Feb. 28, 1939. H. E. GOLBER ET AL 2,148,455

GRAVURE PRINTING-PRESS DOCTOR BLADE CONSTRUCTION

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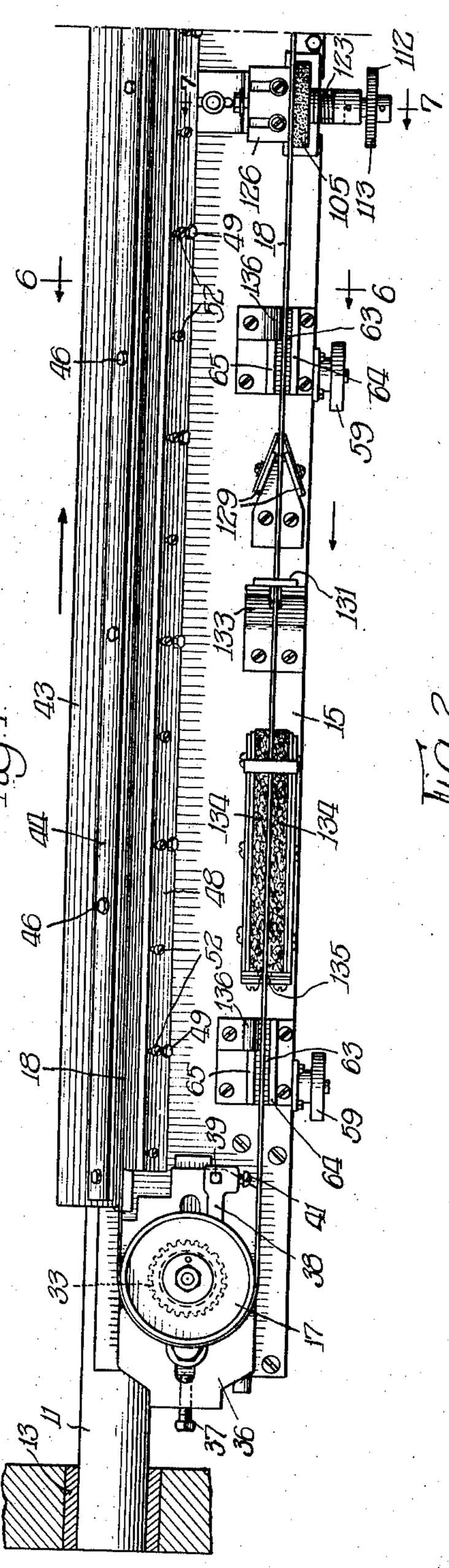

Fig. 1.

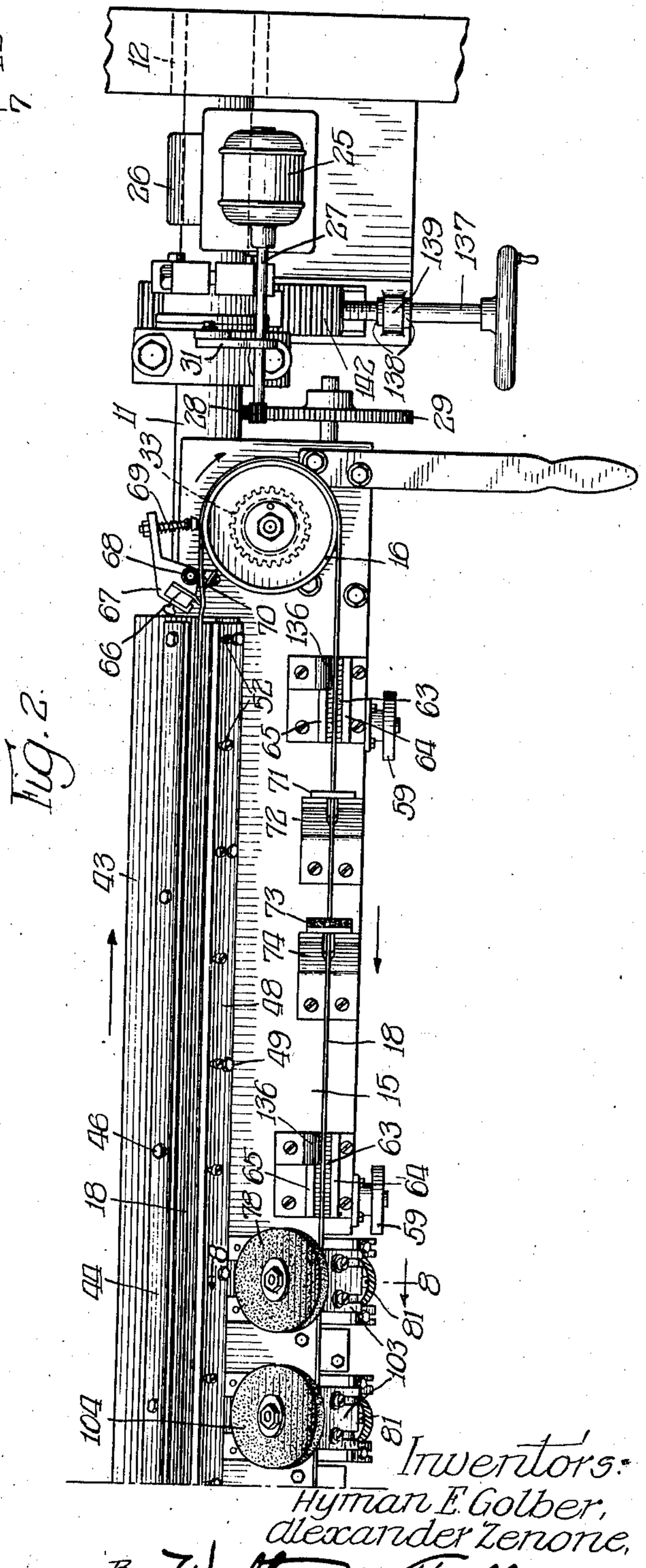

Fig. 2.

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GRAVURE PRINTING-PRESS DOCTOR BLADE CONSTRUCTION

Filed May 6, 1937 5 Sheets-Sheet 2

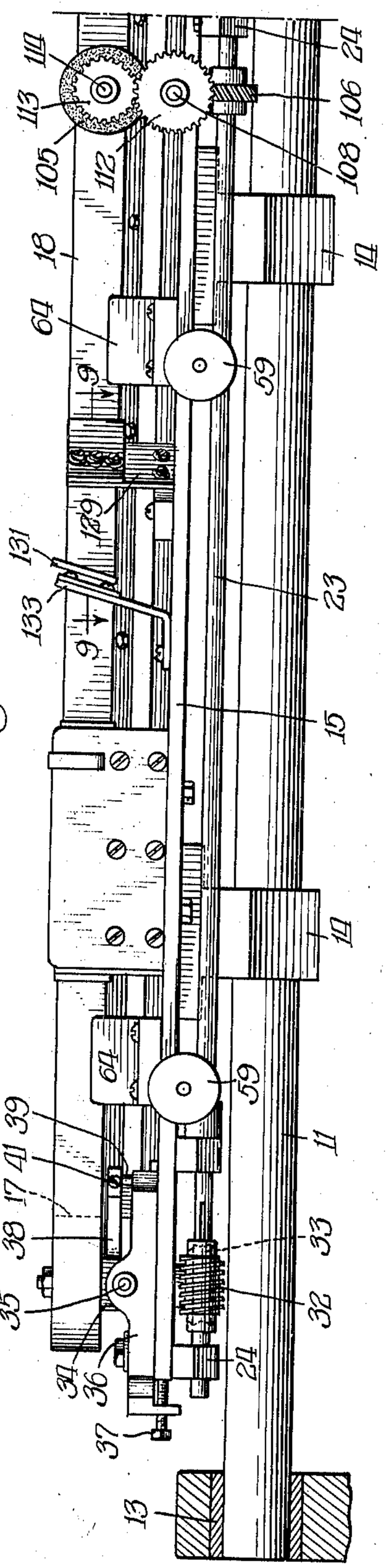

Fig. 3.

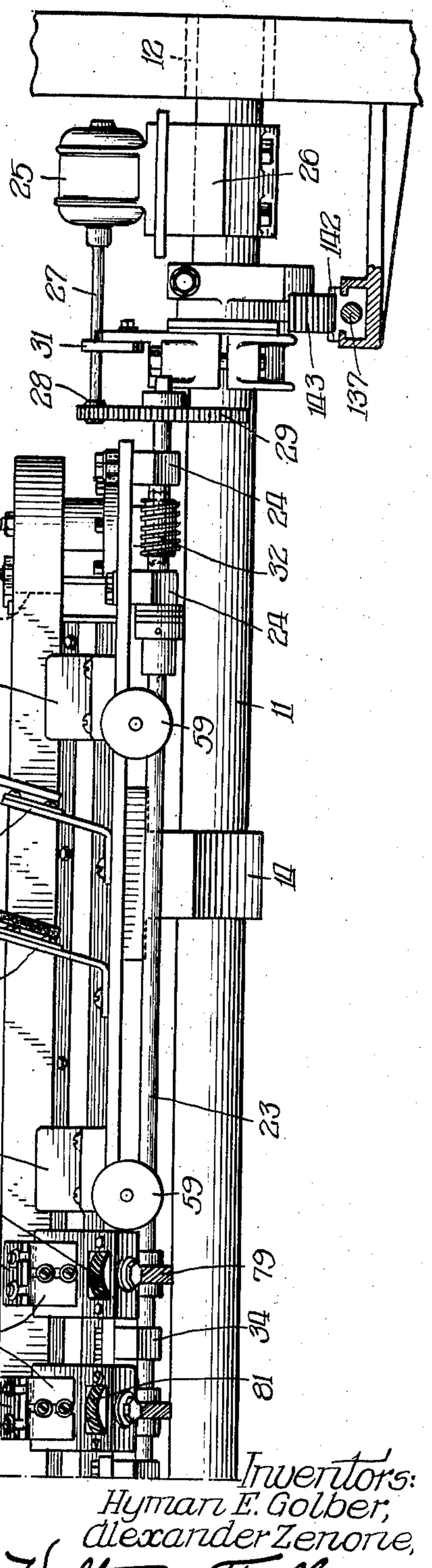

Fig. 4.

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GRAVURE PRINTING-PRESS DOCTOR BLADE CONSTRUCTION

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Fig. 4.

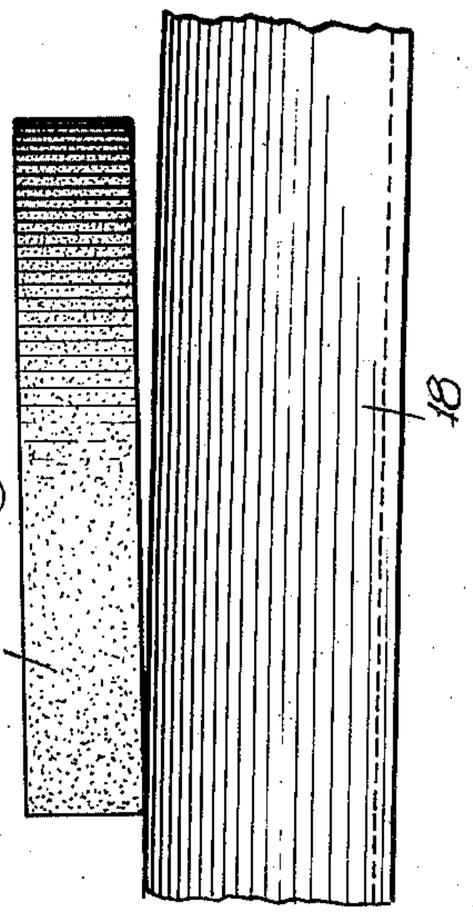
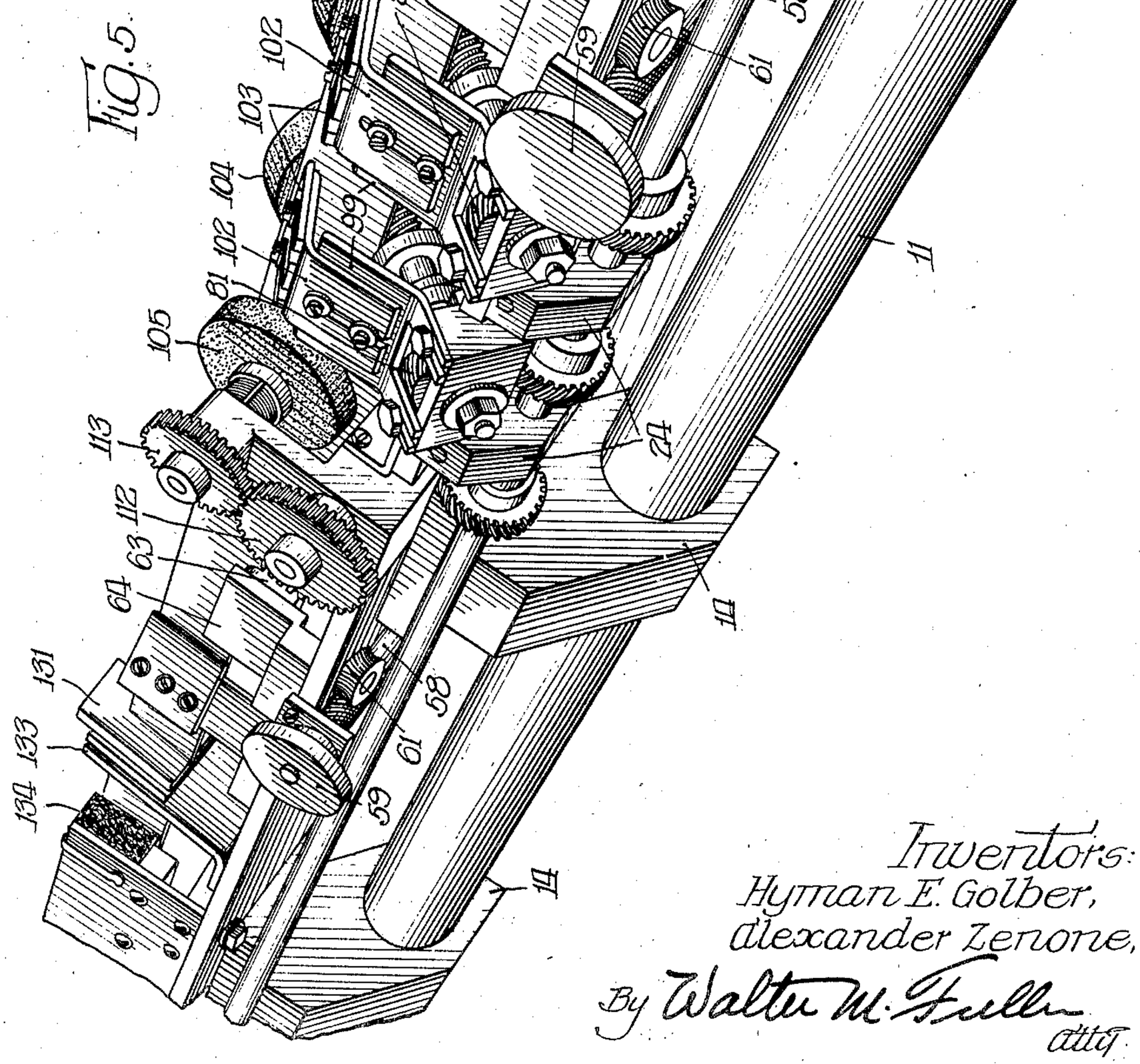


Fig. 5.



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GRAVURE PRINTING-PRESS DOCTOR BLADE CONSTRUCTION

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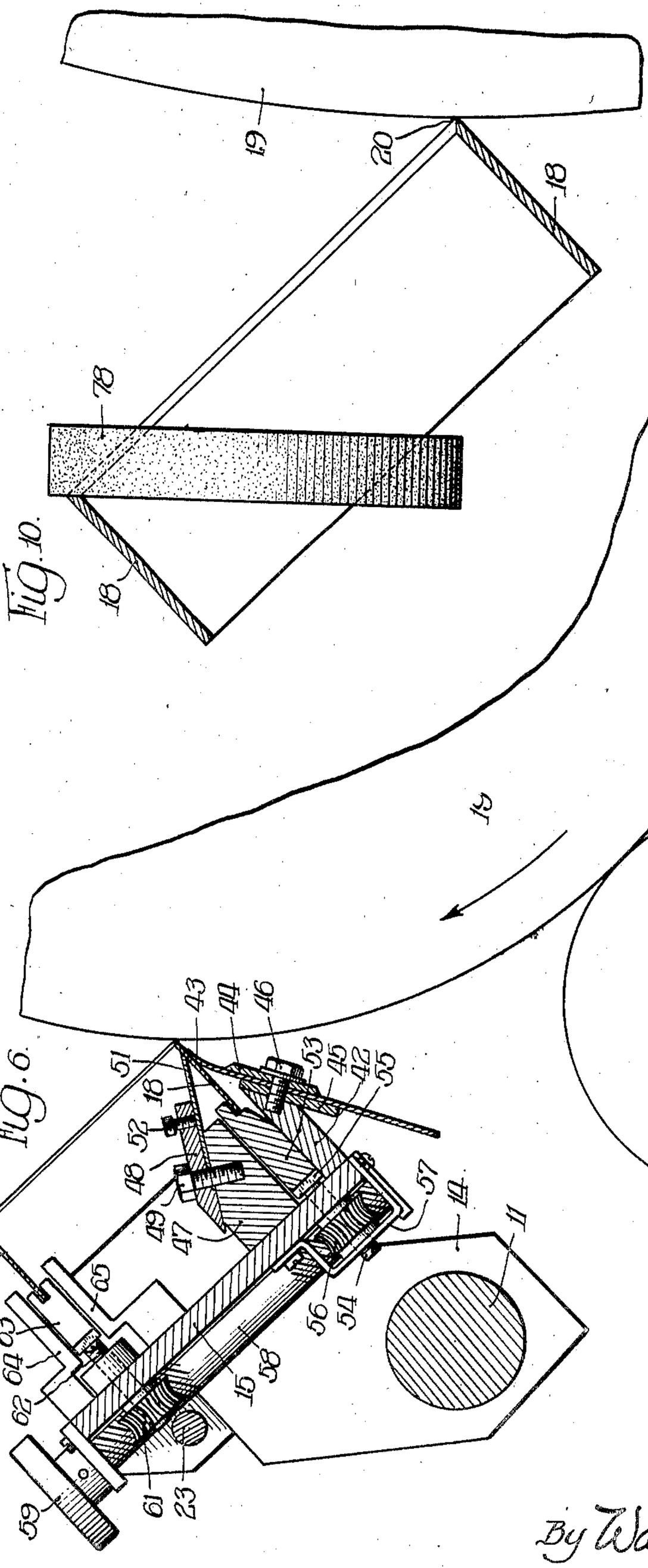
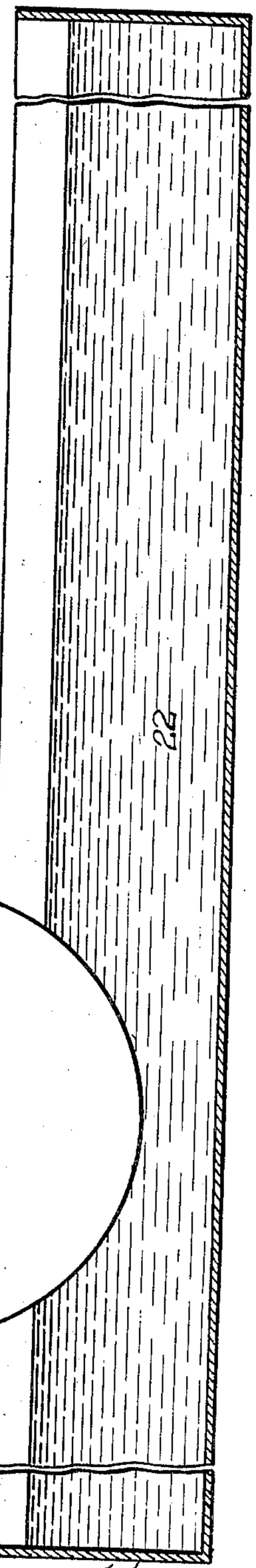


Fig. 10.

Fig. 6.



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GRAVURE PRINTING-PRESS DOCTOR BLADE CONSTRUCTION

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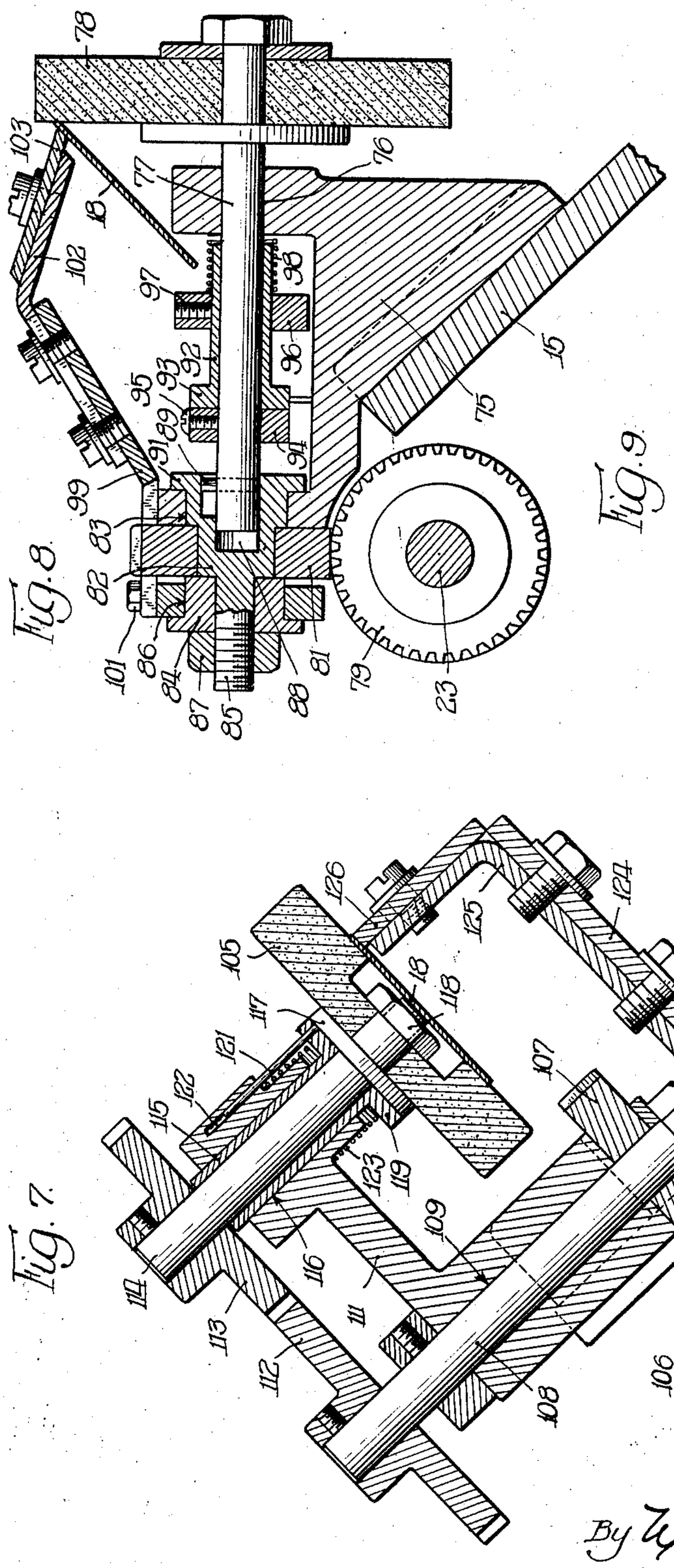

Fig. 8.

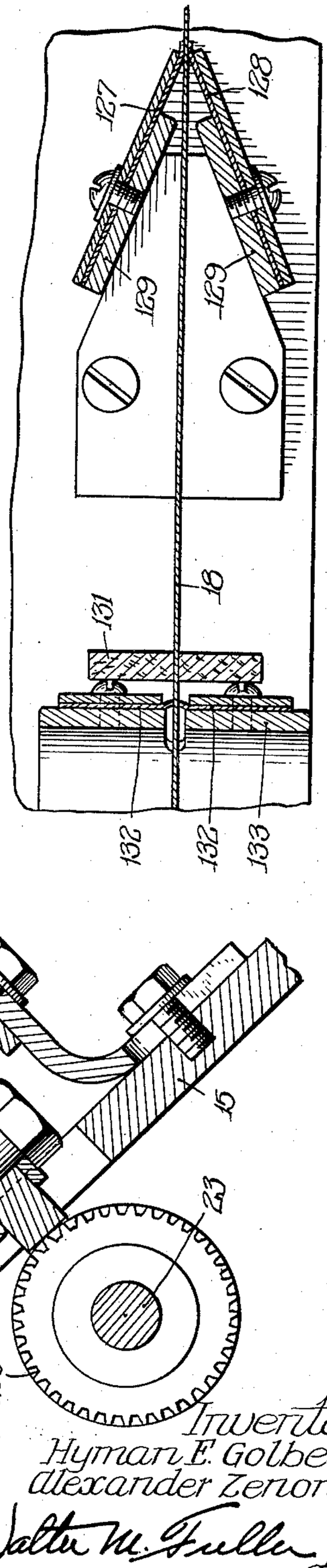

Fig. 9.

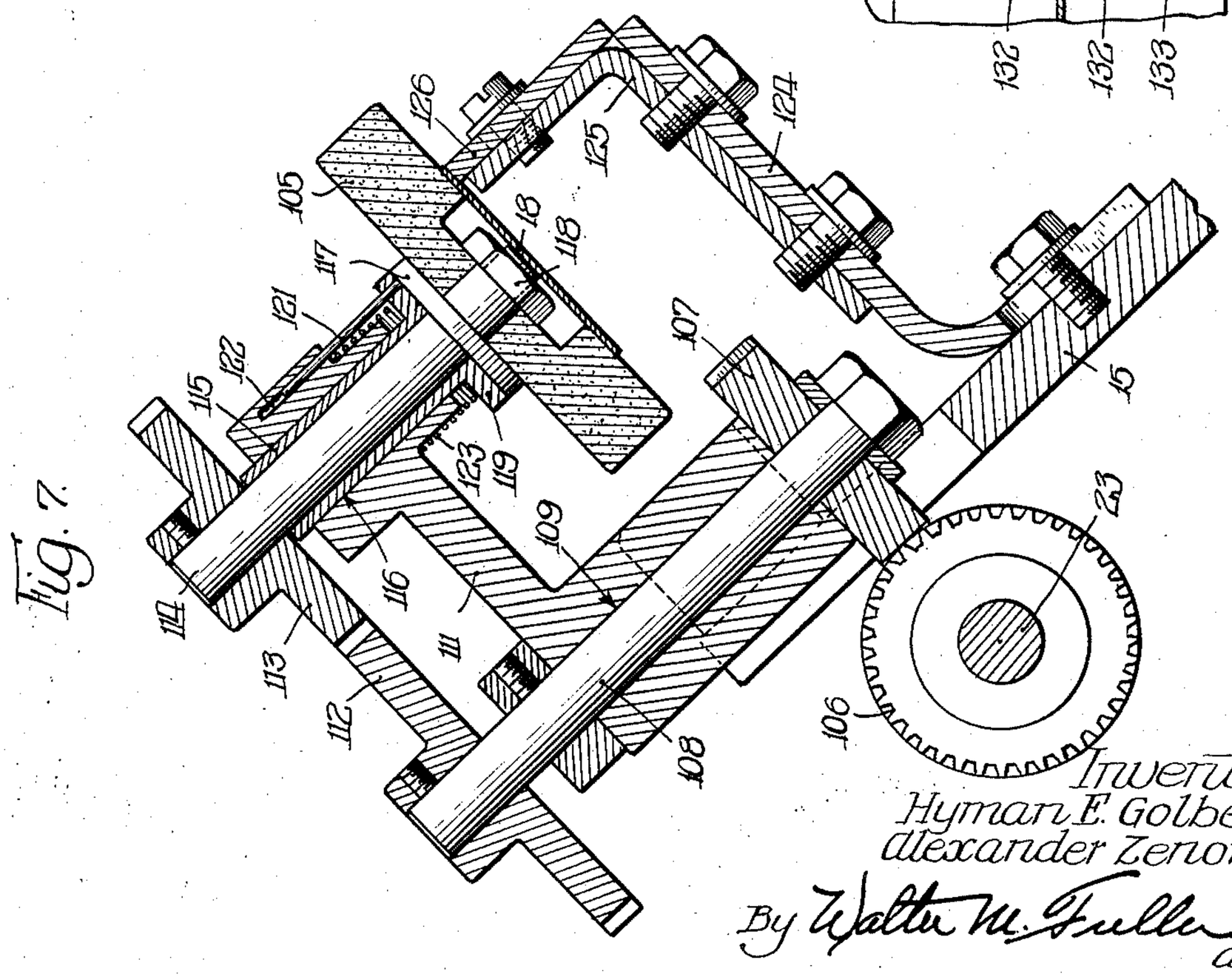

Fig. 7.

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UNITED STATES PATENT OFFICE

2,148,455

GRAVURE PRINTING-PRESS DOCTOR BLADE CONSTRUCTION

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Application May 6, 1937, Serial No. 141,072

52 Claims. (Cl. 101—157)

In the use of gravure or intaglio printing-presses substantial difficulty has always heretofore been encountered in connection with the doctor-blade which scrapes or wipes off the excess ink from the surface of the etched, copper cylinder or other comparable printing-element prior to the printing operation.

The somewhat-rough, acid-etched or engraved printing cylinder or plate during its movement in contact with the edge of the associated doctor-blade, which as stated removes the surplus ink therefrom, wears or dulls such blade relatively rapidly, and, in order to perform good work, the press must be stopped, with resulting loss of time and product, and the blade re-sharpened or reconditioned or replaced by a sharp one at comparatively frequent intervals.

As the active or operative edge of the blade wears, its angle becomes somewhat modified, the prints become progressively undesirably darker, and the whites do not remain pure and clear, because the blade, due to its gradual impairment, cannot properly and completely perform its ink-removing operation.

Thus the quality of the printed work, even under ordinary or normal conditions, deteriorates gradually, becoming progressively poorer and poorer, until the operator is compelled to re-sharpen the blade or replace it with another and then continue the printing; but even this does not solve the difficulty because now with the reconditioned blade the work temporarily improves, and then again increasingly declines.

Instead of re-sharpening the blade when initially required, the operator to save time not infrequently increases the pressure of the blade on the cylinder or plate in an endeavor to scrape off the excess ink by main force thereby to lighten the print and temporarily to avoid the re-sharpening, but this expedient not only changes the angle of the edge of the blade with resulting production of inferior work, but undue wear occurs both on the printing-plate and on the blade.

Such wear occurs much more rapidly on those portions of the printing plate or cylinder where the color is darkest at which locations the ink-wells are deepest and their separating walls are weakest, and such wear obviously cannot be corrected or compensated for by the subsequent use of a sharp doctor-blade. Such impairment of or injury to the plate or cylinder precludes its restoration to normal or original condition.

Accordingly, one of the leading aims of the present invention is to provide novel and improved simple means to avoid the necessity for again and again stopping the printing-press with its obvious forfeiture of production capacity in order to restore the doctor-blade to proper operating condition and efficiency, and experience has proven that the new construction satisfactorily overcomes the objectionable conditions heretofore always encountered in this relation.

Stated somewhat otherwise, in the new construction, a doctor-blade is used of such a character that it is constantly and correctly sharpened while in action, thus completely escaping the need for interrupting the printing operation repeatedly to restore the doctor-blade to correct condition for the production of good and satisfactory work.

The ordinary doctor-blade wipes the printing plate or cylinder locally and consequently it wears unevenly, and, accordingly, the present invention aims to provide a doctor-blade each part of which wipes all portions of the printing element and which wears comparatively evenly thereby retaining its straightness, and, as a result, the amount of metal removed in the sharpening operation need be very little since no unevenness has to be ground out.

The employment of the new structure materially increases the quality and production of work on any gravure press, and if the new principles of construction are applied to old printing-presses they greatly increase their efficiency and decrease their production cost.

The new doctor-blade construction eliminates variations in light tints, half-tone, and heavy tones or solids as the job progresses, avoiding the loss of brilliancy in the highlights and of details in the dark shadows, and, in general, the new structure assures continuity in the high quality of the printed sheets.

The improved apparatus excludes the chatter in tints due to heavy doctor-blade pressure; it avoids the wasting of steel blades, as the present practice is to discard a blade after only about one-eighth of it has been used; it evades the necessity for hand-sharpening; it does away with the production of fine lines on the prints, known as railroads due to a nick or nicks in the edge of the blade; it escapes the production of ink spots on prints caused by the ink or ink-reducer squirting from between the blade and the blade back-support; it eliminates fine lines or scratches on the printed sheets caused by very small and hardly-visible projections on the copper; it precludes the accumulation of fuzz on the outer edge of the blade which transfers it to the etched surface of the cylinder causing smeary lettering

and pictures; it increases the efficiency of the operator since no blade-sharpening is required, thus allowing him more time to concentrate on the remainder of the work; and, due to the fact that in the new construction the doctor-blade is adjustable and is constantly re-sharpened, the printing-press can be run indefinitely without increasing the doctor-blade pressure on the etching and still be able to control the prints as wanted, that is, sharper and with more tone, harder or softer appearing, more or less contrasty, and with a minimum loss or wear of the etching, these favorable features being possible of accomplishment in that in the new apparatus, since a comparatively light and constant pressure of the blade against the etching is maintained, the life of the etching undergoing printing is prolonged in material degree.

Moreover, the life of the doctor-blade is sufficiently long that the ordinary, largest, commercial, printing job can be completed with the same doctor-blade without stopping the press for changing or sharpening blades.

To permit those acquainted with this art to understand the present invention fully both from structural and functional standpoints, a present preferred embodiment of the invention is illustrated in detail in the accompanying drawings throughout the several views of which like reference numerals have been employed to designate the same parts, and these illustrations should be used in connection with the following detailed description of the appliance.

In these drawings:

Figure 1 is a plan view of about one-half of the new structure;

Figure 2 is a like view of the remaining portion of the construction;

Figure 3 is a side elevation of that part of the mechanism presented in Figure 1;

Figure 4 is another side elevation of that section of the device illustrated in Figure 2;

Figure 5 is a perspective view of the middle portion of the appliance on a larger scale;

Figure 6 is a vertical cross-section on line 6—6 of Figure 1 on a large scale showing the doctor-blade in active engagement with the printing cylinder, the ink-fountain and ink-applying roller also being illustrated;

Figure 7 is a vertical cross-section on a large scale on line 7—7 of Figure 1, the parts of the apparatus being shown tilted into operative position;

Figure 8 is a similar section on line 8—8 of Figure 2;

Figure 9 is an enlarged longitudinal section on line 9—9 of Figure 3;

Figures 10 is a fragmentary, enlarged somewhat-diagrammatic cross-section showing the doctor-blade edge construction more clearly, parts being omitted, and

Figure 11 is a plan view of a portion only of the structure shown in Figure 10.

Referring to these drawings, it will be observed that the improved and novel appliance comprises a main, supporting shaft 11 parallel to the printing-cylinder and capable of oscillation or turning movement in appropriate bearings 12 and 13 for manual adjustment of the mechanism mounted thereon toward and from the cylinder into and out of operative position.

A plurality of brackets 14, 14, spaced apart lengthwise of and fixed on such shaft 11, carry a long supporting plate or bar 15 comprising what may be more or less aptly characterized as the back-bone of the apparatus, because it has so many parts of the mechanism fastened on it.

Near its right-hand end such supporting-bar 15 is equipped with a revoluble pulley or drum 16 (Fig. 2), and, near its opposite end, such member 15 is fitted with a similar, complementary or companion, adjustable pulley 17 (Fig. 1), and around these two extends an endless, flexible, steel doctor-blade or band 18, an edge of one stretch of which between such pulleys is designed and adapted to bear on the face of the gravure or etched, copper printing-cylinder 19 (Fig. 6), rotated in the usual way and in the direction indicated by the arrow, by means not shown, such cylinder co-acting with an inking-roller 21 delivering ink to it from an ink-trough or reservoir 22 (Fig. 6).

A drive-shaft 23 (Figs. 3 and 4) revoluble in appropriate bearings 24, 24 carried by the bar 15 is rotated in any suitable manner as by an electric-motor 25 fixed on shaft 11 at 26, the shaft 27 of the motor having a drive-pinion 28 meshing with and revolving a gear 29 keyed or otherwise mounted fixedly on shaft 23, shaft 27 desirably having an added bearing 31 mounted on and adapted to turn with shaft 11 when the latter is rocked for adjustment purposes.

For each pulley 16, 17, shaft 23 has a worm 32 (Figs. 3 and 4) meshing with and driving a worm-wheel 33 (Figs. 1 and 2) on the shaft of the pulley, and in this way both pulleys are power-driven to cause the doctor-blade to travel in its endless path. This double-drive involving both pulleys is of more importance than might at first appear in that experience has demonstrated that, if only one such pulley is power rotated, the flexible doctor-blade may slip on the pulley and the necessary tautness of the blade or band under such conditions of single-pulley drive is likely to cause a hot-box in the worm drive and a spark with its danger of explosion of the ink employed.

In order to provide for proper tautness of such endless blade and to tend to hold it down in correct position and with its active, ink-wiping edge 20 possibly a little tighter than its other or bottom edge, the pulley 17 is made to have a capacity for two different adjustments in that the pulley, instead of being mounted directly on the support 15, as in the case of pulley 16, is revolubly mounted on a casting 34 rockable on two short pins 35, disposed crosswise the length of the endless-blade 18, on a slide 36 on member 15 and adjustable lengthwise the blade in any approved or well-known manner as by a screw 37, thus affording simple means for tightening or loosening the endless, traveling blade.

It has been found to be quite difficult and expensive commercially to obtain endless doctor-blades of the same length, and, for this reason, a relatively long adjustment is afforded the slide 36, the corresponding worm 32 being of an adequate length to allow for such adjustment.

It is desirable to hold the blade down and to prevent its riding up due to the contact of the revolving cylinder therewith, and, to this end, member 34 has an arm 38 provided with a screw-threaded hole accommodating an adjustment-screw 39 bearing at its lower end on the slide and having a set-screw 41 to hold it in its desired position for adjustment.

Obviously, the turning of such screw 39 will tilt the pulley slightly so that its upper portion will be in minor degree tighter on the blade than its lower portion, in this case there being sufficient play between the worm 32 and its worm-wheel

33 to permit the small necessary tilting referred to.

The flexible, endless, metal blade or band, unlike a leather belt travelling around crowned pulleys, move to the slack portion of the pulley shifting downwardly until its bottom portion bears on guiding supports referred to hereinafter.

Along that edge of bar 15 adjacent to the printing-cylinder, there is a flange or marginal-bar 42 (Fig. 6) on a sloping surface of which is adjustably mounted a resilient strip or apron 43 preferably of Micarta which at its upper edge bears or presses against that side of the doctor-blade 18 toward the cylinder and near the upper edge of such blade, the function of such part 43 being to prevent the scraped-off ink from passing down the blade on to its guiding support and to direct the ink back into the ink-reservoir 22, the resiliency or elasticity of the member 43 allowing adjustment of the doctor-blade, as hereinafter specified, while maintaining proper operative engagement therewith.

Such ink-deflecting apron or shield 43 is maintained in place between a pair of long, narrow, plates 44, 45 through registering apertures in which and in the strip screws 46 are received for holding the three elements in proper assembled relation on the flange 42, all as will be readily understood from the illustration.

This flexible element 43 employed in the specified relation is a very important factor in the successful operation of the appliance, in that it is essential that no ink shall be allowed to pass down on to the lower part of the blade and its mounting, because if this is permitted to occur its cementitious property, particularly when solidified, is likely to result in mechanical danger to the parts to which it adheres or to those members with which such parts cooperate.

In spite of the exercise of best efforts, the surface of the etched, copper printing-plate is slightly out of round in spots and as the doctor-blade is brought up to it, the ink is scraped off locally, or, stated somewhat differently, it is practically impossible upon first contact of the blade with the cylinder to clean the copper surface evenly all over, due to the fact that minor local variations are present in the copper, the blade, and the blade-mechanism.

In order, therefore, to secure a smooth, even, ink-wiping action of the blade, it must be made flexible and the apron 43 must also be flexible to accommodate itself to the blade.

The flexibility of such apron is of great significance because it enables it to perform its functions with the efficiency and accuracy which is demanded and actual practice has shown that the flexible Micarta member 43 performs its highly essential function wholly satisfactorily.

The opposite side of this active stretch or length of the travelling blade has a bar 47 mounted on the support 15, and a second, longitudinally-recessed bar 48 is secured on the part 47 by a number of screws 49, with a resilient or elastic, steel, pressure or backing strip 51 accommodated in the recess of the member 48, a protruding marginal portion of such member 51 pressing against the side of the doctor-blade opposite that engaged by the part 43 and near the active sharp edge of such blade.

In order that the blade 18 may be caused to bear against the etched surface of the cylinder substantially uniformly throughout its length, or even variably as is ordinarily required, bar 48 is fitted with a number of screws 52 extended through threaded holes therethrough and bearing against the protruding portion of the blade 51, so that local adjustment of the pressure on the doctor-blade 18 may be easily accomplished.

Thus the active or operative stretch or section of the doctor-blade slides or travels between these two resilient members 51, 43 which bear on its opposite surfaces adjacent to its upper sharp edge 20 to perform their respective and different functions, the one to hold the blade against the cylinder in correct and efficient manner and the other to keep the ink out of the mechanism and to guide the scraped-off ink back into the reservoir.

While such length of the endless doctor-blade is thus fed along, its lower portion slides in a groove in the top of a long, stationary, Micarta guide-block 53 located between, and having minor transverse play or looseness between, the spaced, parallel, stationary members 42 and 47, such block being fastened at a number of points along its length on the tops of a plurality of adjustment-screws 54 each of which has a square or flattened head 55 between the parts 45 and 47 and prevented from rotation by contact therewith.

Each such screw extends down through a correspondingly threaded hole through the center of a worm-wheel 56 held in place by a bracket 47 on the underside of bar 15 and in mesh with a suitably-journalled worm-shaft 58 equipped with a front turning-knob 59.

In each instance, each worm-shaft 58 has a second worm in mesh with and capable of operating another worm-wheel 61 coacting in like or similar manner with another screw 62 on which rests another, grooved, Micarta guide-block or bar 63 in the top channel of which the other or inactive length of the flexible doctor-blade slides, such block being slightly loosely retained between spaced, parallel members 64, 65 on the main-support 15.

Consequently, when the Micarta bearing-block for one length of the doctor-blade is adjusted, the corresponding portion of the opposite length of the blade is equally adjusted, and this may be accomplished while the doctor-blade is in operation.

In the present instance, four of such pairs of position-regulating means are employed, but the number may be varied or modified as circumstances dictate, and they afford means not only for adjusting the blade for proper cooperation with the printing-cylinder and the other members but also to compensate for its gradual reduction in width due to wear and its grinding by means hereinafter set forth, practice having demonstrated that the blade can readily be retained in effective service until its original width is reduced one-half.

As the active length or portion of the doctor-blade is viewed in Figures 1 and 2, it travels to the right, and, of course, its other or inactive stretch travels in the opposite direction, as has been indicated by the arrows in such figures.

At the right-hand portion of the structure, as presented in Figure 2, it has a pivoted, resilient, Micarta ink-scraper 66 bearing on the face of the doctor-blade toward the cylinder and adjacent to the corresponding ends of the members 43, 51 to remove any ink adhering to the blade, and the ink thus scraped off drips back into the reservoir.

This scraper 66 is mounted in a block 67 hinged at 68 on the main support and pressed toward the doctor-blade by a spring 69, all as will be readily understood.

The position of this scraper is such that it is far enough beyond the adjacent end of the cylinder that the ink has time to flow down by gravity on the blade sufficiently to avoid any of the ink afterward being wiped up by the scraper over the edge of the blade onto its opposite surface.

As a safety measure and also to hold the blade up to the wiper or scraper **66**, a pair of stationary abutments or scrapers **70** and **170** are employed in contact with the opposite side of the blade at locations ahead of and to the rear of the element **66**.

After passing around the power-rotated pulley **16**, the doctor-blade slides through one of the slotted, adjustable, Micarta, doctor-blade guides or supports **63** and then through a slit piece of wiping-leather **71** bearing against the sloping face of an inclined bracket **72** which slants downwardly toward the support **15** (Fig. 4).

The leather, which is slit from its bottom partway up its height, is loose and straddles and rides on and scrapes the blade, being prevented from traveling along with it by reason of the presence of the bracket which acts as a stop or abutment.

Such leather piece wipes the sides of the sharp edge of the blade to remove any ink or other material adhering thereto, and, inasmuch as the leather tends to gradually move downwardly by reason of its engagement with the oblique face of the bracket, the slit in the leather gradually increases in length due to the cutting action of the top edge of the blade thereon, this method affording an efficient medium for cleaning the blade and more particularly its upper sharp edge.

When such leather element becomes nearly cut through, or too dirty, it is easily replaced by another.

After traveling through the cut in the leather the blade passes through a similarly-slit piece of felt **73** (Fig. 4) mounted and operating in much the same way as the leather part and desirably moistened with a little kerosene and bearing against another inclined bracket **74**, such pad and kerosene further cleaning the doctor-blade and preparing it for the sharpening and honing operations.

Beyond the felt is another one of the Micarta, supporting guides **63** and beyond that is the first grinding-appliance, illustrated in detail in Figure 8, and comprising an appropriately-shaped casting **75** mounted on the supporting-bar **15** and having a bearing **76** in which a shaft **77** is designed to rotate and in which it may slide longitudinally, such shaft at one end carrying a grinding or sharpening wheel **78** the plane of which is disposed at an acute angle to the plane of the adjacent part of the doctor-blade **18** and against a portion of the flat, side face of which wheel the bevelled top or sharp-edge portion of the blade bears.

Such side face of the wheel is slightly oblique to the surface of the blade undergoing the grinding operation and the rotation of the wheel is such that the active portion of the wheel travels outwardly of the blade edge away from the blade, the same general operation taking place with the honing wheels hereinafter set forth.

The driving means for such grinding-wheel includes the following cooperating instrumentalities:

A spiral-gear **79** on drive-shaft **23** meshes with and rotates a companion spiral-gear **81** on a shaft **82** revoluble in a bearing **83** in casting **75**, a sleeve **84** on a terminal threaded stem **85** of the shaft fitting in a bearing **86**, the sleeve being held on such stem by a retaining-nut **87**.

One end of shaft **82** has a cylindrical cavity **88** receiving an end of shaft **77**, the latter having an outstanding pin **89** in a slot **91** in the shaft **82** and opening directly out of the recess **88**.

By this simple means shaft **23** rotates shaft **77** and the grinding-wheel **78** by the pin and slot connection referred to, which, of course, permits the shaft to slide lengthwise in small measure.

In order to hold such sharpening-wheel yieldingly up to its work, the rotary-shaft **77** has a stationary sleeve **92** thereon with a terminal flange **93**, the end face of which is in bearing contact and engagement with a collar **94** on, and fixed to, the shaft by a set-screw **95**, sleeve **92** being held against rotation by a spring or arm **90** thereon, bearing on an adjacent surface of casting **75**.

Sleeve **92** also has a collar **96** fixedly mounted thereon by a set-screw **97**, and, encircling the sleeve **92** and bearing at its opposite ends against collar **96** and the bearing portion **76** of casting **75**, a coiled spring **98** acts to press the shaft and its grinding-wheel to the left, as viewed in Figure 8.

A slotted bracket **99** (Fig. 8) is adjustably mounted on the stationary part **75** by screws **101**, and a second bent bracket **102** is similarly secured on the first bracket, such second braket carrying an adjustable fibre-block **103** pressing against the proximate face of the doctor-blade to hold the latter from backing away from the wheel **78** during the grinding and sharpening action of the latter.

Observation and trial have indicated that the use of such backing-block **103**, and the others hereinafter referred to, is of material worth, in that, without such a backing member, the band or blade is somewhat uncontrollable and efficient grinding or sharpening did not result due to the fact that the doctor-blade is not quite equally stiff throughout its entire length with a consequent tendency to grind hollows in it.

Just beyond the grinding-wheel **78**, the doctor-blade encounters, and is acted upon by, a finer or honing-wheel **104** whose operating means is an exact duplicate of that employed for wheel **78** and hence needs no detailed description, the two wheels **78** and **104** being disposed at the same angle to the plane of that portion of the doctor-blade on which they operate, each having its own opposite abutment **103**.

After having been thus bevel-ground and honed on one side of its edge, that portion of the blade passes to another honing station at which the opposite side of the blade is acted upon by a complementary honing-wheel **105**, as presented in Figure 7.

In this instance, such second honing-wheel **105** is substantially parallel to the plane of that part of the doctor-blade on which it acts, with of course the slight obliquity referred to above, thus finishing and smoothing the sharpened edge and removing any possible burrs.

To rotate such second or supplementary honing-wheel, shaft **23** has a spiral-gear **106** (Fig. 7) driving a spiral-gear **107** on a shaft **108** rotatable in a bearing **109** in a standard **111** on the supporting-bar **15** and fitted with a spur-gear **112** driving a like gear **113** on another shaft **114**, revoluble in a sleeve **115** slidable in a bearing **116** in the standard, and having the honing-wheel **105** mounted on its other end in any suitable

manner as against a shoulder 117 by means of a nut 118 on a threaded end of the shaft.

Sleeve 115 at its end next to the honing-wheel has a flange 119 equipped with a pin 121 parallel to its axis and fitting in a cavity 122 in the part 111, whereby the sleeve is held against rotation but is capable of sliding axially.

A coiled expansion-spring 123 surrounds a portion of the bearing part of casting 111 and presses at its opposite ends against the casting and against the flange of the sleeve, thus holding the honing-wheel up to the doctor-blade.

To prevent the blade from shifting away from the wheel, a double, adjustable bracket 124, 125 carries a fibre-block 126 contacting with the other side of the blade and in register with the wheel.

Beyond such honing-wheel, the blade then passes between a pair of obliquely-arranged, resilient, Micarta wiping and guiding blades 127, 128, as shown in Figure 9, suitably mounted in brackets 129, 129 and thereafter it passes through another slit leather 131 being guided therethrough between the edges of opposed Micarta strips 132, 132 mounted on the inclined, slotted bracket 133, like guiding Micarta elements being also used on brackets 72 and 74.

Beyond this leather member 131 the blade travels between two bodies of felt 134, 134 (Fig. 1) appropriately charged with cleaning gasoline, then between another set of opposed, guiding, Micarta strips 135 at the far end of the felts and thereupon over one of the adjustable, base, Micarta guides 63 to the pulley 17.

To rock the shaft 11 to bring the elements which it carries and supports into and out of operative relation with the printing-cylinder, the following specified mechanical elements have been provided:

A rotary screw-shaft 137 (Figs. 2 and 4), held against longitudinal movement by collars 138, 138 on opposite sides of its bearings 139 on a bracket forming part of, or mounted on the machine-frame, has a readily-accessible turning-handle 141, such part 137 extending through a screw-threaded opening in a slidable rack 142 whose teeth are in mesh with those of a toothed sector 143 fixed to shaft 11.

Hence, by turning the handle, the rack can be slid in either direction as desired and the shaft and its associated parts carried into, or out of, co-active relation with the surface of the printing-cylinder.

Assuming that such shaft has been rocked to shift the doctor-blade against the etched, copper printing-cylinder and that all of the parts of the mechanism are in operation, their action may be briefly described as follows:

During the revolution of the cylinder, the newly-sharpened and cleaned edge of the doctor-blade travels lengthwise along and in contact with it, with the proper degree of pressure exerted on the blade toward the cylinder, the result being that the blade wipes the excess ink off the cylinder's surface leaving the correct amount of ink in its etched depressions to perform the printing operation which is not illustrated.

This ink, scraped off by the endless, traveling doctor-blade, is kept out of the blade mechanism and is guided and drained back into the ink-reservoir for further use by the resilient apron, such ink, if any, as may remain on the blade after it leaves the cylinder being wiped off by the spring-pressed ink-scraper 66 and this small amount of ink is also drained back into the reservoir because of the location of such scraper thereabove.

Then the blade is additionally wiped successively by the member 70, one of the leathers, and the kerosene-charged felt-pad to assure complete removal of all adhering particles and to prepare the blade for the sharpening action.

It is then sharpened and honed on its narrow bevelled face an acute-angle edge only of which will contact with the cylinder, and then honed on the opposite side of such edge to complete an efficient re-sharpening or reconditioning operation.

Thereupon, it is again thoroughly wiped, including gasoline cleaning, and, after passing around the pulley at the opposite end of the machine, it again performs its ink-removing function and is then again re-sharpened.

From what precedes, it will be clear that the operation of the doctor-blade is continuous both as to its cooperation with the printing-cylinder in the performance of its ink-removal action and as to its cleaning and re-sharpening.

Consequently, it is unnecessary to stop the printing to recondition the blade, an important economical feature, and the quality of the printing produced is uniform and not materially variable as has heretofore been usual and unavoidable.

In passing, it should be noticed that the operative edge of the doctor-blade is bevelled but that such narrow, oblique surface does not engage or bear on the face of the cylinder, the acute-angle edge 20 only between such surface and the unbevelled face of the blade contacting with the ink-covered surface of the cylinder at an acute angle, the removed ink by gravity draining back directly into the ink-reservoir, the inked surface of the etched cylinder before the excess is thus removed being beneath the blade, the wiped surface of the cylinder being above the blade.

If the cylinder were revolved in the opposite direction, the sharp edge of the blade would ruin the etched, copper surface thereof by cutting into it.

During the blade-sharpening operation, the grinding and honing wheels remove a sufficient portion of its metal to effect a sharpening action as distinguished from any mere burnishing result.

Again, such single doctor-blade constitutes the sole and only means for performing the entire ink-eliminating function from the cylinder and its wiping or scraping action is not supplemented by that of any other medium or agency.

The desired pressure of the active edge of the blade on the cylinder can be easily regulated or controlled, while the blade is in contact with the cylinder, by manual turning of one or more of the several screws 52.

Further, by turning the handles 59, which may be done while the blade is in operation, the blade may be shifted to offset or make up for its gradual reduction in width due to wear and its sharpening, gauges 136 (Figs. 1 and 2) desirably being provided to show the correct height or position of the sharp edge of the blade.

In the particular embodiment of the invention shown and described, the flexible, endless ink-scraper or doctor-blade is both guided and driven by the two pulleys 16 and 17, but this arrangement need not necessarily be used, since the pulleys could be employed as blade guides only, the blade being power driven or operated in some other appropriate manner.

These blade-guiding pulleys are rounded and they guide the flexible doctor-blade out of line

or register with the active ink-scraping part of the blade to a place where there is adequate space for the blade cleaning, sharpening and honing mechanism.

Especial attention is directed to the fact that the ink-receiving side of the flexible blade or band is away from the pulleys or guides and, if any ink should remain on the blade after passing the scraper **66**, it will not come into contact with either of the pulleys.

As the supply of ink to the blade is constant and since such ink dries rapidly, if any of it were allowed to touch the guide pulley or pulleys, it would tend to accumulate or build up thereon and it would require some special means to scrape or clean it off the guide.

Moreover, the deposit of a layer of ink on the face of the guide pulley would tend to change its dimension and thus modify or vitiate the setting of the blade with relation to the printing-cylinder with which it directly cooperates.

This feature that the ink-receiving side of the doctor-blade is away from the pulleys permits the carefully sharpened and honed edge **20** to travel around in its endless path without contacting anything other than the cylinder.

If it came in contact with the pulleys or guides, a little particle of dried ink could easily cause a dent in it which might not be completely removed in the next sharpening and honing operation, and on its next engagement with the copper on the printing-cylinder it could readily cause a scratch on the design surface, thus producing either temporary or permanent injury.

The fact that the ink surface of the blade is the one away from the guide pulleys is a highly important feature of the present invention.

The ink removed from the printing-cylinder by the blade edge **20** makes a small ink-pocket near the top of apron **43**, and as the pocket becomes filled up, the ink flows down the side of the blade and by gravity runs down the ink side of the apron falling from the bottom thereof in a sheet or ink-fall into the ink-reservoir.

Since the ink reaches the doctor-blade solely from the revolving cylinder, and as the apron is slightly longer than the cylinder, practically all of the ink scraped off by the flexible blade has an opportunity to flow down by gravity.

Scraper **66** is called upon to remove only a very small amount of ink, as is evidenced by the fact that ink falls only in infrequent drops from such scraper, whereas the ink on the apron descends somewhat as a cataract.

Apron **43** and gravity constitute the means for delivering the major portion of the ink from the blade, the active section of the latter being located within the scraping zone and not outside thereof.

In gravure printing-presses great pressure between the copper plate on the cylinder and the sheet of paper to be printed is required, the present tendency being to exert greater and greater pressure on the paper to extract the ink from the many small ink-wells in the printing face of the copper plate.

For this reason, the copper-plate-carrying cylinders have been made with their journals as conveniently short as feasible to secure sufficient stiffness, the walls supporting the journals being located as close as possible to the ends of the cylinder, as indicated in Figures 1, 2, 3 and 4, the walls having the bearings **12** and **13** being located as near the ends of the cylinder **10** as practicable.

Furthermore, while in gravure printing-press cylinders which print on a web of paper ordinarily there are no "bearers", it has nevertheless been found to be exceedingly desirable to provide bearers for all sheet-fed presses.

Such bearers are naturally brought as close to the copper of the cylinder as possible, and as the bearers are on a level with the surface of the copper and since it is highly undesirable to have the doctor-blade edge rub on the bearer and thus injure or damage both, the blade and mechanism, namely, the rotary pulleys, are located as close to the cylinder end-walls as may be.

This practically limits the length of the inactive portion or portions of the doctor-blade that are in alignment with the active part of the ink-scraping edge of the blade.

The sections of the blade between the pulley-guides in line with the blade edge in active scraping relation to the cylinder and not actually scraping the cylinder are therefore quite short, not allowing much room for any supplemental mechanism, attention being directed to the somewhat crowded relation of the parts **170, 66, 67, 68**, etc. in Figure 2.

When it was found to be desirable to provide blade-conditioning means in a suitable position for sharpening and honing the scraping edge of the blade, naturally it was compulsory to provide room for such mechanism, and the sharpening means was located so as to be operative on that part of the flexible blade which was out-of-line with that portion of the blade which was acting on the cylinder, and the specified conditioning means was placed to act on the return stretch or length of the blade between the two pulleys.

Such location of the power-driven sharpening and honing means as well as the associated blade wiping and cleaning elements afforded plenty of room, great visibility and ready accessibility without materially increasing the distance between the frame walls or cylinder-bearers, and such placing of these several parts constitutes one of the major features of the invention.

Incidentally, this arrangement of the several cooperating elements permitted the installation of the single power-shaft **23** extending the full length of the mechanism parallel to the scraper edge, thus effectively applying the driving power for the blade at its opposite ends, such double-end drive permitting a somewhat reduced tautness or strain on the blade than would be required were the blade driven by only one power-rotated pulley.

Instead of using grinding or honing stone wheels, natural or artificial, in some instances it may be feasible and practicable to employ files to perform the sharpening or reconditioning operation, and the sharpening means regardless of its nature, may, in the broadest aspect of this invention, be stationary, rotatable or power driven.

Those acquainted with this art will readily understand that many modifications may be incorporated in the appliance shown and described without departure from the heart and essence of the invention as defined by the appended claims, and without the loss or sacrifice of any of the material or substantial benefits accruing from the employment of the invention.

We claim:

1. In a doctor-blade construction for gravure printing-presses, the combination of a support, a doctor-blade having a sharp edge which is adapted to contact with the printing-element of the press and to scrape the excess ink therefrom,

means to cause said doctor-blade to travel along said element, portions of said doctor-blade during said travel being alternately active on said element and inactive thereon, a sharpening-wheel positioned with a side surface thereof slightly oblique to the direction of travel of, and in contact with, an inactive portion of a face of said doctor-blade at one side of said edge, and means to rotate said wheel to sharpen the blade during its travel, whereby an inactive part of said blade is automatically resharpened during the engagement of the active part of the blade with said printing-element.

2. The structure presented in claim 1, in combination with an abutment engaging said blade opposite said sharpening-wheel to hold the blade to the wheel during its sharpening action.

3. The structure presented in claim 1 in combination with an abutment engaging, and adjustable toward and from, said blade opposite said sharpening-wheel to hold the blade to the wheel during the sharpening action of the latter, and spring-means pressing said sharpening-wheel to said blade.

4. In a doctor-blade construction for gravure printing-presses, the combination of a support, a pair of pulleys on said support, an endless flexible doctor-blade having a bevelled face an edge of which is adapted to contact with the printing-element of the press and to scrape the excess ink therefrom, said blade extending around and engaging said pulleys, one length of said blade between said pulleys constituting its portion active on the printing-element, means to cause said blade to travel in its endless path, a sharpening-wheel positioned with a side surface thereof slightly oblique to the direction of travel of, and in contact with, said bevelled face of the inactive length of said blade between said pulleys, and means to rotate said sharpening-wheel to sharpen the blade during its endless travel, whereby the inactive length of said blade between the pulleys is automatically resharpened during the active engagement of the other companion length of the blade between said pulleys with the printing-element.

5. The construction presented in claim 4 in combination with an abutment engaging said blade opposite said sharpening-wheel to hold the blade to the wheel during its sharpening action.

6. The construction presented in claim 4 in combination with an abutment engaging, and adjustable toward and from, said blade opposite said sharpening-wheel to hold the blade to the wheel during its sharpening action, and spring-means pressing said sharpening-wheel to said blade.

7. In a doctor-blade construction for gravure printing-presses, the combination of a support, a doctor-blade having a bevelled face an edge of which is adapted to contact with the printing-element of the press and to scrape the excess ink therefrom, means to cause said doctor-blade to travel along said element, the portions of said doctor-blade during its travel being alternately active on said element and inactive thereon, a sharpening-wheel positioned with a side surface thereof slightly oblique to the direction of travel of, and in contact with, said bevelled face of an inactive portion of said doctor-blade, a honing-wheel positioned with a side surface slightly oblique to the direction of travel of, and in contact with, an inactive portion of the face of said blade opposite said bevelled face, and means to rotate said sharpening and honing wheels to recondition said edge of the blade, whereby an inactive part of said blade is automatically reconditioned during the active engagement of another part of the blade with said printing-element.

8. The structure presented in claim 7 in combination with an abutment engaging said blade opposite said sharpening-wheel to hold the blade to said sharpening-wheel during its sharpening action, and an abutment engaging said blade opposite said honing-wheel to hold the blade to the honing-wheel during its honing action.

9. The structure presented in claim 7 in combination with an abutment engaging, and adjustable toward and from, said blade opposite said sharpening-wheel to hold said blade to the sharpening-wheel during its sharpening action, spring-means pressing said sharpening-wheel to said blade, an abutment engaging, and adjustable toward and from, said blade opposite said honing-wheel to hold said blade to the honing-wheel during its honing action, and spring-means pressing said honing-wheel to said blade.

10. In a doctor-blade construction for gravure printing-presses, the combination of a support, a doctor-blade having a bevelled face an edge of which is adapted to contact with the printing-element of the press to scrape the excess ink therefrom, means to cause said doctor-blade to travel along said element, the portions of said doctor-blade during its travel being alternately active on said element and inactive thereon, a sharpening-wheel positioned with a side surface thereof slightly oblique to the direction of travel of, and in contact with, said bevelled face of an inactive portion of said doctor-blade, a honing-wheel positioned with a side surface thereof slightly-oblique to the direction of travel of, and in contact with, said bevelled face of an inactive portion of said doctor-blade after said sharpening-wheel has acted thereon, and means to rotate said sharpening and honing wheels to recondition said blade during its travel, whereby an inactive part of said blade is automatically reconditioned during the active engagement with another part of said blade with said printing-element.

11. The structure presented in claim 10 in combination with an abutment engaging said blade opposite said sharpening-wheel to hold the blade to said sharpening-wheel during its sharpening action, and an abutment engaging said blade opposite said honing wheel to hold said blade to said honing-wheel during its honing action.

12. The structure presented in claim 10 in combination with an abutment engaging, and adjustable toward and from, said blade opposite said sharpening-wheel to hold said blade to said sharpening-wheel during its sharpening action, spring-means pressing said sharpening-wheel to said blade, an abutment engaging, and adjustable toward and from, said blade opposite said honing-wheel to hold said blade to said honing-wheel during its honing action, and spring-means pressing said honing-wheel to said blade.

13. In a doctor-blade construction for gravure printing-presses, the combination of a support, a doctor-blade having a bevelled face an edge of which is adapted to contact with the printing-element of the press to scrape the excess ink therefrom, means to cause said doctor-blade to travel along said element, the portions of said doctor-blade during its travel being alternately active on said element and inactive thereon, a sharpening-wheel positioned with a side face thereof slightly oblique to the direction of travel of, and in contact with, said bevelled face of an

inactive portion of said doctor-blade, a first honing-wheel positioned with a side surface thereof slightly oblique to the direction of travel of, and in contact with, said bevelled face of an inactive portion of said doctor-blade after said sharpening-wheel has acted thereon, a second honing-wheel positioned with a side surface thereof slightly oblique to the direction of travel of, and in contact with, an inactive portion of the face of said doctor-blade opposite said bevelled face and after said sharpening-wheel has acted on said bevelled face, and means to rotate said sharpening and honing wheels to recondition the blade, whereby an inactive part of said blade is automatically reconditioned during the active engagement of another part of the blade with said printing-element.

14. The structure presented in claim 13 in combination with abutments engaging said blade opposite said wheels to hold the blade to the corresponding wheels during their action thereon.

15. The structure presented in claim 13 in combination with an abutment engaging, and adjustable toward and from, said blade opposite each of said wheels to hold the blade to the corresponding wheel during its action thereon, and spring-means pressing each of said wheels to said blade.

16. In a doctor-blade construction for gravure printing-presses, the combination of a support, a pair of pulleys on said support, an endless flexible doctor-blade having a bevelled face an edge of which is adapted to contact with the printing-element of the press and to scrape the excess ink therefrom, said blade extending around and engaging said pulleys, one length of said blade between said pulleys constituting its active portion on the printing-element, the companion length of said blade between said pulleys constituting its inactive portion, means to drive at least one of said pulleys to cause the blade to travel in its endless path, and blade-sharpening means in contact with said bevelled face of the inactive length of said blade between said pulleys, whereby said inactive length is automatically resharpened during the active engagement of the other companion length of said blade between said pulleys with said printing-element.

17. The structure presented in claim 16 in combination with means to hone the inactive portion of said bevelled face of the blade after it has been acted upon by said sharpening-means.

18. The structure presented in claim 16 in combination with means to hone the inactive face of said blade opposite said bevelled face and after the latter has been acted upon by the sharpening-means.

19. In a doctor-blade construction for gravure printing-presses, the combination of an endless doctor-blade, means to drive said blade in its endless path, means to support said doctor-blade in ink-scraping engagement with the surface of the printing-element of the press, a resilient apron engaging the ink-receiving side of the blade and extending substantially the length of the active portion of the blade and adapted to guide the scraped-off ink away from the blade, and means reconditioning that length of said blade opposite said active portion thereof.

20. The construction set forth in claim 19 in which said apron is made of Micarta.

21. In a doctor-blade construction for gravure printing-presses, the combination of a support, a pair of revoluble pulleys on said support, an endless flexible doctor-blade extended around and in engagement with said pulleys, one length of said doctor-blade between said pulleys being adapted for ink-scraping engagement with the surface of the printing-element of the press, means to effect the endless travel of said doctor-blade, a resilient apron engaging the ink-receiving side of the blade and extending substantially the length of the active portion of the blade and adapted to guide from said blade the ink scraped off by said blade, and means reconditioning that length of said blade opposite said active portion thereof.

22. In a doctor-blade construction for gravure printing-presses, the combination of a support, a pair of revoluble pulleys on said support, a flexible endless doctor-blade extending around and engaging said pulleys, means to drive at least one of said pulleys to effect the endless travel of said blade, a length of said blade between said pulleys being adapted to have ink-scraping engagement with the surface of the printing-element of the press, a stationary resilient Micarta apron edgewise engaging the ink-receiving side of said blade and extending substantially the length of the active portion of the blade and adapted to guide the ink scraped off said element by said blade from said blade, and means reconditioning that length of said blade opposite said active portion thereof.

23. In a doctor-blade construction for gravure printing-presses, the combination of a support, a pair of revoluble pulleys on said support, means to rotate at least one of said pulleys, a flexible endless doctor-blade extended around and engaging said pulleys, an edge of said doctor-blade between said pulleys being adapted for ink-scraping engagement with the printing-element of the press, a resilient apron edgewise engaging the side of said doctor-blade toward said printing-element and adapted to guide the ink scraped off said printing-element by said doctor-blade from said blade, a resilient pressure-member edgewise engaging the side of said doctor-blade opposite said printing-element, means to sharpen the inactive length of said blade between said pulleys, and means to adjust both lengths of said blade in their own planes to compensate for the wear and sharpening of the blade.

24. In a gravure printing-press, the combination of a rotary printing-cylinder, means to apply ink to said cylinder, a pair of revoluble pulleys, means other than the doctor-blade to rotate both of said pulleys, an endless flexible doctor-blade extended around and engaging said pulleys with an edge of one of its stretches between said pulleys in active ink-wiping engagement with the surface of said printing-cylinder, said blade engaging the unwiped surface of said cylinder at an acute angle and the adjacent wiped surface of the cylinder at an obtuse angle, said blade being driven by said pulleys solely by its friction therewith, and means reconditioning that length of said blade opposite said active portion thereof.

25. In a doctor-blade construction for gravure printing-presses, the combination of a support, a pair of revoluble pulleys on said support, a single drive-shaft extended between said pulleys, means to rotate both of said pulleys from said drive-shaft common to both, a flexible endless doctor-blade extended around and engaging and

driven by said pulleys solely by friction, one length of said blade between said pulleys constituting its active portion adapted to engage and remove the excess ink from the printing-element of the press, the other length of said blade between said pulleys comprising its inactive length, and means to sharpen the blade along its inactive length while its active portion is in operative engagement with said printing-element.

26. In a doctor-blade construction for gravure printing-presses, the combination of a support, a pair of revoluble pulleys on said support, power means to rotate both of said pulleys, a flexible endless doctor-blade extended around and engaging and driven by said pulleys solely by friction, one length of said blade between said pulleys constituting its active portion adapted to engage and remove the excess ink from the printing-element of the press, the other length of said blade between said pulleys comprising its inactive length, and means to sharpen the blade along its inactive length while its active portion is in operative engagement with said printing-element.

27. In a doctor-blade construction for gravure printing-presses, the combination of a support, a pair of revoluble pulleys on said support, means to rotate at least one of said pulleys, a flexible endless doctor-blade extended around and engaging said pulleys, an edge of one length of said blade between said pulleys being adapted to engage and remove the excess ink from the printing element of the press during the endless travel of said blade, the companion length of said blade between said pulleys comprising its inactive length, and manually operated means to adjust both lengths of said blade simultaneously and equally in their own planes.

28. The construction presented in claim 27 in combination with means to sharpen said edge of the blade along its inactive length.

29. The construction presented in claim 27 in which said adjustment may be effected during the endless travel of the blade.

30. The construction presented in claim 27 in which said manually-operated means includes slotted bearing blocks in the slots of which said blade travels, in combination with means to adjust the positions of said blocks.

31. In a doctor-blade construction for gravure printing-presses, the combination of a doctor-blade having an edge adapted to contact with and to wipe the excess ink from the surface of the printing-element of the press, means to move said blade along said printing-element during its contact therewith, and means to engage said blade on both sides of said edge of a portion of said blade to sharpen said edge while said portion is inactive on said printing-element.

32. The construction presented in claim 31 in combination with means to wipe said blade before being sharpened and also after being sharpened and before becoming again active on said printing-element.

33. In a doctor-blade construction for gravure printing-presses, the combination of a support, a pair of revoluble pulleys on said support, means to rotate at least one of said pulleys, a flexible endless doctor-blade extended around, engaging, and driven in its endless travel by, said pulleys and having an edge adapted to contact with, and to wipe the excess ink from, the surface of the printing-element of the press, and blade-sharpening means engaging said blade on opposite sides of said edge of a portion of said blade inactive on said printing-element.

34. In a doctor-blade construction for printing-presses, the combination of a support, a pair of revoluble pulleys on said support, means to rotate at least one of said pulleys, and endless flexible doctor-blade extended around and engaging said pulleys, an edge of a portion of said blade between said pulleys being adapted to act on the printing-element of the press and to remove the excess ink therefrom, means to sharpen an inactive portion of said blade while its active portion is operative on said printing-element, a blade-wiping member riding on said edge of an inactive portion of said blade, and an abutment against which said wiping-member bears to prevent its travel with the blade.

35. The structure presented in claim 34 in which said wiping-member straddles said blade and bears on said edge and against the blade surfaces on opposite sides of said edge.

36. The structure presented in claim 34 in which said abutment slopes and tends to hold said wiping-member down on the edge of the traveling blade.

37. In a doctor-blade construction for the cylinder of a gravure printing-press, the combination of a support, a flexible doctor-blade having a sharp edge adapted to contact from below with the inked surface of the printing-press cylinder at an acute angle to scrape the ink therefrom onto the underside of the doctor blade, means to move said doctor-blade along the surface of said cylinder during its scraping action thereon, the major portion of the ink on said blade being removed therefrom within the scraping zone, and means coacting with said blade outside of said scraping zone to remove the remainder of the ink, if any, from said blade.

38. The structure presented in claim 37 in which the ink removed from the blade in the scraping zone is so removed by the action of gravity.

39. The structure presented in claim 37 in combination with a flexible apron engaging the ink-receiving side of said blade, the ink removed from the blade in the scraping zone flowing by gravity down the blade and over the surface of said apron.

40. In a doctor-blade construction for the cylinder of a printing-press, the combination of a support, a pair of revoluble pulleys on said support, means to drive at least one of said pulleys, and an endless flexible doctor-blade extended around and engaging said pulleys, said blade having a narrow bevel face the acute-angle edge of which is adapted to contact with said cylinder and is at the outerside of said blade as it passes around said pulleys so as not to contact with said pulleys.

41. In a doctor-blade construction for the cylinder of a gravure printing-press, the combination of a support, a flexible doctor-blade having an ink-scraping edge adapted to coact with said cylinder to remove the excess ink therefrom, means on said support to move said blade to bring sections thereof successively into and out of cylinder-engaging position, means to guide said blade to bring the portions thereof out of line with the active part of the blade and then into such active position again, and means to recondition all portions of said edge while they are moving in a substantially straight path out of line with the active cylinder-engaging length of the blade.

42. The structure set forth in claim 41 in which

said reconditioning means sharpens said edge of the blade in combination with means engaging the part of the blade undergoing sharpening to prevent it from backing away from said sharpening means.

43. In a doctor-blade construction for gravure printing-presses, the combination of a flexible doctor-blade having an edge adapted to contact with, and to remove the excess ink from, the printing-element, said ink thereby depositing on the ink-receiving surface of said blade, means to move said blade along said printing-element, means to flex said blade crosswise to bring its portions into an inactive position, said flexing means contacting said blade on the surface thereof which does not receive ink, and means to recondition the inactive portions of said blade edge.

44. In a doctor-blade construction for gravure printing-presses, the combination of a thin, endless, flexible doctor-blade, means to cause said doctor-blade to travel around its endless path with one length of the blade in edgewise ink-wiping contact with the printing-element of the printing-press, the opposite length of the blade constituting its inactive length, and registering ink-scrapers engaging opposite sides of the inactive length of the blade.

45. The structure set forth in claim 44 in which said scrapers are flexible and disposed obliquely to the blade.

46. The structure set forth in claim 44 in which said scrapers are Micarta and disposed obliquely to the blade.

47. In a doctor-blade construction for gravure printing-presses, the combination of a support, a doctor-blade having a sharp edge which is adapted to contact with the printing-element of the press and to scrape the excess ink therefrom, means to cause said doctor-blade to travel along said element with its edge in active engagement therewith, portions of said doctor-blade during said travel being alternately active on said element and inactive thereon, a sharpening-wheel positioned with a side surface thereof in operative contact with an inactive portion of a face of said doctor-blade at one side of said edge, and means to rotate said sharpening-wheel in a direction whereby that portion of said side surface thereof which is in contact with said doctor-blade face travels outwardly only of the blade away from said edge.

48. The doctor-blade construction set forth in claim 47 in which said side-surface of said sharpening-wheel is at an oblique angle to the face of the blade on which it acts.

49. The doctor-blade construction set forth in claim 47 in which said doctor-blade is endless with one stretch thereof active on the printing-element and the opposite stretch thereof is inactive thereon and in which said sharpening-wheel acts on said inactive stretch.

50. The doctor-blade construction set forth in claim 47 in which said side-surface of said sharpening-wheel is at an oblique angle to the face of the blade on which it acts and in which said doctor-blade is endless with one stretch thereof active on the printing-element and the opposite stretch thereof is inactive thereon and in which said sharpening-wheel operates on the inactive stretch of said blade.

51. In a doctor-blade construction for gravure printing-presses, the combination of a support, a doctor-blade having a sharp edge which is adapted to contact with the printing-element of the press and to scrape the excess ink therefrom, means to cause said doctor-blade to travel along said element with its edge in active engagement therewith, portions of said doctor-blade during said travel being alternately active on said element and inactive thereon, a sharpening-wheel in operative contact with an inactive portion of a face of said doctor-blade at one side of said edge, the surface of said wheel in engagement with said face being at an angle to said face oblique to the direction of travel of the blade, and means to rotate said sharpening-wheel.

52. In a doctor-blade construction for gravure printing-presses, the combination of a support, a doctor-blade having a sharp edge which is adapted to contact with the printing-element of the press and to scrape the excess ink therefrom, means to cause said doctor-blade to travel along said element with its edge in active engagement therewith, portions of said doctor-blade during said travel being alternately active on said element and inactive thereon, a sharpening-wheel in operative contact with an inactive portion of a face of said doctor-blade at one side of said edge, the surface of said wheel in engagement with said face being at an angle to said face oblique to the direction of travel of the blade, and means to rotate said sharpening-wheel in a direction whereby that portion of said surface thereof which is in contact with said doctor-blade face travels outwardly only of the blade away from said edge.

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