on the sheets in opposition to the pulling force to subject the sheets to stresses beyond their yield point. This operation in the said parent application is termed forming-by-drawing.

Such machines are composed of three main functional components comprising the sheet forming structure, a draw bench including a power actuated carriage for the mechanism that is to be translated in the performance of the operation, and the sheet pulling mechanism attached to and propelled by the carriage for gripping and pulling the sheets through the forming structure.

This application relates to the draw bench construction. More specifically, it relates to the draw bench and its relation to the forming structure including the means for lubricating the draw bench slide or carriage.

One of the main functions of the carriage is to translate the jaws to pull the sheets through the forming elements and, being thus heavily loaded, it presents a problem of proper guidance and lubrication. Power means of considerable proportions are required and therefore suitable disposition of the draw bench with respect to the forming structure presents a problem.

In accordance with this invention, the work bench is supported upon the gear box or housing for the gearing, its ends being supported by legs. The gear box is supported upon the base to which are attached the uprights for the forming structure, being either directly in line with the forming elements so that the jaws are carried over the bench, or at one side thereof in close proximity so that the jaws are carried by a laterally extending head.

The bench is U-shaped in cross section and serves as a guide for a carriage sliding therein. A rack on the bottom of the carriage is engaged by a bull gear in the gear box and is thus propelled. Because of the great stress to which the carriage is subjected by the up thrust of the feed gear and the pulling strain, the sides of the guide are provided with an overhang which also requires lubrication.

In accordance with the invention, that bench is provided with a pair of vertical oil ducts that communicate with an oil pressure source and lead to the under side of the carriage on opposite sides of the guide channel and through a branch to the underside of each overhang, thereby providing lubrication for the top and bottom surfaces of the carriage near each side edge, these surface portions bing preferably provided with wear plates.

To distribute the oil on the under side of the bottom wear plates, a longitudinal groove is formed in the lower surface of each bottom wear plate which is continuous from end to end of the plates and is disposed in register with the respective vertical duct.

Also to lubricate the side edges of the carriage, these edges for a distance at each end are provided with wear plates and one or more right angle passages in the slide provide communication from the respective continuous longitudinal groove on the bottom face of the carriage to the side face where the face of the wear plate is recessed laterally for effective oil retention and distribution. The longitudinal groove is also provided at intervals with a lateral recess for effective distribution of the oil on the under surface of the carriage.

Since the stress to which the carriage is subjected, due to the up thrust of the bull gear and the pulling stress, is concentrated on the portion of the draw bench on the gear box and at the delivery end, there is no need for an overhang on the feed end of the bench, and, therefore, for economy, the overhang is discontinued from the gear box to the feed end of the bench. The oil duct in the overhang also feeds into a longitudinal groove on the top face of the top wear plate on each side, but since the portion of the groove outside the overhang is uncovered, it is obvious that the exposed portion cannot be connected to pressure. For this reason, the groove in each of the two top wear plates is interrupted at points such that the uncovered portions of the grooves in the retracted position of the carriage are not connected to the groove sections which are under pressure.

The length of the draw bench and carriage must, of course, be suited to the length of the sheets to be drawn and in order that the carriage may have the capacity for operating on long sheets without the necessity for the excessive travel when operating on short sheets, the invention contemplates means to vary the length of the bench and carriage to adapt them to the particular length of sheets being formed.

The invention has other objects and advantages as will appear from the following description of the embodiment of the invention illustrated in the accompanying drawings.

Fig. 1 is a side elevation of a machine embodying the invention.

Fig. 2 is a plan of the same.

Fig. 3 is a front elevation of the forming structure and a partial transverse section of the draw bench on the line 3—3 of Fig. 1.

Fig. 4 is a partial sectional view of the forming structure and of a portion of the draw bench structure on line 4—4 of Figs. 1 and 6.

Fig. 5 is a fragmentary detail on the section line 5—5 of Fig. 4.

Fig. 6 is a vertical section of the machine on a plane central of the forming structure on line 6—6 of Figs. 3 and 4.

Fig. 7 is a plan of the gear box and enclosed mechanism on line 7—7 of Figs. 1 and 8.

Fig. 8 is a vertical section on line 8—8 of Fig. 7.

Fig. 9 is a vertical section on line 9—9 of Fig. 7.

Fig. 10 is a partial elevation and partial section on line 10—10 of Fig. 8.

Fig. 11 is a fragmentary plan of a section of the draw bench with extension added, being generally as viewed on line 11—11 of Fig. 12.

Fig. 12 is a longitudinal section on broken section line 12—12 of Fig. 11.

Figs. 13 and 13*a* are fragmentary plans of the carriage

slide and draw bench, Fig. 13 being of the forward end, Fig. 13*a* being of the rear end, the sides of the draw bench being largely in section.

Figs. 14 and 14*a* are bottom fragmentary plans of the forward and rear end portions, respectively, of the carriage slide with the adjacent draw bench portions in section on line **14—14** of Fig. 15 and on the scale of Fig. 13.

Fig. 15 is an enlarged section of the inner side portion of the draw bench and slide, the section being on line **15—15** of Fig. 13.

Fig. 16 is a fragmentary horizontal section on line **16—16** of Fig. 15 and on a reduced scale.

In the illustrated construction, the draw bench is disposed alongside the forming structure, all being supported upon a common base. The forming structure comprises three stages, which in the embodiment shown are contained between two uprights attached to the common base.

The first-stage of the forming structure has a lower T-shaped body member with the cross head extending between the uprights and carrying a forming and hold-back element which presents a straight edge over which the sheet is drawn and so determines the general path of movement of the sheet. An upper vertically slidable ram member opposes the cross head and cooperates with the lower element to impose a regulatable pressure upon the sheet, being vertically adjustable and guided within the uprights. The first stage is, therefore, known as the hold-back stage.

The second stage comprises a ram member spanning the uprights and guided therein for vertical adjustment. A forming element carried by the ram member has a geometrical contour differing from that of the hold-back element of the first stage and in operation is in stepped relation to the first stage element. It constitutes a draw-over forming element.

The third stage also has a T-shaped body member with the cross head spanning the uprights. A forming element carried by the cross head is of a contour complementary to that of the second stage element. That is, if one is convex the other is of a corresponding concave shape. The third stage forming element is disposed beyond the second stage element in the direction of draw and in stepped relation thereto during operation so that the sheet takes a reverse bend in its draw over the third stage element, and engages the third stage element with the side opposite that with which it engages the second stage element. The function of this third stage is to compensate for the surface extension resulting from the draw over the second stage and thus control the coiling tendencies of the sheet.

Means are provided to adjust the first and third stages forward and back relative to the second stage so as to vary their spacing in the direction of draw. Power means for this purpose are attached to the rearwardly extending legs of the T-shaped members. Means are also provided to tilt the first stage about a central longitudinal axis and to raise and lower the first stage as a unit about a transverse axis. These relative movements of the first and third stage elements have important functional effects on the drawing operation, as is fully explained in the said parent application.

A base structure **10** has at one side a gear box **11** supported thereon, and laterally of the gear box two spaced uprights **12** and **13** are attached to and supported by the base. The gear box **11** abuts and is attached by keys to upright **13**.

The first stage structure is shown in Figs. 4 and 6. It has two secondary uprights **14** and **15** which contain both the lower T-shaped member and the upper ram assembly so that these may be moved together as a unit relative to the uprights **12** and **13**, having guiding connection therewith through rocker bearing plates **16** and **17**.

The upper first stage assembly comprises a top fixed bar **18** which spans the secondary uprights and is adjustable in height between gibs **19** on the uprights, a ram **20** which is also a cross bar spanning the uprights and slides within gibs **21**, and toggles **22** and **23** connected by bar **24**. A hydraulic cylidner **25** has trunnions in bearing brackets **26** on top of fixed bar **18**, with its piston rod connected to the top end of a toggle operating lever **27** that has its fulcrum pivot in bar **18** and is pivoted at its lower end to the pivot of bar **24**. The lever **27** is double, the rear arm being slightly wider than the front as indicated in Fig. 2 and by broken lines in Fig. 4. The bar **18** is hollow, as shown.

It is desirable to adjust the height of the bar **18** for sheets of different thickness and, as shown in Figs. 4 and 5, the ends of the bar **18** are notched and the gibs **19** are notched. Blocks **28** are inserted in the registering notches and shims on top of the block determine the upward limit of movement of bar **18**. The adjustment of the bar **18** is effected by screws **29** which screw through bridge pieces on top of the gibs and into tapped holes in the bar.

A hold-back element **30** has a dove tail connection with the bottom face of ram **20** and is clamped in place by clamp strip **31**. Smoothing plate **32** is disposed immediately back of hold back element **30**.

The lower first stage assembly comprises a T-shaped body member **33** having a cross head **34** which spans the secondary uprights **14** and **15** and a rearwardly extending leg member **35**. A hold-back element **36** has a dove tail connection with the top face of cross head **34** and is clamped in place by clamp strip **37**. The hold-back element **36** opposes the upper hold-back element **30** and is of complementary shape. The sheet S is fed between the two elements **30** and **36** and between the smoothing plate **32** and an opposing smooting plate **38** on the lower first stage body member **33** immediately back of the lower hold-back element **36**.

The first stage assembly is dynamically adjustable forwardly and backward to a limited extent to and from the second stage. This is done through a hydraulic cylinder **39**, which, as shown in Fig. 2, has its piston rod connected through a pivoted coupler **40** and links **41** to a wrist pin **42** in the end of the leg member **35**. The first stage structure is also dynamically tilted about a longitudinal axis and raised and lowered about a transverse axis by hydraulic cylinders **43**. For this purpose, the T-shaped body member **33** of the lower first stage assembly is supported on the base through a guide structure **44** which is mounted for universal movement through a gimbal mount **45**. This guide structure has two forwardly extending arms **44***a* to which the pistons of cylinders **43** are attached. The rearwardly extending leg **35** of member **33** is guided in the guide structure **44** in its dynamic adjustment to and from the second stage.

The second stage assembly, as shown in Figs. 3 and 6, has at the top a fixed bar **46** spanning and attached at its ends to the uprights **12** and **13**. Supported by this bar through toggles is a two part ram which carries the second stage forming element and is raised and lowered by means of the toggles which are operated by a hydraulic cylinder and piston. The two parts of the ram have turn-buckle connection providing for adjustment of the relative horizontal disposition of the two parts of the ram.

The two parts of the ram are upper bar **47** and lower element carrying bar **48** which are connected by turnbuckles **49**. Toggles **50** connect the fixed bar **46** and bar **47** of the ram, the toggle joints being connected by bar **51**. The toggles are operated by hydraulic cylinder **52** supported on brackets **53** on upright **13**. The piston of the cylinder is connected to the end of toggle-operating bar **51** by piston rod **54**.

A counterweight **55** for the ram is loaded on the free end of lever **56** which is pivoted at its other end to the top edge of fixed bar **46** and has an extension beyond the

pivot connected to the top edge of bar 47 through links 57.

The ends of the ram bars 47 and 48 are constrained and guided by rails 58 which are fastened on the uprights and enter into the slotted ends of the ram bars.

The lower edge portion of the ram bar 48 is thinner than the main portion of the bar and a forming element 59 is fastened to its inner face, having a dovetail connection therewith and being secured in place by a wedge member 60 bearing on its top edge and secured in place by screws 60*a*. The forming element is a full length plate extending from end to end of the ram and having a forming surface on its bottom edge which in the illustrated setting is downwardly curved. The work-engaging portion is a ridge at the entrance or inner side portion of the bottom edge, beyond or in front of which the bottom edge is raised and is opposed by the complementary shape work-engaging face of the third stage element, as will be seen.

The T-shaped body member of the third stage has a carrier T-shaped structure consisting of a cross head 61 and a rearwardly extending leg 62, being supported and guided upon the super base structure 63. On the cross head 61 is the cross head 64 to the rear face of which the third stage forming element 65 is attached by a dovetail connection, and locked in place by a wedge 66. This third stage forming element is a full length plate, the upper edge of which has a longitudinal concave curvature substantially complementary of the second stage element, having as its work-engaging portion a raised ridge at its front or exit edge which opposes the raised portion of the second stage element beyond its work-engaging ridge portion.

The third stage body member, like the first stage member, is susceptible of forward and back dynamic movement during the drawing operation. For this purpose, the rearwardly extending leg 62 has connection with a hydraulic cylinder 67 which is disposed in the super base structure as shown in Fig. 6. A cross head 68 is connected to the rear end of leg 62 and to horizontally reciprocating piston rod 69 of cylinder 67, the cross head having depending legs 70 which have feet that are guided under cleats on base 10 (see Fig. 3).

The gearing in the gear box 11 is driven by the main power unit M1 through the gear reduction in housing 71 and the coupling 72 (Fig. 2). The coupling engages and drives shaft 73 (Figs. 7 and 8) which drives pinion 74. Shaft 73 is hollow and contains an internal pump shaft extension 75 which bears in the bearing 76 on an L-shaped base strip 77 resting upon the top edges of two cross members 78 and 79, the other bearing for shaft 73 being in the wall of the gear box. The member 79 serves as a cross brace and extends diagonally, as shown, for clearance purposes and has openings along its bottom edge to provide free communication between the two sides of the member. The entire bottom of the gear box up to the member 78 constitutes an oil-collecting sump for returned lubricating oil, as will be described, and the member 78 serves to partition off a space 80 which is a tank for clean lubricating oil, filters 81 in the collecting sump delivering into the tank 80. The top 80*a* for the tank 80 has a removable cover 82.

The pump shaft 75 operates a pump 83 through an eccentric on the shaft and draws clean oil from the tank 80 through connection 84 and delivers it into a line 85 from which it is distributed to several points, as will appear.

The pinion 74 meshes with gear 86 the shaft of which bears in bearings in the two sides of the gear box and has pinion 87 fixed thereon. Pinion 87 meshes with bull gear 88 the shaft of which bears in bearings in the sides of gear box 11. The bull gear meshes with and drives a rack on the carriage as will now be described.

The top of the gear box is machined to form a seat for the fixed draw bench 89 which guides the carriage, the seating of the draw bench upon the gear box being shown in Figs. 9 and 10.

The draw bench is an elongated channel guide member which rests at substantially its mid-point on the gear box and has its extending ends supported at intervals by legs 90. The cross-sectional shape of the draw bench is shown in Figs. 9 and 10. The upstanding sides of the channel serve as side guides for the carriage and for a portion of its length the upper edges of the sides have inwardly overhanging projections 89*a*. These overhangs extend from the left end of the draw bench as viewed in Fig. 1 to somewhat beyond the middle of the gear box, as shown in Figs. 2 and 13, and serve to oppose the upward thrust of the bull bear on the carriage. They also have a function in the lubrication of the carriage, as will appear.

The bottom of the draw bench is provided with a longitudinal depression or channel as appears in the cross-sectional views, for accommodation of the rack on the bottom of the carriage, and immediately over the bull gear the bottom of the bench is apertured to provide for the meshing of the bull gear with the rack, as shown in Fig. 8. Also a removable cover 91 affords access to the interior of the gear box.

The carriage is a longitudinal sliding member 92 of a width fitting between the upright sides of the draw bench and, as will be seen, it carries the draw mechanism as well as other parts which require translation in the functioning of the machine. On its underside for the portion of its length corresponding to the length of its travel, the carriage has a rack 93 secured thereto which occupies the longitudinal channel or recess in the bottom of the draw bench. This rack is engaged by the bull gear.

The draw bench and carriage structure is shown in more detail in Figs. 13 to 16. The carriage is provided with wear plates, for example, formica, but preferably more durable material, such as bronze, where the greatest wear friction occurs. Since the draw mechanism, in the construction shown, extends laterally from the carriage, the drawing stress is lateral of the carriage and therefore imposes a lateral strain or torque upon the carriage and causes the greatest wear at two opposing side terminal portions. At these portions, therefore, the wear plates should be metal while formica will suffice for the other bearing or wear strips.

As shown in Figs. 13 through 14*a*, the carriage 92 has relatively long bronze wear strips 94 and 95 on opposite side ends and short formica strips 96 and 97 on the other opposite side terminals. It is evident that the drawing stress will cause a clockwise twisting force on the carriage and produce the greatest friction on the bronze plates.

Also the carriage has full length top and bottom formica wear strips on each face. The two top strips are numbered 98 and 99 and the bottom strips are numbered 100 and 101. The top strips 98 and 99 are relatively narrow, their inner edges terminating with the overhang 89*a*, and the bottom strips 100 and 101 are of a width to reach to the channel in the bottom of the draw bench.

The top and bottom face wear strips are provided with lubricating channels or grooves, and lubricating oil is pumped into these from the gear box as will be described.

The forward wall of the gear box has in its upper portion two vertical oil passages 102 and 103 which are spaced to register with passages 102*a* and 103*a*, respectively, in the draw bench extending through to the slide space. The pump 83 delivers oil from tank 80 to the bearings in the box and to the passages 102 and 103. Conduit 85 has a branch 85*a* which delivers oil to the bearing 76 and to the other bearings for shaft 73, and it also delivers to the bearings for the shafts of pinion 87 and bull gear 88. Thence, it continues on and has branch outlets connected with the passages 102 and 103.

The formica strips **100** and **101** on the bottom of the carriage have full length oil grooves **100***a* and **101***a* together with several lateral grooves and the top formica strips have interrupted oil grooves **98***a* and **99***a*.

The passages **102***a* and **103***a* lead to the full length grooves **100***a* and **101***a* on the under side of wear strips **100** and **101**, and branching from each of passages **102***a* and **103***a* is a passage **104** leading up through the respective side wall of the draw bench and inward and downward through the overhead portion **89***a* into the top grooves **98***a* and **99***a*. Vertical passages **102***b* and **103***b* lead up from the respective grooves **100***a* and **101***a* into the carriage slide **92** and branch laterally into recesses **105** in wear plates **94**, **95**, **96** and **97** by way of lateral passages **106**. There are four passages **102***b* and **103***b* for the bronze wear plates **95** and **94**, respectively, and two passages **102***b* and **103***b* for the formica wear plates **96** and **97**, respectively. It will be seen that the length of each section of the interrupted grooves **98***a* and **99***a* is such that the groove is entirely covered by the overhang **89***a* when oil is delivered to it by the passage **104**.

The excess lubricating oil delivered to the carriage through the passages above described runs down into the channel for the rack and collects in a space around a rectangular angle member **107** surrounding the aperture for the bull gear in the bottom of the draw bench, and from thence it runs through a hole shown in Fig. 7 into a gutter **108** and is led to a tube **109** and delivered into the oil sump in the bottom of the gear case. The oil level is maintained in the gear case about at the top of brace **79** and of the tank **80**, so that the gear **86** and bull gear **88** run in it, as shown in Fig. 8.

The length of the carriage and rack is adjusted to the maximum length of sheets to be drawn and the draw bench is provided with bumpers **110** (see Fig. 13*a*) at its ends to limit the movement of the carriage in case the automatic means for stopping the motor fails, the length of the rack being such that the teeth leave the bull gear just before the bumpers are engaged.

It is desirable on occasions to extend the draw bench and carriage to form unusually long sheets, for example. One of the advantages of the draw bench construction above described is that it may readily be extended.

Figs. 11 and 12 illustrate means for such extension. The draw bench **89** has secured underneath it on each side of the rack channel a plate **111** by means of screws **112** and these plates have extensions to connect to the draw bench extension **89E***x*. The plate extensions have elongated screw holes through which pass screws **112***a* and screw into the bottom of the draw bench extension **89E***x*. Extending from the end of each plate **111** is a threaded tie rod **113** which extends through a leg **90** or other downward lug on the draw bench extension and has a nut and washer on its threaded end which, when tightened up, bears against the leg and draws the two sections of the draw bench together. A gasket **114** will be provided at the point, as shown, to prevent leakage of lubricating oil.

A way is also shown to join an extension **92E***x* to the carriage **92**. As shown two screws protrude from the ends of each section disposed so as to aline, and those in one section have right hand threads and those in the other section have left hand threads. A nut on each pair completes turnbuckles **115**. Thus, the two sections are drawn together and a key **116** is provided at the joint to aline and support the two edges vertically.

It will be understood that for a given extension of the carriage and rack the draw bench must have an equal extension on each end.

Fig. 12 shows a super structure carried by the carriage which is not related to the present invention. As shown this super structure is attached to the carriage by a support **117**. Fig. 12 illustrates how this super structure may be extended to compensate for an extension of the carriage.

As stated above, the sheet pulling or drawing mechanism is carried and translated by the carriage. In the illustrated construction, this consists of a laterally extending arm **118**, and a draw head **119** carried by the arm. The head has jaws for gripping the leading edge of the sheet being drawn. A leg **120** supports the outer end of the arm.

It is obvious that the particular construction of the draw bench and associated mechanism as shown in the drawings and above particularly described may be modified within the scope of the invention as defined in the following claims.

What is claimed is:

1. Draw bench mechanism for sheet forming machines operating on the forming-by-drawing principle comprising a base, a pair of uprights secured to the base, transversely disposed elongated forming elements supported within and spanning the uprights in position to have a sheet drawn over them in succession, a gear box supported upon the base, an elongated channel draw bench member supported upon and secured to the gear box at a point intermediate its ends, a carriage slidable in the draw bench, a rack on the under side of the carriage, a gear in the gear box operatively engaging the rack, an inward extension on each side of the draw bench constituting an overhang, bearing upon and guiding the respective top edges of the carriage, oil passages in the draw bench leading to the under faces of said overhangs, means for delivering lubricating oil under pressure to said passages and a draw head attached to and movable with the carriage and adapted to engage and draw a sheet over said forming elements.

2. Draw bench mechanism for sheet forming machines as defined in claim 1 in which the overhangs extend from the forward end of the bench to a point on the gear box at the rear of the engagement of said gear and are discontinued rearwardly of said point.

3. Draw bench mechanism for sheet forming machines as defined in claim 2 in which the carriage has full length wear strips on each of its top and bottom edges and the top wear strips have each a discontinuous longitudinal oil groove on its exposed face having longitudinal sections adapted to register successively with the respective oil delivery passage leading to the under face of the overhang, the oil delivery passages being disposed relative to the length of the oil groove sections to interrupt delivery of oil to the sections successively before they emerge from under the respective overhangs in the return movement of the carriage.

4. Draw bench mechanism for sheet forming machines as defined in claim 3 in which the bottom wear strips have each a continuous longitudinal oil groove on its exposed face, together with an oil passage in the draw bench leading to each oil groove in the bottom wear strips, together with means for delivering lubricating oil under pressure to said last named passages.

5. Draw bench mechanism for sheet forming machines as defined in claim 4 in which the oil passages in the draw bench leading to the under faces of the overhangs branch from the oil passages leading to the oil grooves in the bottom wear strips.

6. Draw bench mechanism for sheet forming machines as defined in claim 5 together with an oil pump in the gear box, power means for the oil pump, and a conduit connecting the pump with each of the oil passages in the draw bench leading to the oil grooves in the bottom wear strips.

7. Draw bench mechanism for sheet forming machines as defined in claim 6 together with lateral wear strips on the side edges of the carriage, and oil passages in the carriage leading from the continuous oil grooves in the bottom wear strips on the bottom face of the carriage to the external faces of the lateral wear strips on the respective side edges of the carriage.

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