

**No. 637,555.**

**Patented Nov. 21, 1899.**

**E. HETT.**

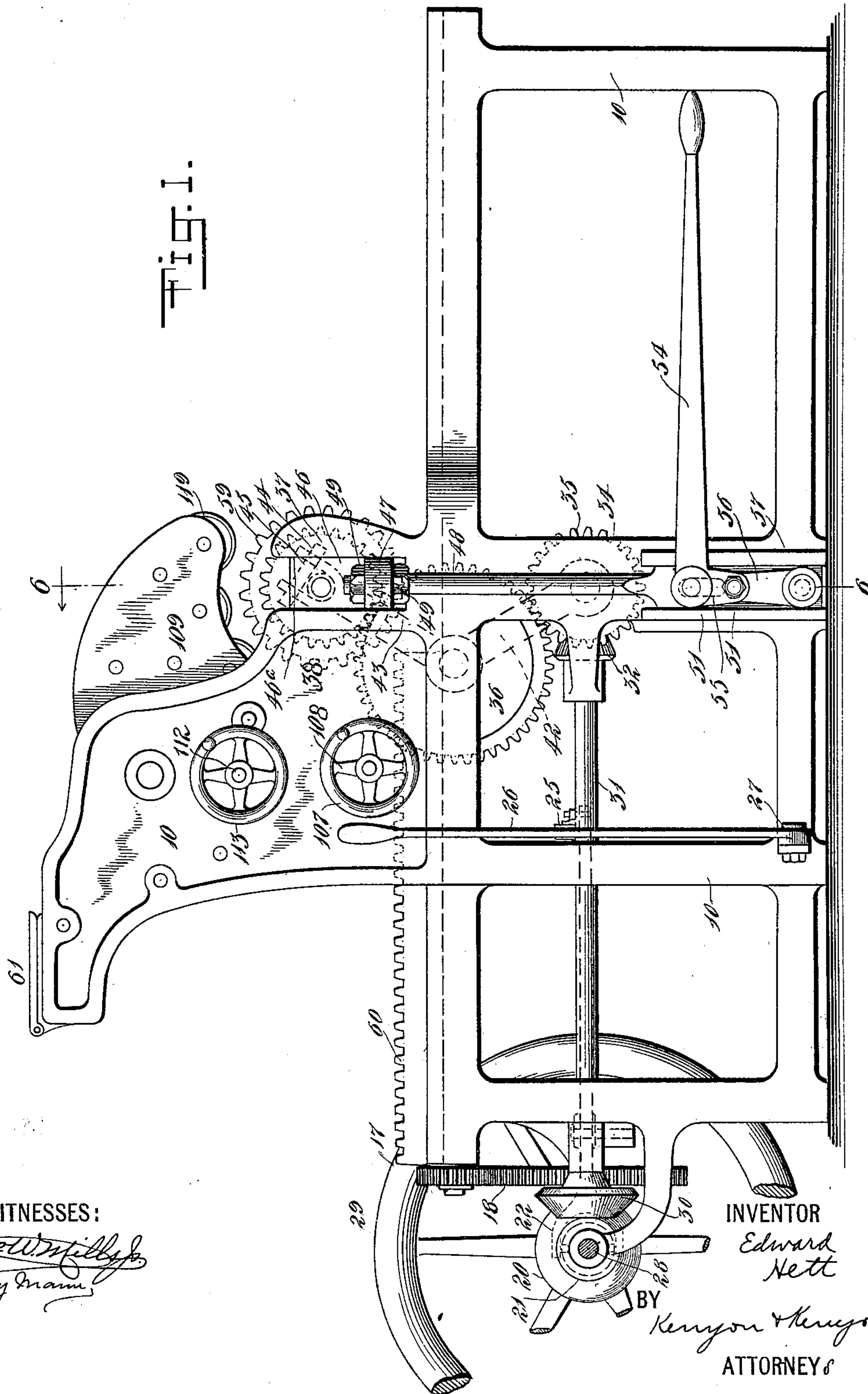
# ART OF MAKING PRINTING SURFACES.

(Application filed Jan. 23, 1899.)

(No Model.)

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**WITNESSES:**

~~Edw. Mills~~  
Sidney Mann

INVENTOR

Edward  
Hett

BY

Kenny & Kenny

ATTORNEY *s*

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7 Sheets—Sheet 2.

Fig. 3.

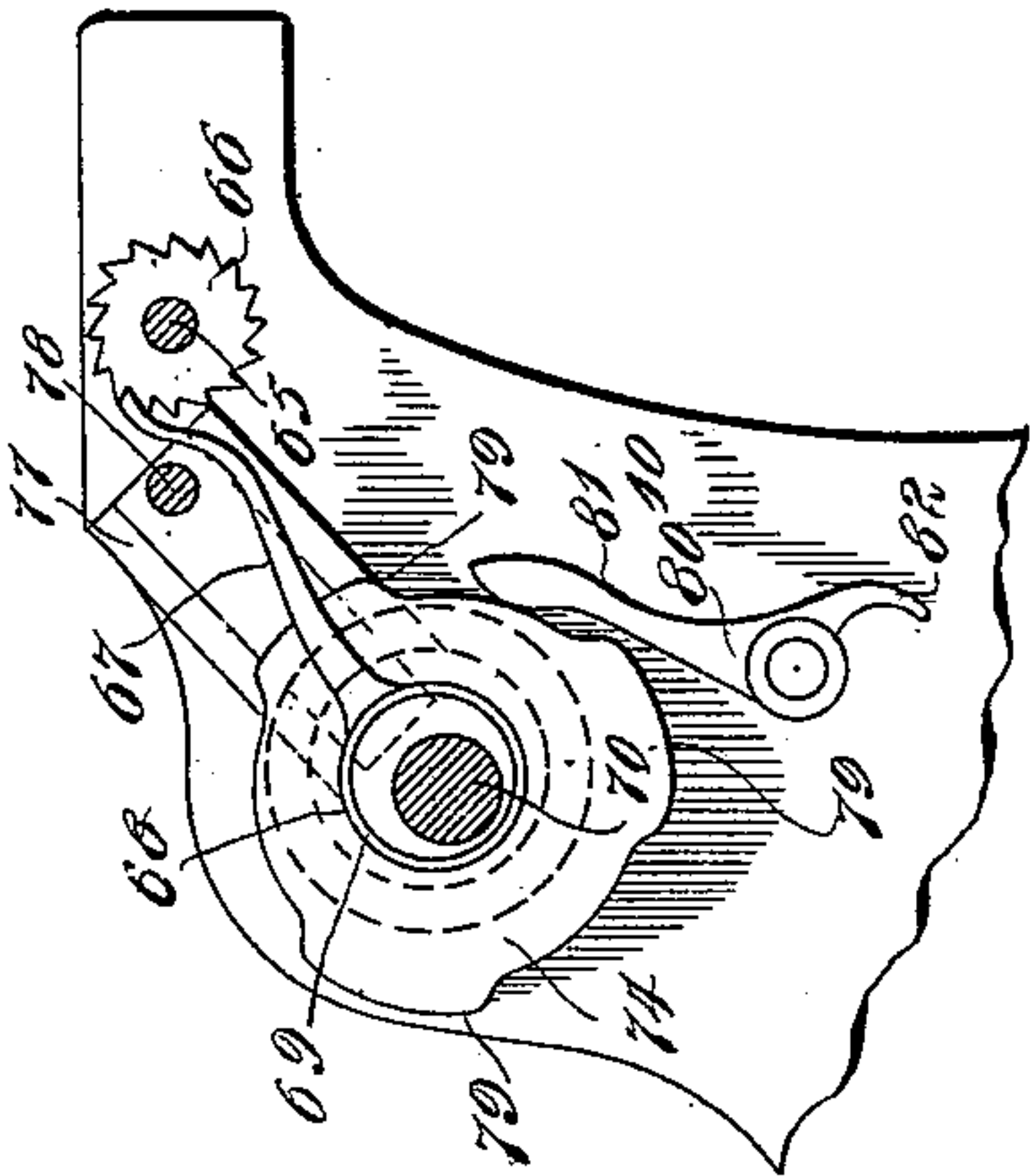
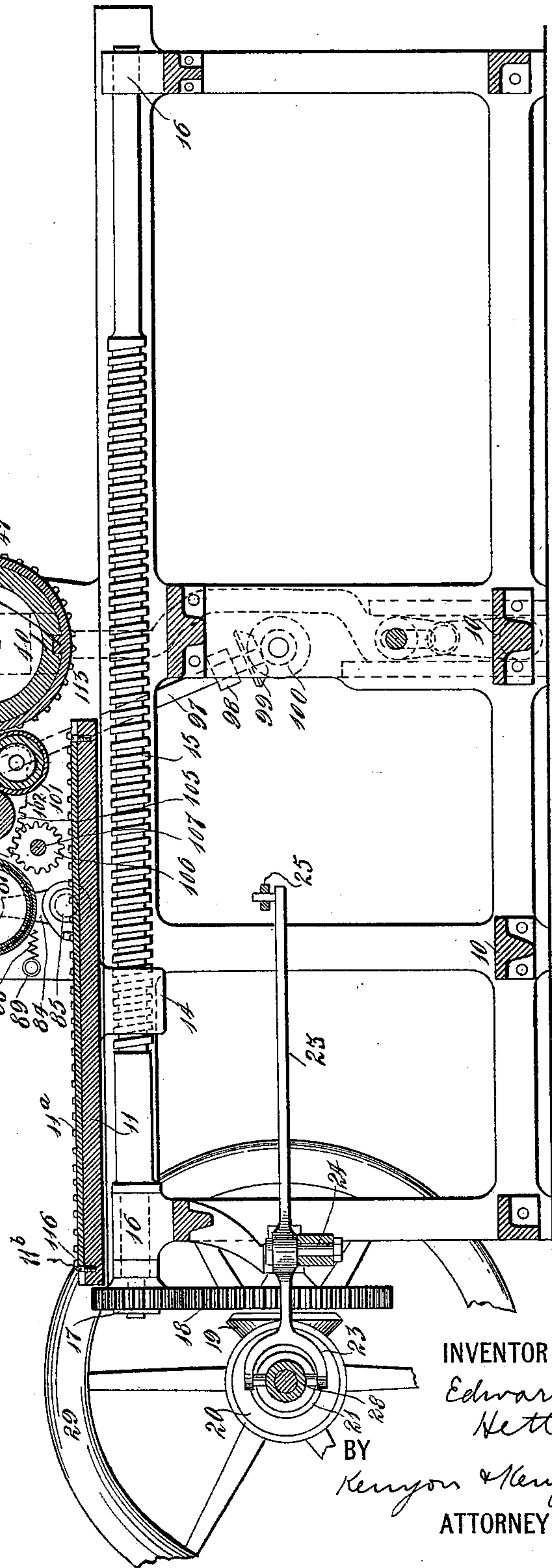
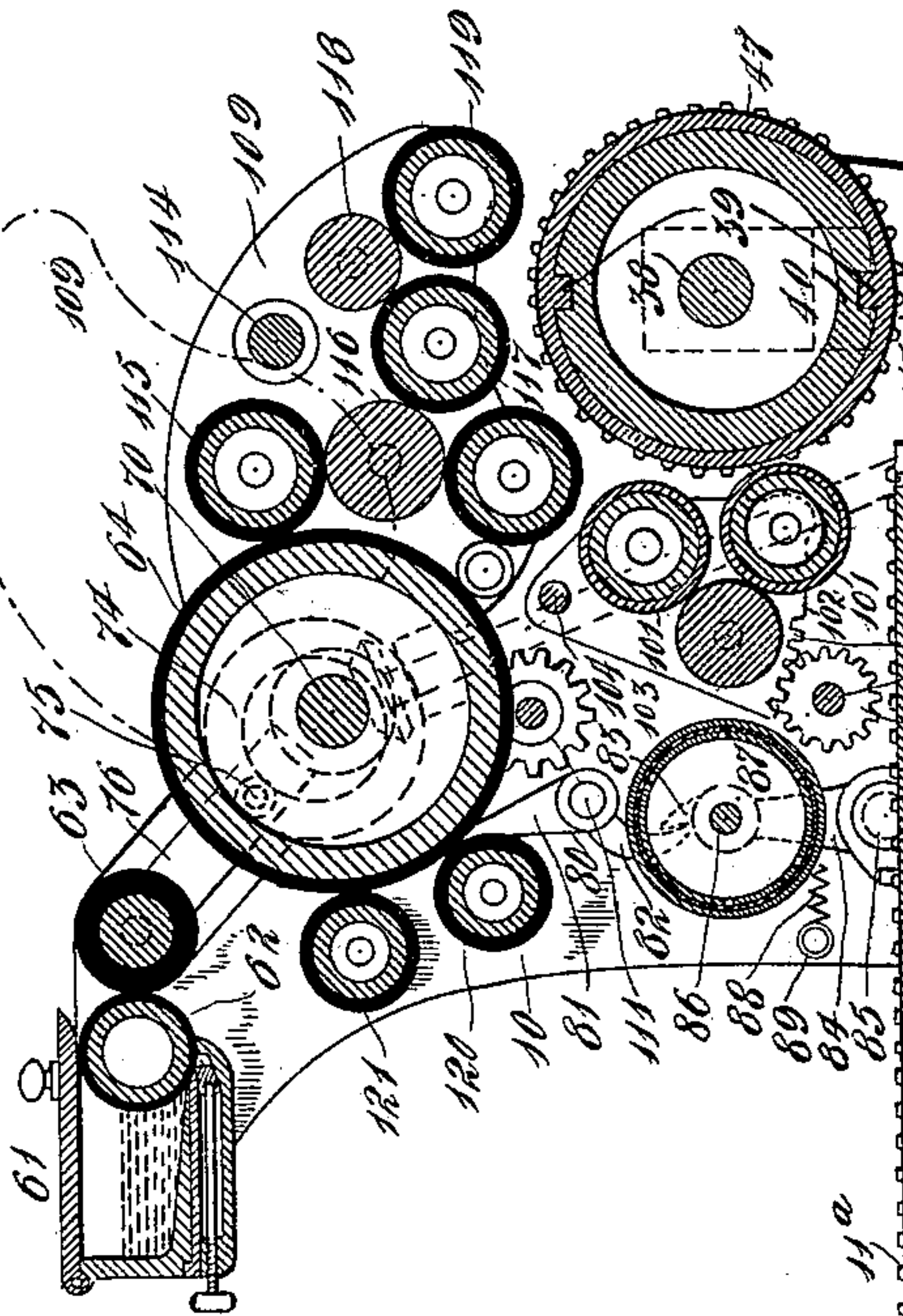


Fig. 2.



WITNESSES:

*Scott H. Hett*  
*Sidney Mann*

INVENTOR

*Edward Hett*

BY

*Kenny & Kenny*  
ATTORNEYS



No. 637,555.

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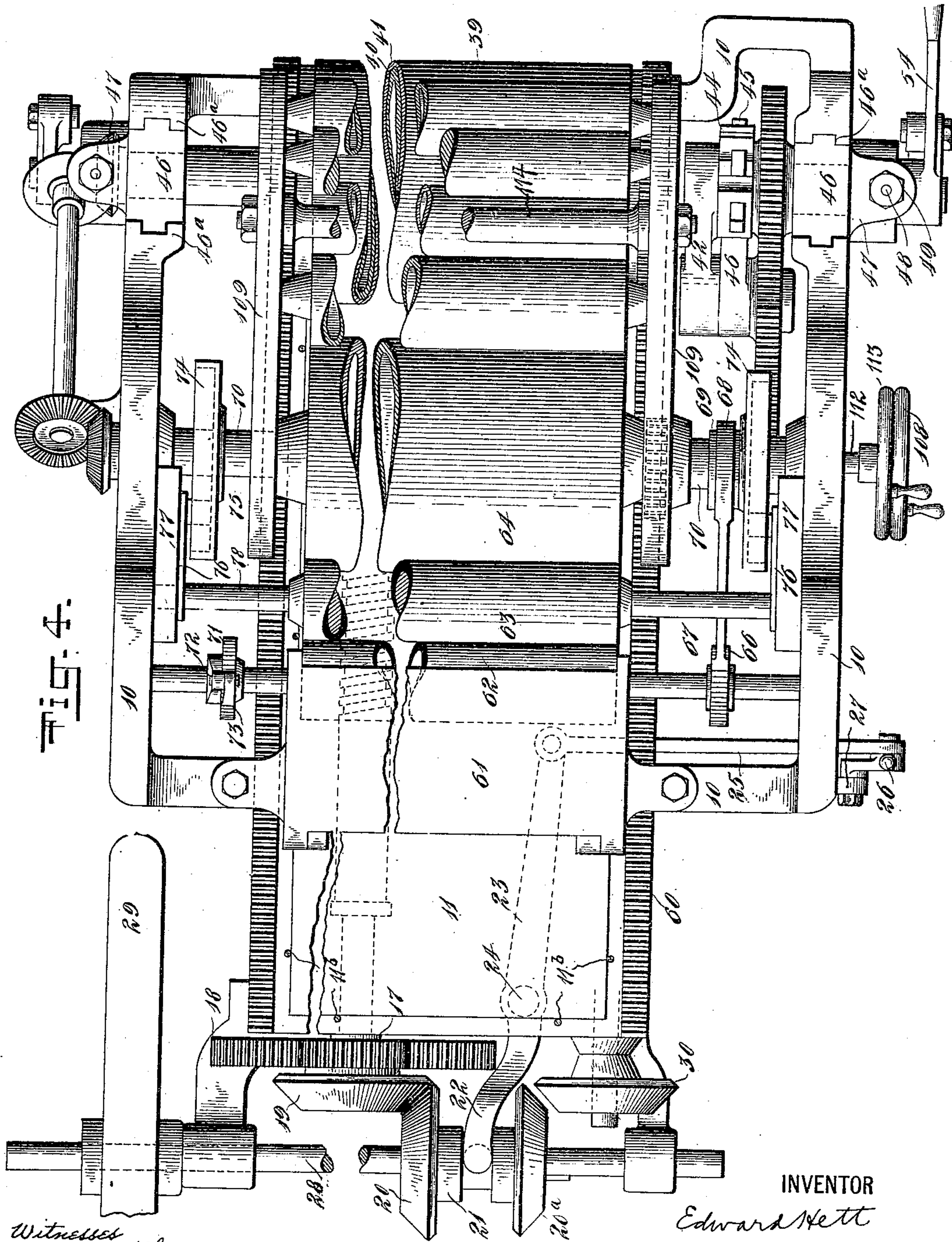
E. HETT.

ART OF MAKING PRINTING SURFACES.

(Application filed Jan. 23, 1899.)

(No Model.)

7 Sheets—Sheet 3.



Witnesses  
*Scott & Wills*  
*Sidney Mahan*

INVENTOR

*Edward Hett*

BY

*Kenny & Kenny*  
ATTORNEYS



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Patented Nov. 21, 1899.

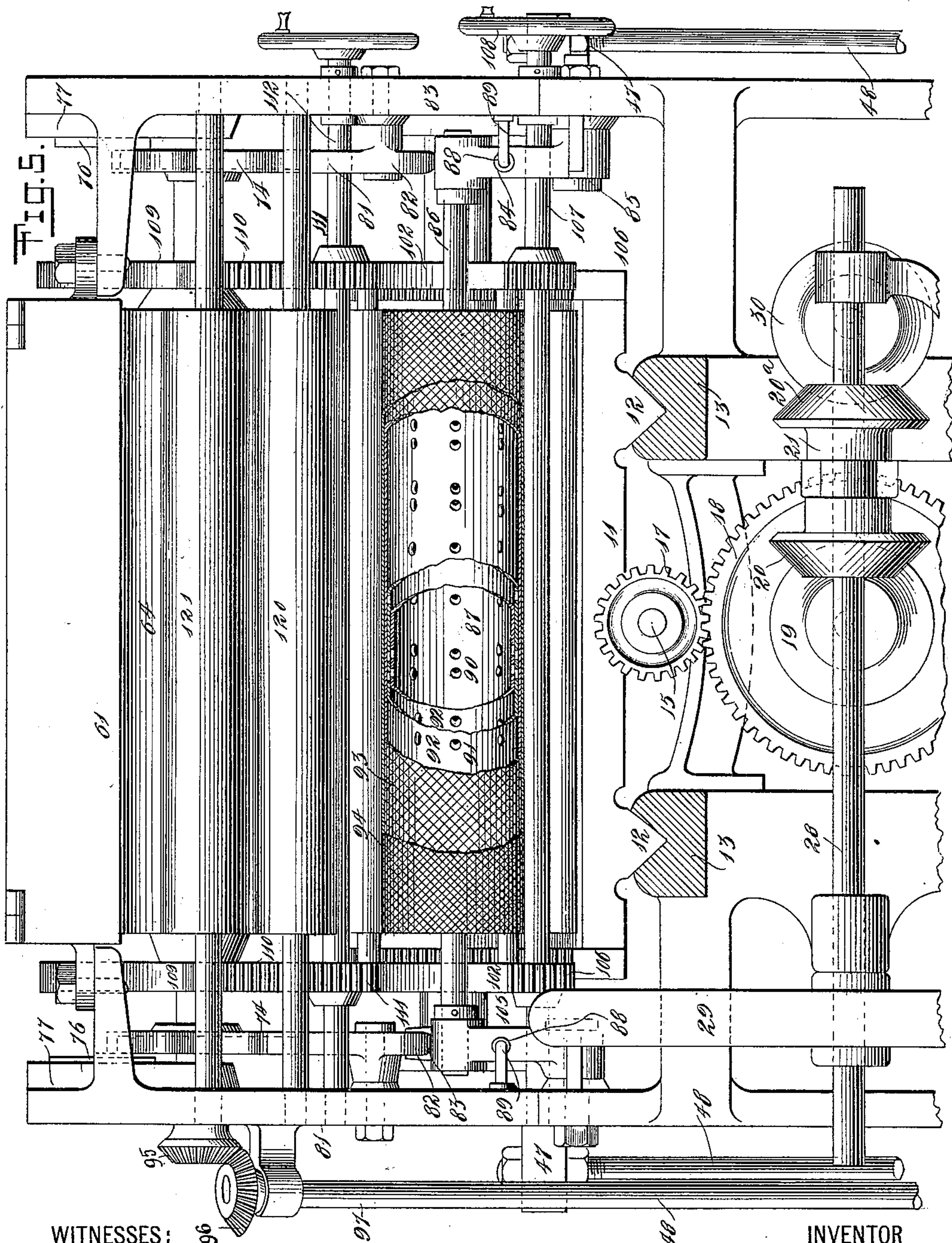
E. HETT.

ART OF MAKING PRINTING SURFACES.

(Application filed Jan. 23, 1899.)

(No Model.)

7 Sheets—Sheet 4.



WITNESSES:

*Geordie M. Kelly*  
*Sidney M. Munn*

INVENTOR

*Edward Hett*

BY

*Kenyon & Kenyon*  
[ATTORNEYS]







No. 637,555.

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E. HETT.

ART OF MAKING PRINTING SURFACES.

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(No Model.)

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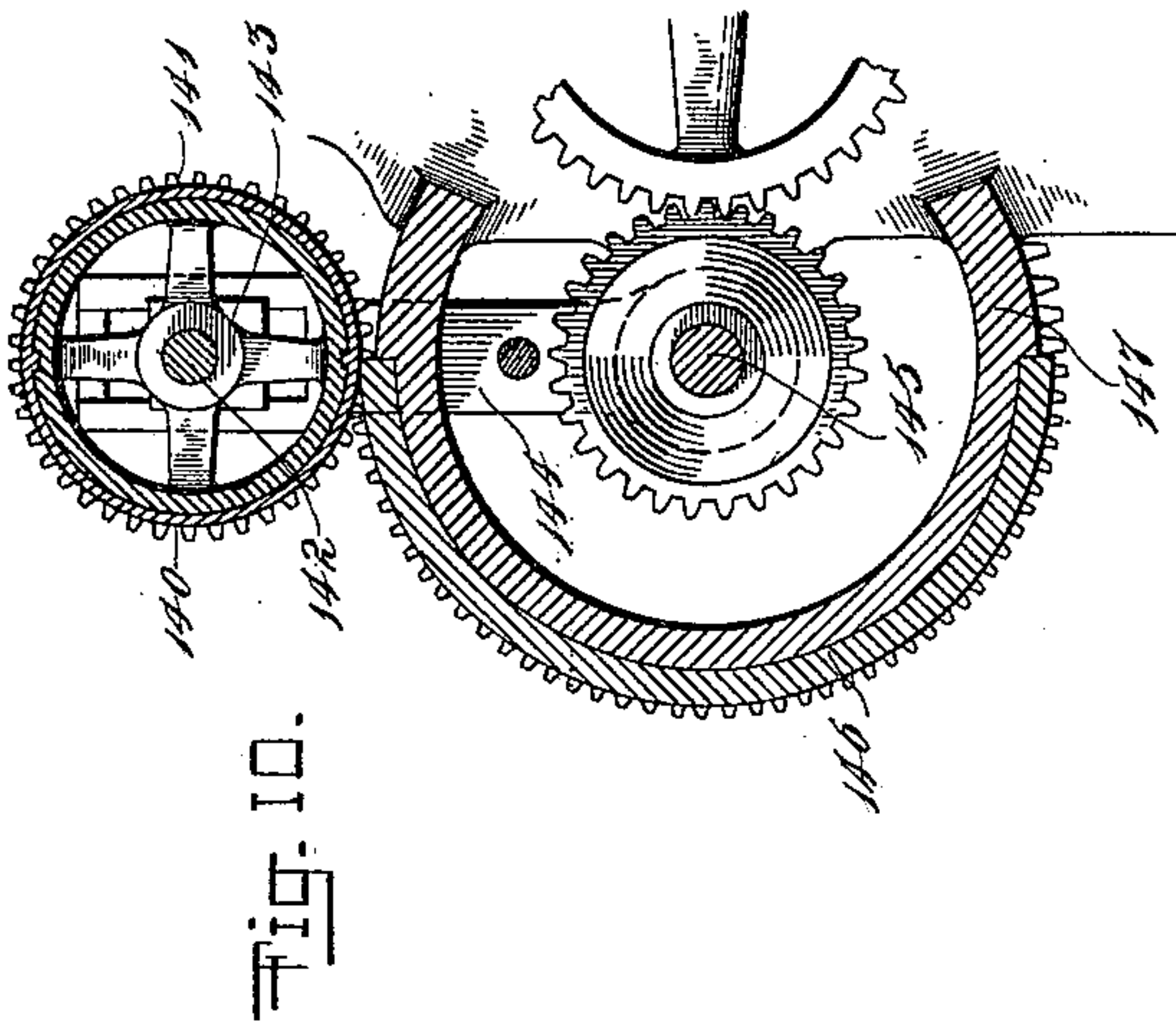


Fig. 10.

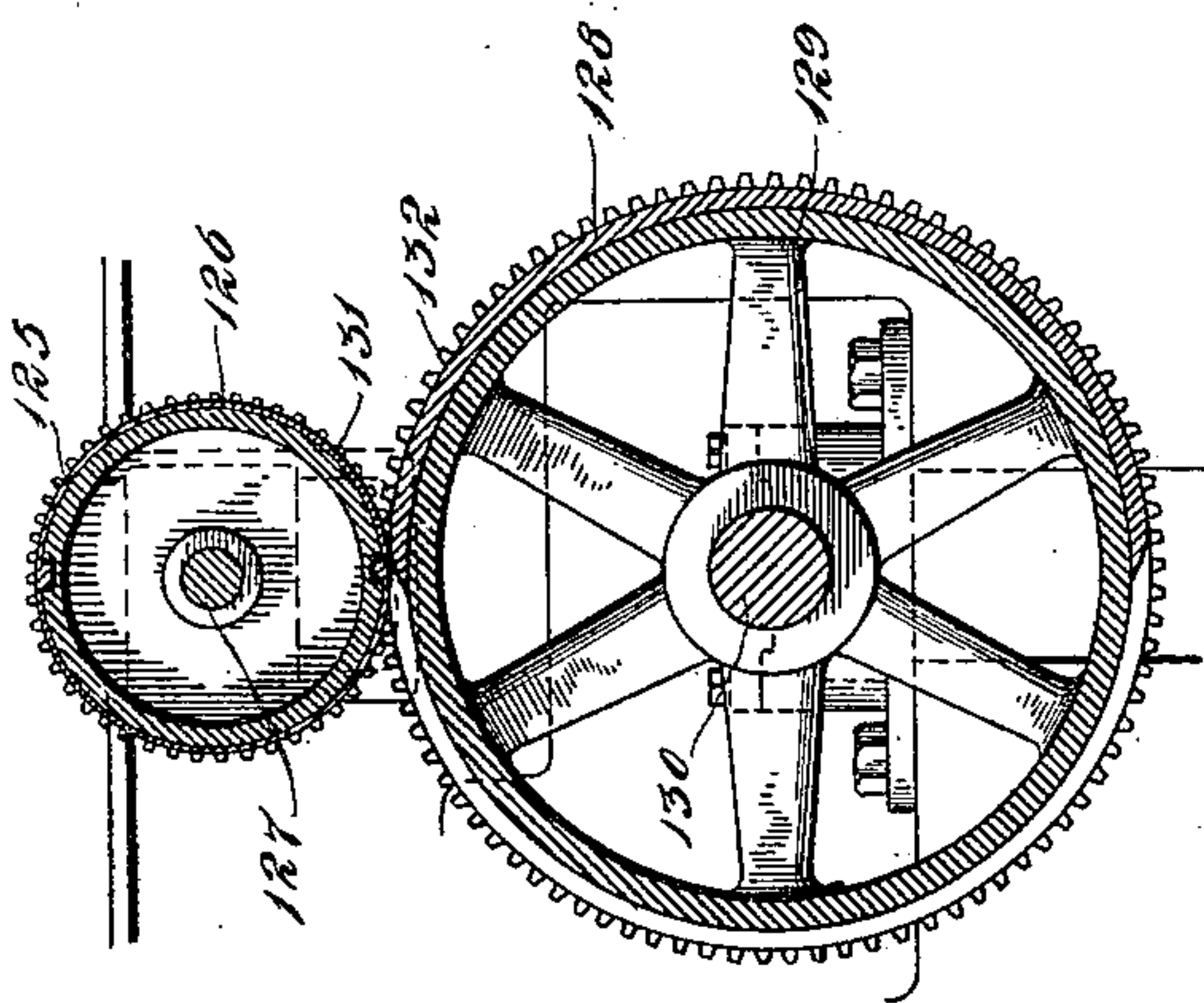


Fig. 8.

WITNESSES:

*Geoff. Milligan*  
*Sidney D. Mann*

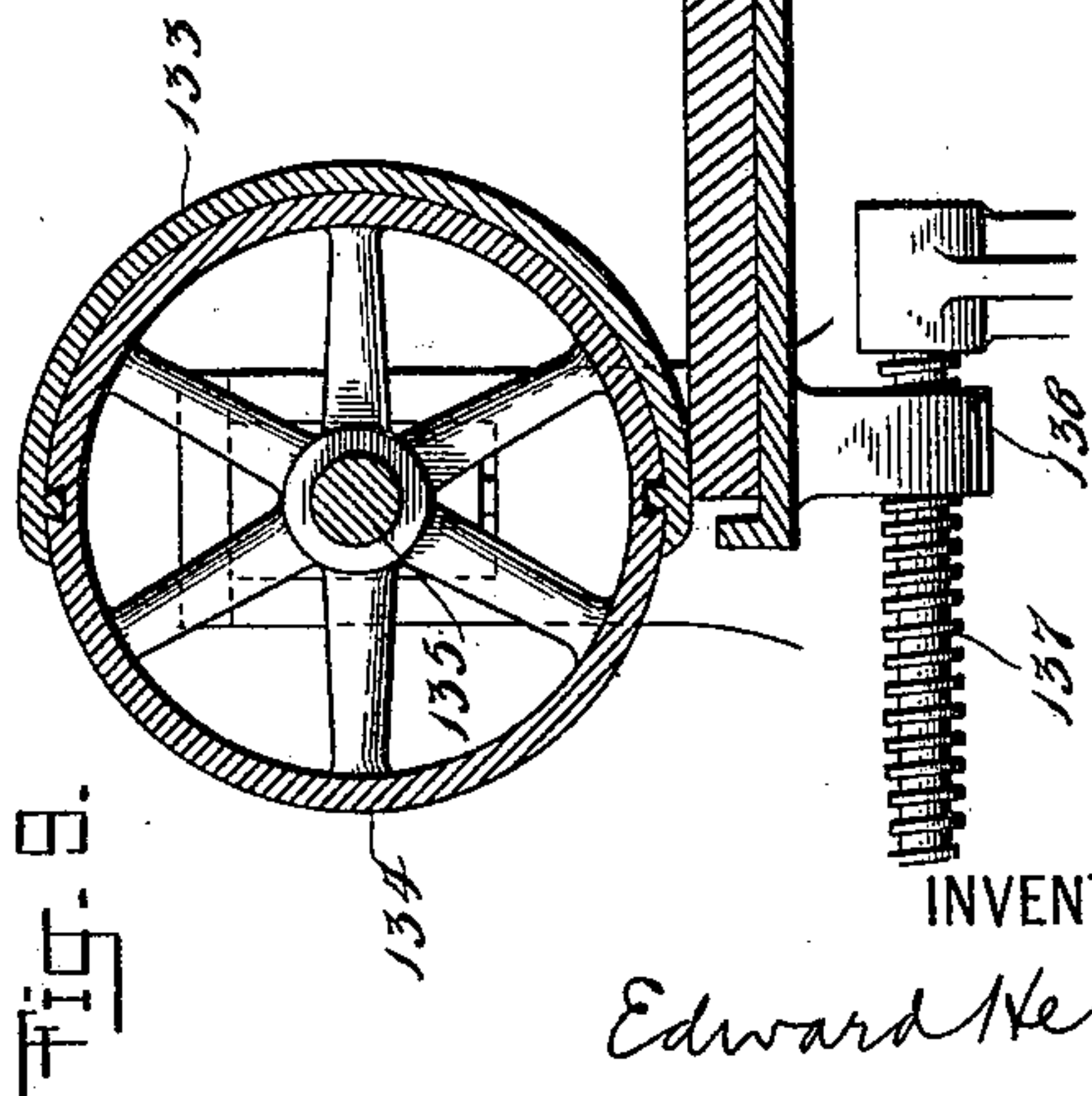


Fig. 9.

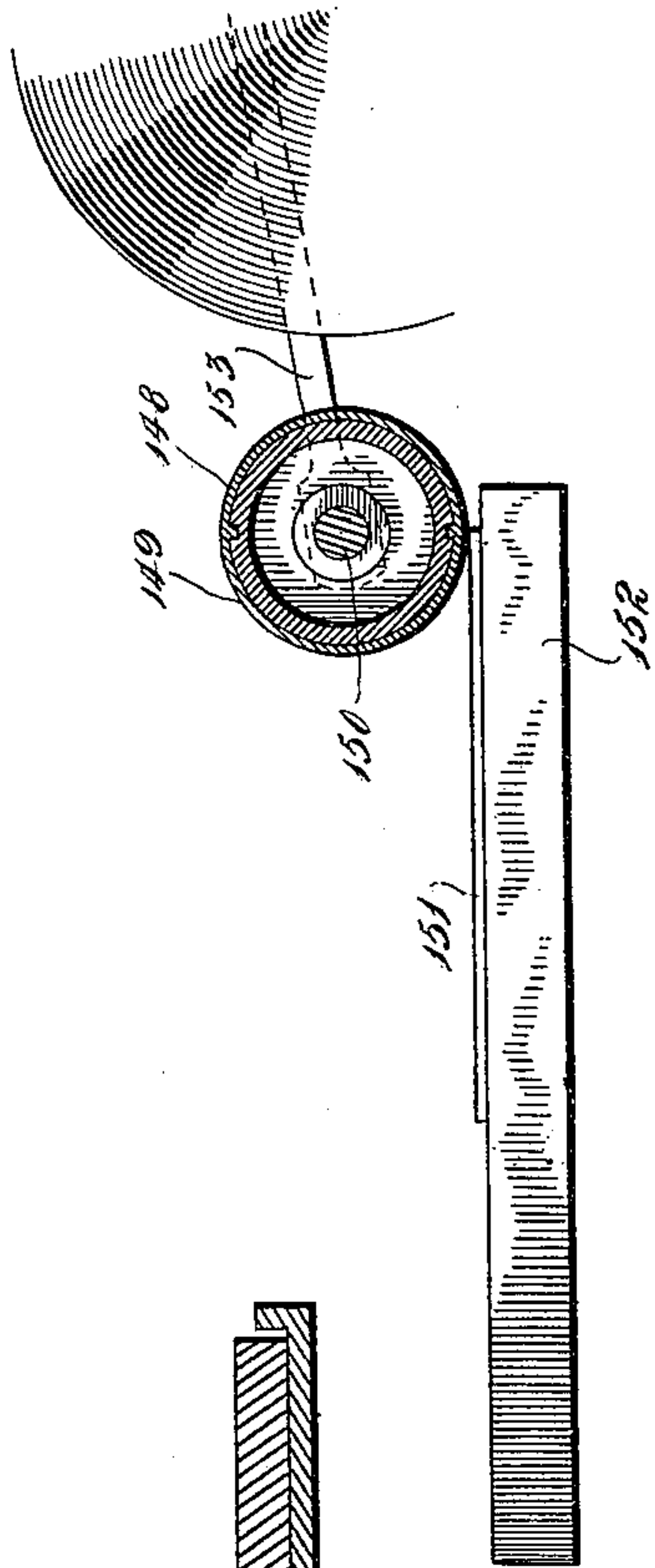


Fig. 11.

INVENTOR

*Edward Hett*

BY

*Kerrison & Kerrison*  
ATTORNEYS

No. 637,555.

Patented Nov. 21, 1899.

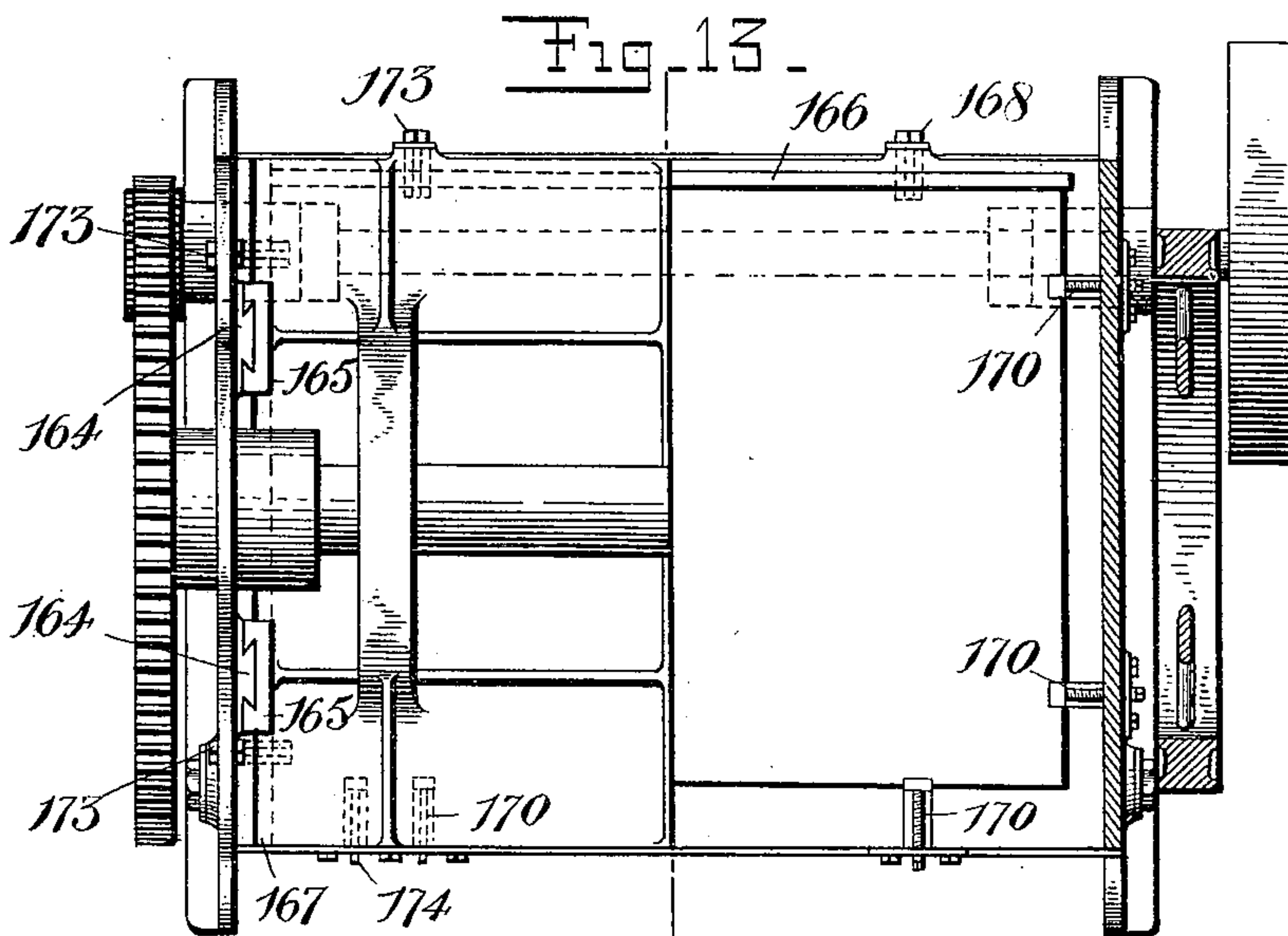
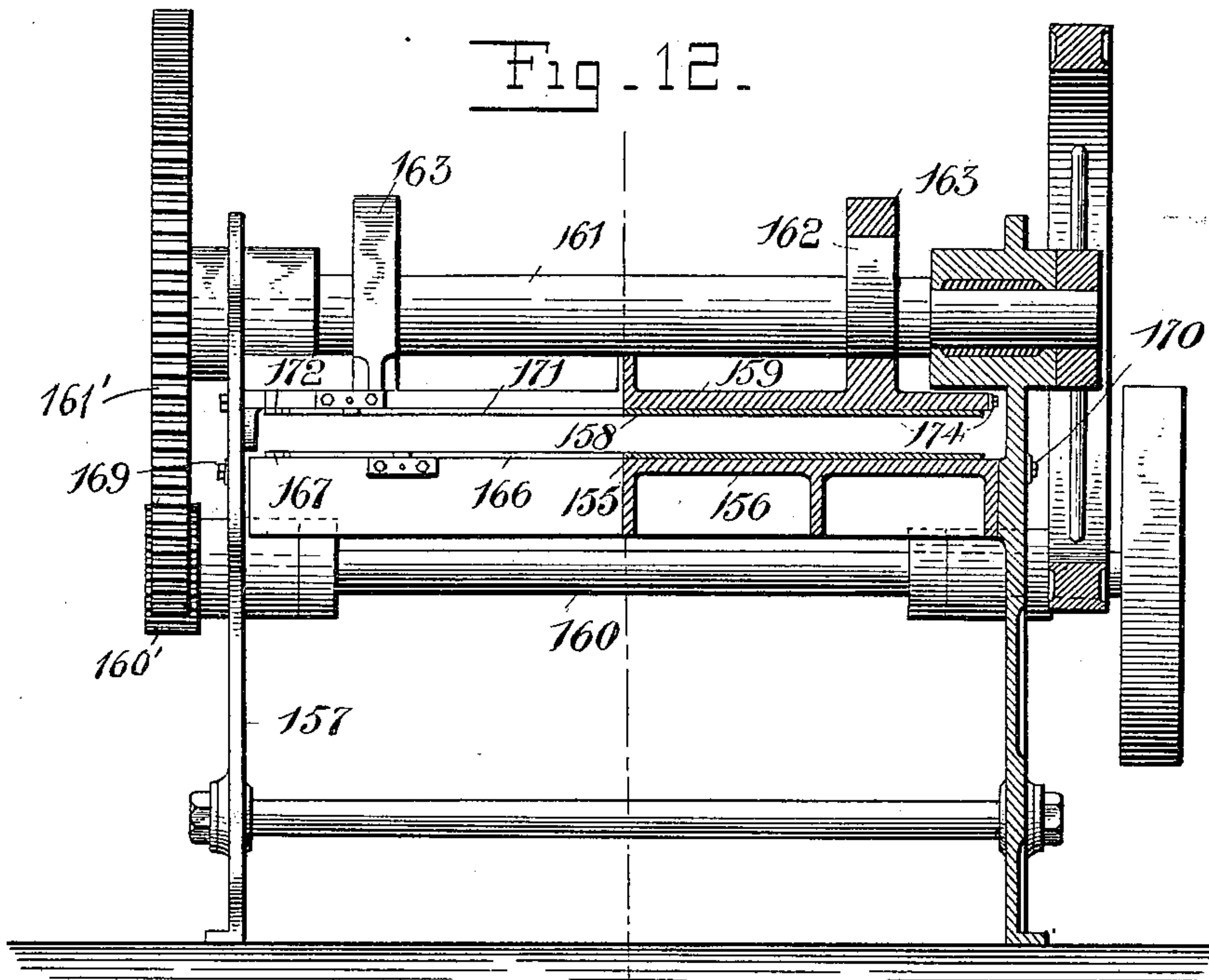
E. HETT.

ART OF MAKING PRINTING SURFACES.

(Application filed Jan. 23, 1899.)

(No Model.)

7 Sheets—Sheet 7



WITNESSES:

*Frederick M. Hill*  
*Sidney M. Hill*

INVENTOR

*Edward Hett*

BY

*Kerny & Kerny*  
ATTORNEYS



# UNITED STATES PATENT OFFICE.

EDWARD HETT, OF NEW YORK, N. Y.

## ART OF MAKING PRINTING-SURFACES.

SPECIFICATION forming part of Letters Patent No. 637,555, dated November 21, 1899.

Application filed January 23, 1899. Serial No. 703,082. (No model.)

*To all whom it may concern:*

Be it known that I, EDWARD HETT, a citizen of the United States, and a resident of New York, (New Dorp,) in the county of Richmond and State of New York, have invented certain new and useful Improvements in the Art of Making Printing-Surfaces, of which the following is a specification.

This invention relates to a new and useful improvement in the art of making printing-surfaces suitable for planographic, relief, intaglio, or other printing.

In the lithographic art, to which my invention was in its inception largely directed, it has been the universal practice to transfer designs to printing-forms without regard in the transferring to ultimate register in the printing, leaving register to be attained subsequently and empirically in the printing-press, and, moreover, it has been the general and almost universal practice to print from flat surfaces. Although the advantages of accurate transferring with regard to subsequent automatic register in the printing are manifest, and especially in connection with simultaneous multicolor-printing, no effort seems to have been made in that direction, and although the advantages of printing from curved or cylindrical surfaces have long been recognized and persistent and strenuous efforts have been made for many years to practically utilize such curved or cylindrical surfaces yet the difficulties have been so many and their solution so troublesome that prior to my invention, as from the inception of the art, lithographic printing has been carried on practically almost entirely by means of flat surfaces.

Among the many difficulties of the problem of using curved or cylindrical printing-surfaces have been those connected with that part of the art of making the printing-surface which involves the art of transferring the design to the printing-form, whereby the printing-form may by subsequent development be made suitable for printing that design. It is this branch of the art of making printing-surfaces to which the present invention is more particularly addressed.

This application is confined to the improvements which I have effected with reference to the making of a printing surface or sur-

faces, and more particularly to transferring or imparting a design to a printing-form, whereby the printing-surface, and especially a curved or cylindrical printing-surface, may be made, so as to be suitable for printing.

In the old art the method of transferring upon flat printing-forms has ordinarily been carried on in the following manner: The design to be transferred is first printed upon suitable transfer-paper without special or necessary regard to its position on that paper. The transfer-paper is then dampened and is stuck up, design side up, on a suitable setting-up plate, usually a flat sheet of zinc, and is so stuck up without special or necessary regard to its accurate position on that setting-up plate. The setting-up plate, with the transfer-paper carrying the design-face upon it, is then turned upside down and placed on the top of the prepared surface of the lithographic stone, (the face of the design on the transfer-paper thus contacting with the face of the stone,) but this without special or necessary regard to its exact position on the stone. A scraper is then passed over the back of the setting-up plate on top from end to end, applying pressure to the whole surface. The setting-up plate is then lifted and the dampened transfer-paper is found turned over face down onto the stone. More pressure is applied to drive the last remnants of the ink of the design out of the transfer-paper and into the stone, and the transfer-paper is then soaked off, the ink remaining in the stone, and the stone is then developed, as by etching, and so becomes a printing-surface suitable for printing. In the same way all the other printing-surfaces of a series having the component designs intended to register in printing are prepared for the other colors to be especially printed, there being no special or necessary accurate predetermined relation between the position of the design as a whole for one color on its setting-up plate and the position of the design as a whole for the other colors or any of them upon their respective setting-up plates, and no special or necessary accurate predetermined relation between the relative positions of one setting-up plate and its stone while so turning over its design and the relative positions of another setting-up plate and its stone while turning over its de-



sign, and no special or necessary accurate predetermined relation between the positions of the several designs as a whole on the several stones after they are turned over. All that is necessary is that the component designs which as they come from the designer are so drawn as to be capable of ultimately registering in the printing shall not be distorted in shape, but shall be kept accurately intact as a whole in the process of transferring. In the printing-press the colors are printed separately, one at a time, upon the entire edition of prints. When the first color has been printed, the stone for printing the second color is empirically and painstakingly adjusted to and fro in the press or the paper-feeding devices are so adjusted, or both, until the printer succeeds in hitting the exact register—that is, succeeds in printing the second color exactly over the first, as intended by the design—when the printing proceeds. Thus each stone is first adjusted to register and then it prints. Thus register is left entirely to the printing department, where it is obtained only by empirical adjustment in the printing-press. It frequently happens in practice that many designs are for the sake of economy to be grouped on one printing-surface. In such case the grouping is achieved in the sticking up on the setting-up plate, and where that is to be done with component designs in multicolor work the grouping on one setting-up plate for one color must, of course, be identical with the grouping on every other setting-up plate of the series for the other colors of the series, and the workman takes accurate pains to that end; but the positions of the combined groups—that is to say, the positions of the grouped designs as a whole—do not have and need not have accurate predetermined relation or identity on their respective surfaces, and in all essential respects the procedure is as set out above. Accordingly the transfer mechanisms or printing-forms heretofore in use are entirely unprovided with any guiding means or pre-established guides with reference to which the printing-forms and setting-up plates may be accurately adjusted therein in exact and predetermined positions both longitudinally and transversely or any guiding means with reference to which a printing-form and a setting-up plate may be brought into exact and predetermined coöperating relation both longitudinally and transversely. Such guiding means are not required and would have no advantage in transfer-presses employed in accordance with the old practice.

In the case of flat printing-surfaces, heretofore in general use in lithography, their empirical adjustment in the press for register may, though at great labor and expense, be perfected with certainty, because being flat they may be turned and moved in all directions, and all that is necessary in the transferring is that, however placed as a whole on

the printing-form, the designs be not distorted one part with respect to another in such placing.

In the case of a permanently curved or cylindrical printing-surface, however, the conditions are quite different. They cannot be moved in all directions in the press—for example, they cannot be moved obliquely, and hence cannot always be empirically adjusted so as to bring the designs into register, even though those designs have not been distorted at all in the transferring. The difficulty of securing register with curved or cylindrical printing-surfaces in accordance with the prevalent practice of empirical adjustment in the printing-press is thus apparent and has been largely influential in the continuance of the use of flat printing-surfaces. Sheet-metal printing-surfaces, such as zinc sheets, have been bent around rotary form-supports, and thus used in a printing-press to a very limited extent; but in such cases the sheet is laid out flat when its design is transferred or imparted to it and the transferring is carried out in the same manner and with the same disregard of any accurate predetermined positioning of the design on the sheet as has been described with reference to flat lithographic stones. The sheet is then stretched on its rotary curved-form support and empirically adjusted in the same way as a flat stone. There have been one or two attempts made to solve the difficult problem of empirically securing in the printing-press accurate register of curved or cylindrical printing-surfaces; but so far as I am aware they have not been practically successful, so that to-day in the practical art of lithography flat printing-surfaces are almost exclusively used, and this notwithstanding the universally-recognized advantages that would attend the use of curved or cylindrical printing-surfaces if they could be made practical.

In accordance with the present invention I am enabled to make printing-surfaces and curved or cylindrical printing-surfaces adapted to register and which may be mounted in a press and made to print immediately in accurate register and without the usual empirical adjustment in the press. The printing-surfaces may be said to automatically register. This important result is effected in the process of making the printing-surfaces themselves, and that process proceeds by the making of registering basic surfaces and results in the production of registering printing-surfaces as distinguished from non-registering printing-surfaces produced by the old process. Moreover, my invention in certain of its broad features may be carried out both with curved or cylindrical printing-forms and also with flat printing-forms, and in certain other of its broadest features is not limited to the attainment of register, but includes also a new method of imparting the designs of the basic surface to the printing-form, wherein rolling



contact is employed in this operation instead of the flat surface-scraping contact heretofore employed.

This invention consists, generically speaking, in the process of preparing a non-expansible and non-contractible basic surface having a design fixed thereto, so that the design is rendered non-expansible and non-contractible, and then bringing said basic surface into positive rolling contact with a suitable printing-form, so that one of said bodies rolls in progressive contact with the other, whereby the design may be imparted to the printing-form. The printing-form is subsequently developed in a suitable manner, so as to be capable of printing, and is then a "printing-surface," as herein termed.

The basic surface may be made in any convenient manner, so as to be capable of imparting by contact the design to the printing-form, and the printing-form may be made of any suitable material. One of these bodies must, and either or both may, be curved in form, so as to make possible the rolling contact, which may be effected in various ways and by various movements of the printing-surface or basic surface, or both. In carrying out this part of the invention a non-expansible and non-contractible basic surface is suitably prepared and preferably prepared by fixing upon a transfer-base a design capable of being imparted by contact—as, for example, by sticking up in the usual manner a transfer sheet or sheets upon a setting-up plate. A printing-form is then brought into positive rolling contact with the basic surface, so that one of said bodies, at least, rolls with the other in progressive contact. This contact must be positive—i. e., entirely free from all slipping of one surface upon the other. By means of this rolling contact the design of the basic surface is positively and accurately and according to the position of the design and all its parts on the basic surface imparted to the printing-form. This part of the invention is susceptible of being carried out with perfect accuracy and despatch, and enables me to accurately and speedily make not only flat, but also curved or cylindrical printing-surfaces. Further details will hereinafter appear in connection with the mechanism to be presently described.

The invention also consists, generically speaking, in preparing a basic surface of any suitable character having a design adapted to be imparted by contact, bringing said basic surface and a printing-form into suitable contact of any character, whether rolling or otherwise, in accurate predetermined coöperating relation both longitudinally and transversely and with reference to suitable preestablished guides or guiding means whereby the design may be imparted to the printing-form in accurate predetermined position. By the use of such guiding means or preestablished guides, which may vary widely in character and arrangement, the design

may be located on a printing-form in an exact and predetermined position both longitudinally and transversely and also with reference to register, and from a series of basic surfaces having component designs a series of registering printing-surfaces may be readily and accurately made. These basic surfaces are so prepared as to the arrangement of their designs that if they could be used themselves as printing-surfaces they would be capable of printing registering impressions.

In the accompanying drawings, forming part of this specification, I have shown a complete machine embodying in a preferred form the various mechanical features which are made the subject of a separate application and capable of efficiently carrying out the various steps of the process above described. Said application was filed by me on the 4th day of October, 1899, Serial No. 732,437, as a division of the present application and made necessary under a new rule of the Patent Office. I have also shown several modified forms of mechanism in diagram in connection with which the process may be carried out.

The various features of the process will be made clear by the following description of mechanism preferably employed in carrying out the process.

Referring now to the various views, in which like numerals of reference indicate corresponding parts throughout, Figure 1 is a side elevation of the machine. Fig. 2 is a central longitudinal section of the same. Fig. 3 is an enlarged detail view of the cam-and-ratchet mechanism for operating certain of the ink-rollers and the dampening-rollers. Fig. 4 is a broken plan view of the machine. Fig. 5 is a sectional end view looking from the rear. Fig. 6 is a cross-section on the line 6 6 of Fig. 1, and Fig. 7 is a detail sectional plan on the line 7 7 of Fig. 6. Figs. 8, 9, 10, 11, 12, and 13 show modified forms of mechanism, in Figs. 8, 9, 10, and 11 of which the printing-form and the basic surface are brought together in rolling contact and in Figs. 12 and 13 of which the basic surface and printing-form are brought together in whole surface contact.

Referring now to the mechanism shown in Figs. 1 to 7, inclusive, the machine is provided with a suitable and substantial frame 10, which may be of any approved design, and on this is a bed or support 11, having thereon a removable basic surface, preferably including a zinc or equivalent setting-up plate or transfer-base 11<sup>a</sup>, having fixed thereto the design to be imparted or transferred to the printing-form. The transfer-base is non-expansible and non-contractible, so that the design fixed thereon is also non-expansible and non-contractible under the pressure of the printing-form, and thus the design without being distorted may be imparted to the printing-form. The transfer-base is generally of such thickness as to form a rigid body, as shown. It is located on and held to the bed



by screws 11<sup>b</sup> or by other suitable fastenings. These screws, four in number, pass through holes made for them in the margin of the setting-up plate or transfer-base and enter corresponding holes tapped in the margin of the support 11. These holes are all accurately located with reference to the precise position which it has been previously determined the basic surface shall occupy in the press. These devices it will be seen afford one form of guiding means with reference to which the basic surface and successive basic surfaces may be accurately and positively located in a predetermined position or preestablished seat in the transfer-press and on its support 11 and in the same identically-preestablished seat. Any other form of means convenient for this purpose might be employed. The bed or support is preferably flat. It reciprocates horizontally, as shown, and for this purpose may be held in any suitable slide-way; but it is preferably arranged, as clearly shown in Fig. 6, with depending longitudinal ribs 12, which are approximately triangular in cross-section and which slide in grooved rails or ways 13 on the frame 10.

The bed has a depending fixed nut 14, (see Fig. 2,) which engages a screw 15, which is journaled in suitable bearings 16 and extends longitudinally of the machine, this screw being adapted, therefore, by its rotation first in one direction and then in another to move the bed backward and forward, and to enable the screw to be turned it has at one end a gear-wheel 17, meshing with a gear-wheel 18, which is journaled on one end of the machine-frame and is provided with a friction-cone 19, adapted to engage and be driven by a cone 20, which is connected with a similar cone 20<sup>a</sup> of opposite pitch by means of a sleeve 21, which is grooved in the customary manner to engage a shifting fork 22 on one end of the horizontally-tilting lever 23, which is arranged beneath the bed 11, is fulcrumed, as shown at 24, and connects by a rod 25 with a lever 26 at one side of the machine, this latter lever being preferably arranged in a vertical position and pivoted at its lower end, as shown at 27. It will be seen, then, that by simply moving the lever 26 the screw 15 may be thrown into and out of gear, and it will of course be understood that any suitable gears may be substituted for the friction-cones illustrated.

The cones 20 and 22<sup>a</sup> are keyed to slide on a driving-shaft 28, which is journaled in suitable bearings and extends transversely across one end of the machine, the bearing-shaft having preferably a fly-wheel 29 thereon to insure steadiness of movement, and it is driven by a suitable motor, so that to reverse the direction of the bed 11 the motor is reversed.

When the cone 20<sup>a</sup> is moved away from the cone 19, it engages a cone 30 on a shaft 31, which extends longitudinally beneath the press, and when the connection just described

is made the machine is in gear to turn the printing cylinder or surface, as hereinafter described. The shaft 31 has at its inner end a beveled gear-wheel 32, meshing with a beveled gear-wheel 33, (see Fig. 6,) the latter gear-wheel being secured to a transverse counter-shaft 34 in the main frame 10, and on this shaft is a gear-wheel 35, which connects, by means of an intermediate gear-wheel 36, with a gear-wheel 37 on the shaft 38, which carries the printing surface or cylinder 39.

41 is a printing-form carried by the support 40 and from which it is preferably removable. In its best form the printing-form is continuous and cylindrical and tubular in form, the support 40 being in the form of a hollow barrel or body removably fixed on the shaft 38. The printing-form 41 is shell-like, as shown, and 39 are ribs formed on the under side of the printing-form and adapted to enter corresponding recesses in the support 40, a marked rib in a marked recess, when a printing-form is slipped onto its support. The supporting-cylinder 40 is provided with a circumferential shoulder 40<sup>a</sup> near one end, against which the printing-form is adapted to accurately fit. When the printing-form is slipped on to the cylinder, the ribs 39 enter their proper recesses. The printing-form is forced snugly against the shoulder 40<sup>a</sup> by means of the removable gear 59, carried on the opposite end of the support 40, and which is made to press against the printing-form by means of the screws 59<sup>a</sup>. The shoulder 40<sup>a</sup> and the ribs 39 and their corresponding grooves in the support afford convenient guiding means with reference to which the printing-surface and successive printing-surfaces may be accurately and positively located on their support in a predetermined position or seat and always in identically the same predetermined position or seat. Any other form of means convenient for this purpose might of course be employed.

In order to avoid the usual empiric adjustment of the printing-surface in the printing-press, the printing-form is so constructed and designed as to fit in the printing-press in a predetermined operating position or preestablished seat, so that when working in the printing-press it will print its impression accurately in the position required. Thus when a series of printing-forms constructed and designed to fit in the printing-press in predetermined operating positions have been made into registering printing-surfaces they may be mounted in a printing-press and be made to print in accurate register without the delays and uncertainties incident to the usual empiric adjustment of the printing-surfaces in the printing-press. In the case of the printing-form 41 (shown in the drawings) the printing-form may be removed from its support 40 and slipped onto a similar support mounted in the printing-press, a marked rib of the printing-form entering a marked recess of the support, and thus be brought into



its predetermined operating position in the printing-press, or the support 40, with the printing-form 41 thereon, may be removed from its shaft 38 and mounted on a shaft of the printing-press constructed to receive it in a predetermined position, or the shaft 38, with the support 40 and printing-form 41 thereon, may be removed from the transfer-press and mounted in a predetermined position prepared for it in the printing-press. In all of these cases the printing-form is constructed and designed to fit in a predetermined operating position or preestablished seat in the printing-press.

When the printing-form 41 is in active co-operation with the basic form, the printing-surface is lowered into contact with the basic form; but when the printing-surface is being subsequently developed into a printing-surface, as by being etched, dampened, inked, or otherwise operated on, it is raised out of contact with the basic surface, as hereinafter described, and the gear connections referred to, in conjunction with the mechanism to be now described, enable the cylinder 40, with its printing-form, to be turned or revolved or driven when out of contact with the basic surface.

The shaft 38, which carries the cylinder 40, is movable up and down, as presently described, and it connects with the shaft 34 by means of a chain of links 42 and 43, the upper link having at its upper end a fork 44, which straddles the shaft 38, to which it is held by a pin 45; but any other suitable coupling may be substituted for the fork and pin. The gear-wheel 36 is carried on the pivot which connects the two links referred to, and hence when the shaft 38 is raised so as to lift the printing form or cylinder 39 above the bed 11 the gear 36 swings inward with the levers and keeps in mesh with the gear-wheels 35 and 37, and so the power is transmitted to the printing form or cylinder from the shaft 34 independently of whether the said cylinder is in its raised or in its lowered position.

In order that the printing-cylinder may be conveniently raised, its shaft 38 is journaled in vertically-movable slide-blocks 46, which are held in slideways 46<sup>a</sup>, (see Fig. 4,) and the blocks have outwardly-extending lugs 47, which are secured to pressure bars or rods 48 by means of nuts 49, which are screwed on the pressure-rods above and below the lugs, and the said pressure-rods at their lower ends are formed into slides 50, which are dovetailed into slideways 51 on the frame 10, as shown best in Fig. 7.

The slides 50 have in them vertically-elongated holes 52 to receive the cross-shaft 53, which is journaled in the frame 10, (see Fig. 6,) and on one end of which is secured the lever 54, which has an extension or link 55 at its lower end, to which is pivoted a link 56, and the latter is secured by a screw 57 to one of the slides 50, while the opposite slide is connected by a link and screw 56 and 57 to a

crank or link 58 on the other end of the shaft 53, and thus when the lever 54 is tilted the slides 50 are raised or lowered, the slide-blocks 46 similarly moved, and a corresponding movement given to the shaft 38 and the supporting-cylinder which it carries, and the leverage and power increase in lowering as the contact of the printing-form with the basic surface is attained, and thus the desired pressure of contact may be obtained.

The mechanism above described operates to turn or rotate the cylinder 40 independently of the bed or support 11. When the printing-form is brought into firm operative contact with the basic surface and the latter is moved by its screw, the cylinder 40 rotates and the printing-form 41 and basic surface cooperate in positive and rolling contact, the printing-form rolling upon the basic surface in progressive contact, and the basic surface thereby positively and at once accurately, according to the position of the design and all its parts upon it, imparting said design to the printing-form. If the contact of the printing-form and the basic surface is accompanied with sufficient pressure and the rotation of the cylinder 40 is sufficiently free from friction, and this is generally the case, the printing-form and basic surface will work together in positive contact without slipping on account of the friction due to their contact. I may, however, provide special means which will cooperate to prevent slipping and will therefore work for the attainment of the positive contact desired. For this purpose I have shown intermeshing gearing for the printing-form and basic surface. In the drawings this intermeshing gearing comprises the two gear-wheels 59, firmly but removably fixed to the opposite end of the cylinder 40, and the two racks 60, fixed to the support 11. One of these gear-wheels and its rack may be omitted, if desired, or both may be omitted, as stated above. When these intermeshing gears are used, it is important that they be made to fit with such accuracy as will enable the contacting bodies to move together without slipping.

In order that a basic surface and a printing-form or successive basic surfaces and successive printing-forms, having been suitably mounted in the machine, may be accurately and positively brought into a predetermined cooperating relation both longitudinally and transversely, I provide suitable guiding means or preestablished guides with reference to which said bodies may be brought into the relation desired. These guiding means may vary widely in form and arrangement. By their use the location of the design or designs of the printing-surface or printing-surfaces may be controlled with precision and despatch and the designs on a series of printing-surfaces intended to cooperate in printing may be so located that said surfaces will be registering printing-surfaces. I may make use of this intermeshing gearing in providing such



guiding means, and for this purpose I mark a tooth and a recess of the intermeshing gear, so that this tooth and recess may be first brought into engagement when the printing-form and basic surface are first brought into contact. However, any other form of means might be employed and whether the intermeshing gear is used or not.

From the above description it will be seen that by placing the cone 20 in engagement with the cone 19 and depressing the printing form or cylinder the latter will be driven in absolute unison with the support 11, while by throwing the cone 20<sup>a</sup> into engagement with the cone 30 the screw and bed are necessarily thrown out of gear and the printing form or cylinder is turned independently of the bed and independently of whether it is raised by the lever mechanism described or not.

The ink is supplied to the printing form or cylinder 39 from a fountain 61, (see Fig. 2,) which will not be described in detail, as any suitable fountain will do, and in the mouth of the fountain is an ink-feeding roller 62, which is adapted to discharge intermittently on the vibrating or ductor roller 63, which vibrates between the ink-feeding roller 62 and the main ink-distributing roller 64, so as to apply the ink to the latter roller in sufficient but controlled quantities.

The shaft 65 of the ink-feeding roller 62 has a ratchet-wheel 66 thereon which is engaged by a spring-pawl 67, which projects from an eccentric-strap 68 on an eccentric 69, secured to the shaft 70 of the main ink-distributing roller 64. The rotation of the shaft 70 will therefore cause the pawl 67 to be moved backward and forward, so as to turn the ratchet-wheel 66, the shaft 65, and the ink-feeding roller 62. The said shaft 65 is also provided with a ratchet-wheel 71, (see Fig. 6,) opposite which is a loose arm 72, carrying a pawl 73 to engage the ratchet-wheel 71 and enable the shaft and roller to be turned by hand; but the hand mechanism just referred to is old and the automatic turning device, comprising the pawl 67 and accessories, is like similar mechanism shown in my application for Letters Patent of the United States for a printing-press, No. 518,015, filed July 19, 1894, and renewed under date of May 27, 1899, Serial No. 718,570.

The shaft 70 is journaled in the frame 10 and has near opposite ends grooved cam-wheels 74, in the grooves of which run rollers 75, which are journaled on the slides 76, which move in slideways 77 on the frame 10, (see Figs. 2, 3, and 6,) and the slides 76 carry the shaft 78 of the vibrating or ductor inking-roller 63, and consequently as the shaft 70 rotates the slides 76 are reciprocated in the slideways 77 and the vibrating or ductor roller 63 is moved back and forth between the roller 62 and the main ink-distributing roller 64. The cam-wheels 74 have also surface cams 79, (see Fig. 3,) which contact with

the upper arms 81 of bell-cranks 80, which are journaled on the frame 10 and have their lower ends 82 curved slightly and extending into contact with the lugs 83 of the arms 84, which are pivoted, as shown at 85, on opposite sides of the machine, and the arms 84 carry the shaft 86 of the water-supply or fountain roller 87, which, together with the arm 84, is normally pulled back, as shown in Fig. 2, by springs 88, which are secured to the arms 84 and to suitable studs 89 on the machine-frame.

The water-supply fountain may be of any desired construction, but is preferably constructed as a roller 87, as shown in Fig. 5, having concentric tubes 90 and 91, which have perforations 92, adapted to register or to be brought out of register with each other, and therefore one tube is movable in relation to the other; but I have shown no mechanism for moving the tubes, as I do not claim the specific features of the roller in this application, such features being claimed in an application for United States patent for a device for distributing water, filed November 28, 1894, Serial No. 530,220, and renewed under date of July 12, 1898, Serial No. 685,765. The outer tube 91 is covered by layers 93 and 94 of felt, cloth, or other absorbent material, so that the water which issues through the perforations will cause the roller to have an evenly-wet surface. It will be seen that the various ink and water rollers receive their movement from the shaft 70 of the main ink-distributing roller. The latter has at one end a beveled gear 95, meshing with a gear-wheel 96 on the shaft 97, which is journaled in suitable supports 98 on the side of the frame 10 and extends in a nearly vertical position, the lower end of the shaft having a gear-wheel 99, meshing with a gear-wheel 100 on the shaft 34, which is driven in the manner heretofore described.

The water from the water-supply fountain or roller 87 is applied to the printing form or cylinder 39 by means of the dampening-rollers 101, which are adapted to contact with the said cylinder and which have the water delivered to them and distributed on them by a roller 103, the said dampening-rollers and the roller 103 being journaled in a swinging frame 102, which is journaled on a cross-bar 104, (see Fig. 2,) and the roller 103 is adapted to contact with the water-supply fountain or roller 87, so as to receive its water from the said fountain-roller. The swinging frame 102 has teeth 105 at its lower ends which engage cog-wheels 106 on a shaft 107, which is journaled in the frame 10 and has at one end a hand-wheel 108, by which the shaft may be turned and the swinging frame 102 moved, and thus the dampening-rollers may be moved in relation to the printing form or cylinder and so placed under the complete and easy control of the operator.

The watering mechanism is very similar to that shown in my former application referred



to above, and the inking mechanism is also similar, and the ink-distributing rollers are in the chain carried by the swinging frame 109, which is centered on the shaft 70 of the main ink-distributing roller 64, this swinging frame having at its inner ends racks 110, which mesh with cog-wheels 111 on a shaft 112, which is journaled in the main frame 10 and has thereon a hand-wheel 113, which on being turned turns the shaft and the cog-wheel 111 and moves the swinging frame 109, so that the said frame and the rollers which it carries may be turned up easily to the position shown by dotted lines in Fig. 2, thus making it easy to get at the printing form or cylinder 39 and remove it when necessary.

The swinging frame 109 is strengthened by a suitable cross-bar 114 and also stiffened by the several rollers which it carries and which are adapted to apply the ink to the printing form or cylinder, and these rollers are preferably arranged as shown in the drawings, where the upper leather-covered roller 115 takes the ink from the roller 64 and delivers it upon a metal roller 116, which delivers upon the two leather-covered rollers 117, which are adapted to contact with the printing-cylinder, and on one of these rides a metal roller 118, which delivers to the leather-covered roller 119, this being also adapted to contact with the printing-cylinder. Behind the main ink-distributing roller 64 and bearing on it are leather-covered rollers 120 and 121, which cause the ink to be evenly spread on the said main roller.

When the machine of the drawings above described is to be used, the transfer-sheet or transfers or sheets to be turned over or transferred from the basic surface upon or to the printing-form are first stuck up or set up on the setting-up plate 11<sup>a</sup>. This is generally done apart from the press and at the table of the workman, whose duty it is to carefully stick up the transfers in accurate and related positions on the series of basic surfaces. The basic surface thus prepared or made ready is then fastened on the bed-plate or support 11 by the pins 11<sup>b</sup>, which insure the ready and proper positioning of the entire series of basic surfaces and both longitudinally and transversely and always in identically the same place on the bed or support. The printing-form is secured on its support in its proper position, predetermined both longitudinally and transversely, the entire series in identically the same position, and the printing-form and basic surface are then brought into contact in pairs, the lever 54 being moved so as to bring down the printing-form 39 by means of the lever mechanism described so as to apply the desired pressure to said contact, the marked tooth and recess of the intermeshing gearing meshing together so as to bring the printing-form and basic surface into their predetermined cooperating relation, both longitudinally and transversely, all the pairs of the series into identically the same relation,

each as every other and with reference to ultimate register in the printing. Then the cone 20 is thrown into engagement with the cone 19 and the screw 15 thereby started. This carries forward the bed and revolves the cylinder, which, being so revolved, takes up the transfer sheet or sheets having the design or designs from the setting-up plate 11<sup>a</sup>. The transfer-sheets are then subjected to further pressure and are finally soaked off from the cylinder, but the ink remains, as will be understood by those conversant with this line of industry. The revoluble and removable printing form or cylinder is then, if desired, at once developed into a printing-surface. To do this for planographic printing it is first preliminarily etched by being gummed up and dried in the usual way, after which it is washed off with water to remove the gum and, as is usual, is again washed with water and turpentine to remove the ink. The dampening-rollers 101 are then applied to the cylinder, the cylinder being driven by the cones 20<sup>a</sup> and 30 and the chain of gears on the chain of links and the water-supply roller by the main ink-distributing roller shaft, after which the cylinder is properly inked and then resined and then fully etched with dilute acid and washed off and, if necessary, reetched, and the tubular printing-surface is then ready to be used as a planographic-printing surface, which may, if desired, be done in the machine of the drawings, the setting-up plate 11<sup>a</sup> or any similar plate being the impression-surface for that purpose, or it is ready to be removed and applied to any other suitable printing-press, a cylinder-press of the form shown in my application referred to above being suitable for this purpose.

It will of course be understood that when the washing operations, &c., are being performed the bed and the frames 109 and 102 and the dampening and inking rollers are swung out of the way of the printing-cylinder and that the inking and dampening are also done while the cylinder is raised above the track of the bed, the frame 109 in the latter case as well as the frame 102 being of course moved toward the printing-cylinder, so as to bring the inking-rollers and the dampening-rollers into contact with that cylinder.

After the printing surface or cylinder has been developed, as specified, and it is desired to remove it the frames 109 and 102 and the rollers carried thereby are moved out of the way by turning the hand-wheels 113 and 107, the pins 45 are removed from the fork 44, the slide-blocks 46 are uncoupled from the pressure-rods 48, and the cylinder, its shaft, and blocks lifted from the frame 10, when the slide-blocks are slipped off and the printing-tube, with or without the form-cylinder and with or without the shaft, may be transferred to the printing-press in which it is to be used, the designs on it being ready for printing.

The machine of the drawings is as a machine



quite as readily adaptable to the operations of printing from the cylinder 39 onto the plate 11<sup>a</sup> or onto paper carried by it as to the operations of transferring from the plate 11<sup>a</sup> to the cylindrical surface 39, and, indeed, both operations may be involved in the general process of lithographic transferring in multicolor-printing, for the "key" (which may be the design for one of the colors) may be first transferred onto a printing-form, that form developed into a printing-surface, and then a print made from that printing-surface onto a fresh clean setting-up plate properly held in the bed, this print to serve as a guide in setting up the several transfers for the several or the remaining colors on the setting-up plate, so that all may be relatedly transferred onto a series of printing forms or cylinders, and their prints accurately register subsequently in the printing-press.

Some of the details of my improvements are as readily applicable to printing-presses that involve no transferring operations as they are to transfer-presses.

I have used the terms "lithographic" and "lithography" herein not as limited to the use of stone surfaces, as its etymology might imply, but in its ordinary sense in the art, including zinc, aluminium, and kindred surfaces to be etched for printing, where, as in the case of stone, the mutually repugnant and repelling properties of grease and water and the peculiar action of a properly-etched surface with reference to them are made use of to determine the ink distribution and so the picture to be printed.

The term "planographic-printing surface" as herein used means a printing-surface having the design in substantially the same plane as the surface which carries the design, thus distinguishing it from a relief-printing surface in which the design is raised above the plane of the carrying-surface and from an intaglio-printing surface in which the design is depressed below the surface which carries it.

The term "planographic state" as herein used in certain of the claims with reference to the design when imparted to the printing-form means that the design is imparted so as to be substantially in the plane of the surface which receives and supports it as distinguished from a design which is imparted in a relief state or in an intaglio state to the surfaces which receive them.

However, when the basic surface has imparted its design to the printing-form in the way described the printing-form may be developed into a printing-form in any suitable way, as by etching, and in the machine of the drawings or otherwise. It may be lightly etched or it may be deeply etched and routed out, and when completed it may be a planographic, relief, or intaglio or other character of printing-form. When the printing-form is in curved form, it is preferably made continuous and in the form of a cylindrical tube composed of a metallic base, such as copper,

on which is electrolytically deposited a coating of zinc. I may, however, cast the printing-form in the form of a hollow shell or cast a printing-form about a permanent hollow shell, as of copper.

In the organized machine above described I have shown inking and dampening devices forming part of said machine and designed for use in developing the printing-surface after it has received the design from the basic surface. Of course, if desired, the inking and dampening devices may be entirely omitted from this machine and the development of the printing-form be effected apart from the machine in which the basic surface imparts its design to the printing-form.

In Figs. 8, 9, 10, and 11 I have shown several arrangements whereby a printing-form and a basic surface may be brought into rolling contact in accordance with my invention.

In Fig. 8, 125 is a cylindrical printing-form mounted upon a cylindrical support 126, fixed to a rotating shaft 127. The printing-form is in the form of a continuous tube removable from its support 126. 128 is a curved basic surface removably secured to a rotating cylindrical support 29, carried on the shaft 130. When these moving bodies or couples are brought into coöperating contact, the intermeshing gears 131 and 132 come together and the rotation of the shaft 127 or the rotation of the shaft 130 rotates both the printing-form and the basic surface, so that they work together in rolling contact, whereby the designs of the basic surface may be imparted to the printing-form.

In Fig. 9, 133 is a curved basic surface removably secured to the rotating cylinder 134, fixed on the shaft 135. 136 is a flat-stone printing-form arranged to be reciprocated by means of the screw 137, working in the nut 138, fixed to the bed or support 139, which carries the printing-form. The shaft 135 is carried in vertically-movable boxes, whereby the basic surface may be lowered into contact with the printing-form. By operating the screw 137 the basic surface is caused to roll over the printing-form by friction, whereby the design of the basic surface may be imparted to the printing-form. This frictional driving of one body by the other may be employed in various types of machines embodying the invention and to drive a rolling printing-form or a rolling basic surface.

In Fig. 10, 140 is the continuous cylindrical printing-form mounted on and removable from the cylindrical support 141, fixed to the support 142. This shaft is supported in vertically-movable boxes 143, carried by the swinging arms 144, fixed to the shaft 145. 146 is a curved basic surface removably mounted on the fixed curved support 147. When the printing-form is lowered into contact with the basic surface and the shaft 145 is rotated first in one direction and then in the other, the arms 144 carry the printing-form back and forth over the basic surface, so that



the former rolls in contact with the latter. In this case intermeshing gearing is employed for the basic surface and printing-forms.

In Fig. 11, 148 is a continuous cylindrical printing-form mounted on and removable from the cylinder 149, fixed on the shaft 150. 151 is a flat basic surface removably mounted upon the support 152. When the basic surface and printing-form are brought into contact, the arms 153, connected with the ends of the shaft 150, carry the printing-form backward and forward over the basic surface, so that the printing-form rolls by friction in contact with the basic surface, whereby the design of the latter is imparted to the former.

In these various arrangements guiding means are or may be employed with reference to which the printing-form or successive printing-forms may be fixed on their supports always in the same identical predetermined position. Guiding means are or may be employed with reference to which the basic surface and successive basic surfaces and the printing-forms and successive printing-forms may always be mounted on their supports in identically the same predetermined position, and guiding means are or may be employed whereby the basic surfaces and printing-forms may be brought together always in the desired predetermined cooperating relation.

The guiding means or preestablished guides for the printing-forms and basic surfaces in Figs. 8, 9, 10, and 11 may be and preferably are the same or substantially the same as are shown in Figs. 1 to 7, and all the rotating bodies of each transferring-couple shown in Figs. 1 to 11 may be made to rotate by frictional contact with its mate, as in Fig. 9, their intermeshing gears being in such case dispensed with.

In Figs. 12 and 13 are shown in vertical elevation and plan, respectively, and partly in section, a modified form of machine illustrating one of the features of my invention. 155 is a flat basic surface removably mounted on a flat stationary support 156 and secured firmly to the frame 157 of the machine. 158 is a flat printing-form removably mounted on the reciprocating support 159. 160 is the driving-shaft, having a pinion 160', meshing with a gear 161', carried by the eccentric-shaft 161, on which are fixed the eccentrics 162, working in the straps 163, fixed to the support 159. 164 are vertical ribs fixed to the frame of the machine and on which slide the ways 165, fixed to the support 159. By the rotation of the shaft 161 the support 159, with its printing-form, is moved up and down to and from the support 156, upon which is mounted the basic surface 155. When the printing-form and basic surface are brought together in operative contact, they come together throughout the entire area of their surfaces, so that the design of the basic surface is imparted to the printing-form. The support 156 is provided with guiding means with reference to which the basic surface may always be mount-

ed thereon in a positive predetermined position. Such guiding means consists of the flanges or strips 166 and 167, running across one side and end of the support. They are shown as provided, respectively, with the adjusting-screws 168 and 169, whereby they may be adjusted and fixed in the required position. When the basic surface is laid upon its support, it is forced positively and snugly against the strips 166 and 167 and is thus brought into a predetermined position. Screws 170 are employed to force and hold the basic surface into its required predetermined position. Guiding means are likewise provided with reference to which the printing-form may be mounted on its support always in the same predetermined position. Such means consist of the flanges or strips 171 and 172, extending along one side and one end of the support 159. These strips may be adjusted by means of the screws 173. When the printing-form is mounted on its support, it is forced positively and accurately against the strips 171 and 172, so that it is thereby brought into a predetermined position on its support. Screws 174 are employed for the purpose of forcing and holding the printing-form to its required position. The guiding means for the basic surface and the guiding means for the printing-form, it will be seen, enable the operator to bring these surfaces together always in the same predetermined cooperating relation, whereby the design of the basic surface may be imparted to the printing-form in the same predetermined position thereon and with reference to register.

In Figs. 12 and 13 the guiding means with reference to which the basic surface is located always in the same place and both longitudinally and transversely on its support and the guiding means with reference to which the printing-form is located always in the same place and both longitudinally and transversely on its support constitute the guiding means, and all that is necessary to constitute the guiding means with reference to which the basic surface and the printing-form of these figures may be always brought in that machine into the same predetermined cooperating relation both longitudinally and transversely and with reference to register, whereby the design of the basic surface may be imparted to the printing-form in an accurate predetermined position thereon with reference to register.

In connection with the machine shown in Figs. 1 to 7, inclusive, I have shown and described three sets of guiding means, which together constitute in that machine the guiding means whereby the printing-form and the basic surface may be brought into an accurate and predetermined cooperating relation both longitudinally and transversely, or successive printing-forms and basic surfaces may always be brought into the same accurate predetermined cooperating relation both longitudinally and transversely with ref-



erence to register, whereby the design of the basic surface may be imparted to the printing-form in a predetermined position thereon with reference to register. This arises from the fact that the printing-form and basic surface are both removable from and replaceable on their respective seats in said machine, and guiding means are required to accurately seat them in said machine. It also arises from the fact that when said bodies are accurately seated in the machine their cooperating relation is not thereby determined, and further guiding means, which may be the marked tooth and recess of their intermeshing gears, are required to attain this relation. In the machines shown in Figs. 8, 9, 10, and 11 three sets of preestablished guides will of course be also employed for the same purpose and for the same reason.

My invention includes any and all guiding means with reference to which the printing-forms and basic surfaces may be brought together in a predetermined cooperating relation both longitudinally and transversely, whereby the design of a basic surface may be imparted to a printing-form in an accurate predetermined position thereon, and I wish to claim the same broadly. It will be noted that the printing-form and basic surface, in cases where they rotate, as shown in the drawings, are carried in preestablished bearings. The bearings for these rotating bodies in all the figures, except Figs. 10 and 11, are, moreover, fixed or stationary. These preestablished bearings for the rotating body are serviceable in insuring the accurate and positive contact of the rotating body without slipping. The design of the basic surface may be fixed thereto in any suitable manner. For example, a removable transfer-sheet may be stuck up on the setting-up plate or transfer-base, or the design may be etched or engraved, and thus made permanent on the basic surface, or the design may be otherwise fixed.

In alluding to the positions of the printing-form and transfer-base on their respective supports and to their cooperating relation I use the terms "longitudinally" and "transversely" as referring to the two directions at right angles over said bodies, whether either or both of these bodies is flat or curved. If the body is curved, "longitudinal" would refer to the axial direction and "transverse" to the circumferential direction.

What I claim as new, and desire to secure by Letters Patent, is—

1. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a design so that the design is rendered non-expansible and non-contractible; and bringing said basic surface and a suitable printing-form, one at least of which is curved, into rolling contact, and thereby imparting the design in a planographic state to the printing-form.

2. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a design so that the design is rendered non-expansible and non-contractible; bringing said basic surface and a suitable printing-form, one at least of which is curved, into rolling contact, whereby the design is imparted to the printing-form, and developing said printing-form into a printing-surface of the character desired.

3. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a removable transfer-sheet bearing a design, so that the design is rendered non-expansible and non-contractible; and bringing said basic surface and a suitable printing-form, one at least of which is curved, into rolling contact, whereby the design is turned over upon and imparted to the printing-form.

4. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a removable transfer-sheet bearing a design, so that the design is rendered non-expansible and non-contractible; bringing said basic surface and a suitable printing-form, one at least of which is curved, into rolling contact, whereby the design is turned over upon and imparted to the printing-form, and developing said printing-form into a printing-surface of the character desired.

5. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a design, so that the design is rendered non-expansible and non-contractible; bringing said basic surface and a suitable printing-form, one at least of which is curved, into rolling contact, whereby the design is imparted to the printing-form; and etching said printing-form for the purpose of developing it into a printing-surface of the character desired.

6. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a design, so that the design is rendered non-expansible and non-contractible; and bringing said basic surface and a suitable printing-form, one at least of which is curved, into rolling contact, the curved body being rotated by frictional contact with the other body, and thereby imparting the design in a planographic state to the printing-form.

7. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a removable transfer-sheet bearing a design, so that the design is rendered non-expansible and non-contractible; and bringing said basic



surface and a suitable printing-form, one at least of which is curved, into rolling contact, the curved body being rotated by frictional contact with the other body, whereby the design is turned over upon and imparted to the printing-form.

8. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a removable transfer-sheet bearing a design, so that the design is rendered non-expansible and non-contractible; bringing said basic surface and a suitable printing-form, one at least of which is curved, into rolling contact, the curved body being rotated by frictional contact with the other body, whereby the design is imparted to the printing-form; and developing said printing-form into a printing-surface of the character desired.

9. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a removable transfer-sheet bearing a design, so that the design is rendered non-expansible and non-contractible; bringing said basic surface and a suitable printing-form, one at least of which is curved, into rolling contact, whereby the design is turned over upon and imparted to the printing-form; and etching said printing-form for the purpose of developing it into a printing-surface of the character desired.

10. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a design, so that the design is rendered non-expansible and non-contractible; and bringing said basic surface and a suitable printing-form, one at least of which is curved, into rolling contact, the curved body being carried in bearings in a transfer-press, and thereby imparting the design in a planographic state to the printing-form.

11. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a design, so that the design is rendered non-expansible and non-contractible; and bringing said basic surface and a suitable printing-form, one at least of which is curved, into rolling contact, the curved body being carried in bearings in a transfer-press and rotated by frictional contact with the other body, and thereby imparting the design in a planographic state to the printing-form.

12. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a removable transfer-sheet bearing a design, so that the design is rendered non-expansible and non-contractible; and bringing said basic surface and a suitable printing-form, one at

least of which is curved, into rolling contact, the curved body being carried in bearings in a transfer-press and rotated by frictional contact with the other body, whereby the design is turned over upon and imparted to the printing-form; and etching said printing-form for the purpose of developing it into a printing-surface of the character desired.

13. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a design so that the design is rendered non-expansible and non-contractible; and bringing said basic surface and a suitable curved printing-form into rolling contact, and thereby imparting the design in a planographic state to the printing-form.

14. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a removable transfer-sheet bearing a design so that the design is rendered non-expansible and non-contractible; bringing said basic surface and a suitable curved printing-form into rolling contact, whereby the design is turned over upon and imparted to the printing-form, and etching said printing-form for the purpose of developing it into a printing-surface of the character desired.

15. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a design so that the design is rendered non-expansible and non-contractible; and bringing said basic surface and a suitable curved printing-form into rolling contact, the printing-form being carried in bearings in a transfer-press and rotated by frictional contact with the basic surface, whereby the design is imparted to the printing-form.

16. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a removable transfer-sheet bearing a design so that the design is rendered non-expansible and non-contractible; bringing said basic surface and a suitable curved printing-form into rolling contact, the printing-form being carried in bearings in a transfer-press and rotated by frictional contact with the basic surface, whereby the design is turned over upon and imparted to the printing-form; and etching said printing-form for the purpose of developing it into a printing-surface of the character desired.

17. The improvement in the art of making a lithographic-printing surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a design, so that the design is rendered non-expansible and non-contractible; and bringing said basic surface and a suitable lithographic-printing form, one at



least of which is curved, into rolling contact, whereby the design is imparted to the printing-form.

18. The improvement in the art of making  
5 a lithographic-printing surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a removable transfer-sheet bearing a design, so that the design is rendered  
10 non-expansible and non-contractible; and bringing said basic surface and a suitable lithographic-printing form, one at least of which is curved, into rolling contact, whereby the design is turned over upon and imparted  
15 to the printing-form.

19. The improvement in the art of making a lithographic-printing surface which consists in preparing a suitable non-expansible and non-contractible basic surface having  
20 fixed thereto a design, so that the design is rendered non-expansible and non-contractible; bringing said basic surface and a suitable lithographic-printing form, one at least of which is curved, into rolling contact,  
25 whereby the design is imparted to the printing-form; and etching said printing-form for the purpose of developing it into a lithographic-printing surface.

20. The improvement in the art of making  
30 a lithographic-printing surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a design, so that the design is rendered non-expansible and non-contractible;  
35 and bringing said basic surface and a suitable lithographic-printing form, one at least of which is curved, into rolling contact, the curved body being rotated by frictional contact with the other body, whereby the design  
40 is imparted to the printing-form.

21. The improvement in the art of making a lithographic-printing surface which consists in preparing a suitable non-expansible and non-contractible basic surface having  
45 fixed thereto a design, so that the design is rendered non-expansible and non-contractible; and bringing said basic surface and a suitable lithographic-printing form, one at least of which is curved, into rolling contact,  
50 the curved body being carried in bearings in a transfer-press and rotated by frictional contact with the other body, whereby the design is imparted to the printing-form.

22. The improvement in the art of making  
55 a lithographic-printing surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a removable transfer-sheet bearing a design, so that the design is rendered  
60 non-expansible and non-contractible; bringing said basic surface and a suitable lithographic-printing form, one at least of which is curved, into rolling contact, the curved body being carried in bearings in a transfer-press and rotated by frictional contact with  
65 the other body, whereby the design is turned over upon and imparted to the printing-form;

and etching said printing-form for the purpose of developing it into a lithographic-printing surface.

23. The improvement in the art of making  
70 a lithographic-printing surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a design so that the design is rendered non-expansible and non-contractible;  
75 and bringing said basic surface and a suitable curved lithographic-printing form into rolling contact, whereby the design is imparted to the printing-form.

24. The improvement in the art of making a lithographic-printing surface which consists in preparing a suitable non-expansible and non-contractible basic surface having  
80 fixed thereto a removable transfer-sheet bearing a design so that the design is rendered non-expansible and non-contractible; bringing said basic surface and a suitable curved lithographic-printing form into rolling contact,  
85 whereby the design is turned over upon and imparted to the printing-form; and etching said printing-form for the purpose of developing it into a lithographic-printing surface.

25. The improvement in the art of making  
95 a lithographic-printing surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a removable transfer-sheet bearing a design so that the design is rendered non-expansible and non-contractible;  
100 bringing said basic surface and a suitable curved lithographic-printing form into rolling contact, the printing-form being carried in bearings in a transfer-press and rotated by frictional  
105 contact with the basic surface, whereby the design is turned over upon and imparted to the printing-form; and etching said printing-form for the purpose of developing it into a lithographic-printing surface.

26. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a design so that the design is rendered non-expansible and non-contractible;  
115 and bringing said basic surface and a suitable continuous cylindrical printing-form into rolling contact, whereby the design is imparted to the printing-form.

27. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a removable transfer-sheet bearing a design so  
125 that the design is rendered non-expansible and non-contractible; and bringing said basic surface and a suitable continuous cylindrical printing-form into rolling contact, whereby the design is turned over upon and  
130 imparted to the printing-form.

28. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contracti-



ble basic surface having fixed thereto a removable transfer-sheet bearing a design so that the design is rendered non-expansible and non-contractible; bringing said basic surface and a suitable continuous cylindrical printing-form into rolling contact, whereby the design is turned over upon and imparted to the printing-form; and etching said printing-form for the purpose of developing it into a printing-surface of the character desired.

29. The improvement in the art of making a printing-surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a design so that the design is rendered non-expansible and non-contractible; and bringing said basic surface and a suitable continuous cylindrical printing-form into rolling contact, the printing-form being carried in bearings in a transfer-press and rotated by frictional contact with the basic surface, whereby the design is imparted to the printing-form.

30. The improvement in the art of making a lithographic-printing surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a design so that the design is rendered non-expansible and non-contractible; and bringing said basic surface and a suitable continuous cylindrical lithographic-printing form into rolling contact, whereby the design is imparted to the printing-form.

31. The improvement in the art of making a lithographic-printing surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a removable transfer-sheet bearing a design so that the design is rendered non-expansible and non-contractible; and bringing said basic surface and a suitable continuous cylindrical lithographic-printing form into rolling contact, whereby the design is turned over upon and imparted to the printing-form.

32. The improvement in the art of making a lithographic-printing surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a removable transfer-sheet bearing a design so that the design is rendered non-expansible and non-contractible; bringing said basic surface and a suitable continuous cylindrical lithographic-printing form into rolling contact, whereby the design is turned over upon and imparted to the printing-form; and etching said printing-form for the purpose of developing it into a lithographic-printing surface.

33. The improvement in the art of making a lithographic-printing surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a design so that the design is rendered non-expansible and non-contractible; and bringing said basic surface and a suitable continuous cylindrical lithographic-printing form into rolling contact, the printing-form being carried in bearings in a transfer-press

and rotated by frictional contact with the basic surface, whereby the design is imparted to the printing-form.

34. The improvement in the art of making a lithographic-printing surface which consists in preparing a suitable non-expansible and non-contractible basic surface having fixed thereto a removable transfer-sheet bearing a design so that the design is rendered non-expansible and non-contractible; and bringing said basic surface and a suitable continuous cylindrical lithographic-printing form into rolling contact, the printing-form being carried in bearings in a transfer-press and rotated by frictional contact with the basic surface, whereby the design is turned over upon and imparted to the printing-form.

35. The improvement in the art of making a printing-surface which consists in preparing a suitable basic surface having a design adapted to be imparted by contact; and bringing said basic surface and a suitable printing-form into contact in accurate predetermined cooperating relation both longitudinally and transversely and with reference to preestablished guides, whereby the design is imparted to the printing-form in accurate predetermined position.

36. The improvement in the art of making a printing-surface which consists in preparing a suitable basic surface having a design adapted to be imparted by contact; bringing said basic surface and a suitable printing-form into contact in accurate predetermined cooperating relation both longitudinally and transversely and with reference to preestablished guides, whereby the design is imparted to the printing-form in accurate predetermined position; and developing said printing-form into a printing-surface of the character desired.

37. The improvement in the art of making a printing-surface which consists in preparing a suitable basic surface having thereon a removable transfer-sheet bearing a design adapted to be imparted by contact; and bringing said basic surface and a suitable printing-form into contact in accurate predetermined cooperating relation both longitudinally and transversely and with reference to preestablished guides, whereby the design is turned over upon and imparted to the printing-form in accurate predetermined position.

38. The improvement in the art of making a printing-surface which consists in preparing a suitable basic surface having thereon a removable transfer-sheet bearing a design adapted to be imparted by contact; bringing said basic surface and a suitable printing-form into contact in accurate predetermined cooperating relation both longitudinally and transversely and with reference to preestablished guides, whereby the design is turned over upon and imparted to the printing-form in accurate predetermined position; and developing said printing-form into a printing-surface of the character desired.



39. The improvement in the art of making a printing-surface which consists in preparing a suitable basic surface having a design adapted to be imparted by contact; bringing  
5 said basic surface and a suitable printing-form into contact in accurate predetermined cooperating relation both longitudinally and transversely and with reference to preestablished guides, whereby the design is imparted  
10 to the printing-form in accurate predetermined position; and etching said printing-form for the purpose of developing it into a printing-surface of the character desired.

40. The improvement in the art of making  
15 a printing-surface which consists in preparing a suitable basic surface having thereon a removable transfer-sheet bearing a design adapted to be imparted by contact; bringing said basic surface and a suitable printing-  
20 form into contact in accurate predetermined cooperating relation both longitudinally and transversely and with reference to preestablished guides, whereby the design is turned over upon and imparted to the printing-form  
25 in accurate predetermined position; and etching said printing-form for the purpose of developing it into a printing-surface of the character desired.

41. The improvement in the art of making  
30 a lithographic-printing surface which consists in preparing a suitable basic surface having a design adapted to be imparted by contact; and bringing said basic surface and a suitable lithographic-printing form into contact  
35 in accurate predetermined cooperating relation both longitudinally and transversely and with reference to preestablished guides, whereby the design is imparted to the printing-form in accurate predetermined position.

40 42. The improvement in the art of making a lithographic-printing surface which consists in preparing a suitable basic surface having thereon a removable transfer-sheet bearing a design adapted to be imparted by contact;  
45 and bringing said basic surface and a suitable lithographic-printing form into contact in accurate predetermined cooperating relation both longitudinally and transversely and with reference to preestablished guides, whereby  
50 the design is turned over upon and imparted to the printing-form in accurate predetermined position.

43. The improvement in the art of making a lithographic-printing surface which consists  
55 in preparing a suitable basic surface having thereon a removable transfer-sheet bearing a design adapted to be imparted by contact; bringing said basic surface and a suitable lithographic-printing form into contact in  
60 accurate predetermined cooperating relation both longitudinally and transversely and with reference to preestablished guides, whereby the design is turned over upon and imparted to the printing-form in accurate predetermined  
65 position; and etching said printing-form for the purpose of developing it into a lithographic-printing surface.

44. The improvement in the art of making a printing-surface, which consists in preparing a suitable printing-form and a suitable  
70 basic surface having a design adapted to be imparted by contact, said bodies being constructed and designed to fit removably and replaceably in preestablished seats in a transfer-press; and bringing said bodies, mounted  
75 in such press, into contact, in accurate predetermined relation both longitudinally and transversely and with reference to preestablished guides, whereby the design is imparted to the printing-form in accurate predetermined  
80 position.

45. The improvement in the art of making a printing-surface, which consists in preparing a suitable printing-form and a suitable  
85 basic surface having thereon a removable transfer-sheet bearing a design adapted to be imparted by contact, said bodies being constructed and designed to fit removably and replaceably in preestablished seats in a transfer-press; and bringing said bodies, mounted  
90 in such press, into contact, in accurate predetermined relation both longitudinally and transversely and with reference to preestablished guides, whereby the design is turned over upon and imparted to the printing-form  
95 in accurate predetermined position.

46. The improvement in the art of making a printing-surface, which consists in preparing a suitable printing-form and a suitable  
100 basic surface having a design adapted to be imparted by contact, said bodies being constructed and designed to fit removably and replaceably in preestablished seats in a transfer-press; bringing said bodies, mounted in  
105 such press, into contact, in accurate predetermined relation both longitudinally and transversely and with reference to preestablished guides, whereby the design is imparted to the printing-form in accurate predetermined position; and etching said printing-form for the  
110 purpose of developing it into a printing-surface of the character desired.

47. The improvement in the art of making a printing-surface, which consists in preparing a suitable printing-form and a suitable  
115 basic surface having thereon a removable transfer-sheet bearing a design adapted to be imparted by contact, said bodies being constructed and designed to fit removably and replaceably in preestablished seats in a transfer-press; bringing said bodies, mounted in  
120 such press, into contact, in accurate predetermined relation both longitudinally and transversely and with reference to preestablished guides, whereby the design is turned over upon and imparted to the printing-form in accurate predetermined position; and etching said printing-form for the purpose of developing it into a printing-surface of the character desired.  
125 130

48. The improvement in the art of making a series of registering printing-surfaces, which consists in preparing a series of suitable basic surfaces having component designs adapted



to be imparted by contact; and bringing said basic surfaces and a series of suitable printing-forms into contact, in accurate predetermined cooperating relation both longitudinally and transversely by the aid of preestablished guides and with reference to register, a basic surface and a printing-form together, whereby the component designs are imparted to said printing-forms in accurate predetermined positions and adapted to register in printing.

49. The improvement in the art of making a series of registering printing-surfaces, which consists in preparing a series of suitable basic surfaces having thereon removable transfer-sheets bearing component designs adapted to be imparted by contact; and bringing said basic surfaces and a series of suitable printing-forms into contact in accurate predetermined cooperating relation both longitudinally and transversely by the aid of preestablished guides and with reference to register, a basic surface and a printing-form together, whereby the component designs are turned over upon and imparted to said printing-forms in accurate predetermined positions and adapted to register in printing.

50. The improvement in the art of making a series of registering printing-surfaces, which consists in preparing a series of suitable basic surfaces having component designs adapted to be imparted by contact; bringing said basic surfaces and a series of suitable printing-forms into contact in accurate predetermined cooperating relation both longitudinally and transversely by the aid of preestablished guides and with reference to register, a basic surface and a printing-form together, whereby the component designs are imparted to said printing-forms in accurate predetermined positions and adapted to register in printing; and etching said printing-forms for the purpose of developing them into printing-surfaces of the character desired.

51. The improvement in the art of making a series of registering lithographic-printing surfaces, which consists in preparing a series of suitable basic surfaces having component designs adapted to be imparted by contact; and bringing said basic surfaces and a series of suitable lithographic-printing forms into contact, in accurate predetermined cooperating relation both longitudinally and transversely by the aid of preestablished guides and with reference to register, a basic surface and a printing-form together, whereby the component designs are imparted to said printing-forms in accurate predetermined positions and adapted to register in printing.

52. The improvement in the art of making a series of registering lithographic-printing surfaces, which consists in preparing a series of suitable basic surfaces having thereon removable transfer-sheets bearing component designs adapted to be imparted by contact; bringing said basic surfaces and a series of suitable lithographic-printing forms into con-

tact, in accurate predetermined cooperating relation both longitudinally and transversely by the aid of preestablished guides and with reference to register, a basic surface and a printing-form together, whereby the component designs are imparted to said printing-forms in accurate predetermined positions and adapted to register in printing; and etching said printing-forms for the purpose of developing them into lithographic-printing surfaces.

53. The improvement in the art of making a series of registering printing-surfaces, which consists in preparing a series of suitable basic surfaces having component designs adapted to be imparted by contact; preparing a series of suitable printing-forms, said bodies being of a permanent size and shape to adapt them to fit removably and replaceably in preestablished seats in a transfer-press; and bringing said bodies, mounted in such press, into contact, in accurate predetermined cooperating relation both longitudinally and transversely by the aid of preestablished guides and with reference to register, a basic surface and a printing-form together, whereby the component designs are imparted to the printing-forms in accurate predetermined positions and adapted to register in printing.

54. The improvement in the art of making a series of registering lithographic-printing surfaces, which consists in preparing a series of suitable basic surfaces having thereon removable transfer-sheets bearing component designs adapted to be imparted by contact; preparing a series of suitable lithographic-printing forms, said bodies being of a permanent size and shape to adapt them to fit removably and replaceably in preestablished seats in a transfer-press; bringing said bodies, mounted in such press, into contact, in accurate predetermined cooperating relation both longitudinally and transversely by the aid of preestablished guides and with reference to register, a basic surface and a printing-form together, whereby the component designs are turned over upon and imparted to the printing-forms in accurate predetermined positions and adapted to register in printing; and etching said printing-forms for the purpose of developing them into lithographic-printing surfaces.

55. The improvement in the art of making printing-surfaces which consists in preparing a curved shell-like metallic printing-form and a rotary form-support therefor, said printing-form and form-support being made of a permanent predetermined size and shape to adapt them to fit removably and replaceably one upon the other, and so that the form-support is adapted to fit in a preestablished seat in a transfer-press; preparing a suitable non-expansile and non-contractible basic surface having a design fixed thereto so that the design is rendered non-expansile and non-contractible; mounting said printing-form in its preestablished seat in the transfer-press with



said basic surface seated in said press; and bringing said printing-form into rolling contact with the basic surface, and thereby imparting said design to said printing-form.

5 56. The improvement in the art of making printing-surfaces which consists in preparing a continuous cylindrical metallic printing-form and a rotary form-support therefor, said printing-form and form-support being made  
10 of a permanent predetermined size and shape to adapt them to fit removably and replaceably one upon the other, and so that the form-support is adapted to fit in a preestablished seat in a transfer-press; preparing a  
15 rigid basic surface having a design adapted to be imparted by contact; mounting said printing-form in its preestablished seat in the transfer-press with said basic surface seated in said press; and bringing said printing-form into progressive and positive rolling  
20 contact with the basic surface, and thereby imparting said design to said printing-form.

57. The improvement in the art of making  
25 printing-surfaces, which consists in preparing a curved shell-like metallic printing-form and a rotary form-support therefor, said printing-form and form-support being made of a permanent predetermined size and shape to adapt them to fit removably and replaceably  
30 one upon the other, and so that the form-support is adapted to fit in a preestablished seat in a transfer-press; preparing a basic surface having a design adapted to be imparted by contact; mounting said printing-form in its preestablished seat in the transfer-press with  
35 said basic surface seated in said press; and bringing said printing-form into progressive and positive rolling contact with the basic surface, and thereby imparting said design to said printing-form; and then etching said  
40 printing-form for the purpose of developing it into a printing-surface for said design.

58. The improvement in the art of making  
45 graduated printing-surfaces, which consists in preparing a curved continuous cylindrical metallic printing-form and a rotary form-support therefor, said printing-form and form-support being made of a permanent predetermined size and shape to adapt them to fit  
50 removably and replaceably one upon the other, and so that the form-support is adapted to fit in a preestablished seat in a transfer-press; preparing a rigid basic surface having a graduated design adapted to be imparted  
55 by contact; mounting said printing-form in its preestablished seat in the transfer-press with said basic surface seated in said press; and bringing said printing-form into progressive and positive rolling contact with the  
60 basic surface, and thereby imparting said design to said printing-form; and then etching said printing-form for the purpose of developing it into a printing-surface for said design.

65 59. The improvement in the art of making printing-surfaces, which consists in preparing a curved shell-like metallic printing-form and

a rotary form-support therefor, said printing-form and form-support being made of a permanent predetermined size and shape to adapt  
70 them to fit removably and replaceably one upon the other, and so that the form-support is adapted to fit in a preestablished seat in a transfer-press; preparing a basic surface consisting of a rigid transfer-base bearing a removable transfer-sheet having a design adapted  
75 to be imparted by contact; mounting said printing-form in its preestablished seat in the transfer-press with said basic surface seated in said press; and bringing said printing-form  
80 into progressive and positive rolling contact with the basic surface, and thereby turning over the removable transfer-sheet and imparting said design to said printing-form.

60. The improvement in the art of making  
85 printing-surfaces, which consists in preparing a curved shell-like metallic printing-form and a rotary form-support therefor, said printing-form and form-support being made of a permanent predetermined size and shape to adapt  
90 them to fit removably and replaceably one upon the other, and so that the form-support is adapted to fit in a preestablished seat in a transfer-press; preparing a basic surface consisting of a rigid transfer-base bearing a removable transfer-sheet having a design adapted  
95 to be imparted by contact; mounting said printing-form in its preestablished seat in the transfer-press with said basic surface seated in said press; and bringing said printing-form  
100 into progressive and positive rolling contact with the basic surface, and thereby turning over the removable transfer-sheet and imparting said design to said printing-form; and then etching said printing-form for the purpose of developing it into a printing-surface  
105 for said design.

61. The improvement in the art of making  
110 printing-surfaces, which consists in preparing a continuous hollow metallic printing-form and a rotary form-support therefor, said printing-form and form-support being made of a permanent predetermined size and shape to adapt them to fit removably and replaceably  
115 one upon the other, and so that the form-support is adapted to fit in a preestablished seat in a transfer-press; preparing a basic surface consisting of a rigid transfer-base bearing a removable transfer-sheet having a design adapted to be imparted by contact; mounting  
120 said printing-form in its preestablished seat in the transfer-press with said basic surface seated in said press; and bringing said printing-form into progressive and positive rolling contact with the basic surface, and  
125 thereby turning over the removable transfer-sheet and imparting said design to said printing-form; and then etching said printing-form for the purpose of developing it into a printing-surface for said design.

62. The improvement in the art of making  
130 printing-surfaces which consists in preparing a curved shell-like metallic printing-form and a rotary form-support therefor, said printing-



form and form-support being made of a permanent predetermined size and shape to adapt them to fit removably and replaceably one upon the other in an exact predetermined position both longitudinally and circumferentially, and so that the form-support is adapted to fit in a preestablished seat in a transfer-press; preparing a basic surface having a design adapted to be imparted by contact; mounting said printing-form in its preestablished seat in the transfer-press with said basic surface seated in said press; and bringing said printing-form into progressive and positive rolling contact with the basic surface in accurate predetermined cooperating relation both longitudinally and circumferentially and with reference to preestablished guides, and thereby imparting said design to said printing-form in accurate predetermined position.

63. The improvement in the art of making printing-surfaces which consists in preparing a continuous cylindrical metallic printing-form and a rotary form-support therefor, said printing-form and form-support being made of a permanent predetermined size and shape to adapt them to fit removably and replaceably one upon the other in an exact predetermined position both longitudinally and circumferentially, and so that the form-support is adapted to fit in a preestablished seat in a transfer-press; preparing a rigid basic surface having a design adapted to be imparted by contact; mounting said printing-form in its preestablished seat in the transfer-press with said basic surface seated in said press; and bringing said printing-form into progressive and positive rolling contact with the basic surface, in accurate predetermined cooperating relation both longitudinally and circumferentially and with reference to preestablished guides, and thereby imparting said design to said printing-form in accurate predetermined position.

64. The improvement in the art of making printing-surfaces, which consists in preparing a curved shell-like metallic printing-form and a rotary form-support therefor, said printing-form and form-support being made of a permanent predetermined size and shape to adapt them to fit removably and replaceably one upon the other in an exact predetermined position both longitudinally and circumferentially, and so that the form-support is adapted to fit in a preestablished seat in a transfer-press; preparing a basic surface consisting of a rigid transfer-base bearing a removable transfer-sheet having a design adapted to be imparted by contact; mounting said printing-form in its preestablished seat in the transfer-press with said basic surface seated in said press; and bringing said printing-form into progressive and positive rolling contact with the basic surface in accurate predetermined cooperating relation both longitudinally and circumferentially and with reference to preestablished guides, and thereby turning over

the removable transfer-sheet and imparting said design to said printing-form in accurate predetermined position.

65. The improvement in the art of making a series of registering printing-surfaces which consists in preparing a series of printing-forms designed and constructed to work in accurately-preestablished seats in a printing-press; preparing a series of basic surfaces having component designs adapted to be imparted by contact; bringing said basic surfaces and said printing-forms mounted in accurately-preestablished seats in a transfer-press, into positive contact, a basic surface and a printing-form together, in accurate predetermined cooperating relation both longitudinally and transversely by the aid of preestablished guides and with reference to the attainment of register in the subsequent conjoint use of the printing-forms as printing-surfaces in a printing-press and without the usual empiric adjustment, and thereby imparting said designs to said printing-forms in accurate predetermined positions.

66. The improvement in the art of making a series of curved registering printing-surfaces which consists in preparing a series of curved printing-forms designed and constructed to work in accurately-preestablished seats in a printing-press; preparing a series of basic surfaces having component designs adapted to be imparted by contact; bringing said basic surfaces and said printing-forms mounted in accurately-preestablished seats in a transfer-press into positive rolling contact, a basic surface and a printing-form together, in accurate predetermined cooperating relation both longitudinally and circumferentially by the aid of preestablished guides and with reference to the attainment of register in the subsequent conjoint use of the printing-forms as printing-surfaces in a printing-press and without the usual empiric adjustment, and thereby imparting said designs to said printing-forms in accurate predetermined positions.

67. The improvement in the art of making a series of registering printing-surfaces which consists in preparing a series of printing-forms designed and constructed to work in accurately-preestablished seats in a printing-press; preparing a series of basic surfaces having removable transfer-sheets thereon bearing component designs adapted to be imparted by contact; bringing said basic surfaces and said printing-forms mounted in accurately-preestablished seats in a transfer-press into positive contact, a basic surface and a printing-form together, in accurate predetermined cooperating relation both longitudinally and transversely by the aid of preestablished guides and with reference to the attainment of register in the subsequent conjoint use of the printing-forms as printing-surfaces in a printing-press and without the usual empiric adjustment, and thereby imparting said designs to said printing-forms in accurate predetermined positions.



68. The improvement in the art of making a series of rigid registering printing-surfaces which consists in preparing a series of rigid printing-forms designed and constructed to work in accurately-preestablished seats in a printing-press; preparing a series of rigid basic surfaces having component designs adapted to be imparted by contact; bringing said basic surfaces and said printing-forms mounted in accurately-preestablished seats in a transfer-press into positive contact, a basic surface and a printing-form together, in accurate predetermined cooperating relation both longitudinally and transversely by the aid of preestablished guides and with reference to the attainment of register in the subsequent conjoint use of the printing-forms as printing-surfaces in a printing-press and without the usual empiric adjustment, and thereby imparting said designs to said printing-forms in accurate predetermined positions.

69. The improvement in the art of making a series of continuous, cylindrical, rigid registering printing-surfaces which consists in preparing a series of continuous, cylindrical, rigid printing-forms designed and constructed to work in accurately-preestablished seats in a printing-press; preparing a series of basic surfaces having component designs adapted to be imparted by contact; bringing said basic surfaces and said printing-forms mounted in accurately-preestablished seats in a transfer-press into positive rolling contact, a basic surface and a printing-form together, in accurate predetermined cooperating relation both longitudinally and circumferentially by the aid of preestablished guides and with reference to the attainment of register in the subsequent conjoint use of the printing-forms as printing-surfaces in a printing-press and without the usual empiric adjustment, and thereby imparting said designs to said printing-forms in accurate predetermined positions, and etching said printing-forms for the purpose of developing them into printing-surfaces for said designs.

70. The improvement in the art of making a series of registering printing-surfaces which consists in preparing a series of lithographic printing-forms designed and constructed to work in accurately-preestablished seats in a printing-press; preparing a series of basic surfaces having component designs adapted to be imparted by contact; bringing said basic surfaces and said printing-forms, mounted in accurately-preestablished seats in a transfer-press, into positive contact, a basic surface and a printing-form together, in accurate predetermined cooperating relation both longitudinally and transversely by the aid of preestablished guides and with reference to the attainment of register in the subsequent conjoint use of the printing-forms as printing-surfaces in a printing-press and without the usual empiric adjustment, and thereby imparting said designs to said printing-forms

in accurate predetermined positions and developing said printing-forms into printing-surfaces of the character desired.

71. The improvement in the art of making registering printing-surfaces which consists in preparing a series of printing-forms and a series of form-supports therefor, said printing-forms and form-supports being made of a permanent predetermined size and shape to adapt them to fit removably and replaceably one upon the other in an exact predetermined position, and so that each form-support is adapted to fit in a preestablished seat in a transfer-press; preparing a series of basic surfaces having component designs adapted to be imparted by contact; bringing said basic surfaces and said printing-forms mounted on their form-supports into positive contact in said transfer-press, a basic surface and a printing-form together, in accurate predetermined cooperating relation both longitudinally and transversely by the aid of preestablished guides and with reference to the attainment of register in the subsequent conjoint use of said printing-forms as printing-surfaces in a printing-press and without the usual empiric adjustment, and thereby imparting said designs to said printing-forms in accurate predetermined positions.

72. The improvement in the art of making registering printing-surfaces which consists in preparing a series of curved shell-like printing-forms and a series of rotary form-supports therefor, said printing-forms and form-supports being made of a permanent predetermined size and shape to adapt them to fit removably and replaceably one upon the other in an exact predetermined position both longitudinally and circumferentially, and so that each form-support is adapted to fit in a preestablished seat in a transfer-press; preparing a series of basic surfaces having component designs adapted to be imparted by contact; bringing said basic surfaces and said printing-forms mounted on their form-supports into positive rolling contact in said transfer-press, a basic surface and a printing-form together, in accurate predetermined cooperating relation both longitudinally and circumferentially by the aid of preestablished guides and with reference to the attainment of register in the subsequent conjoint use of said printing-forms as printing-surfaces in a printing-press and without the usual empiric adjustment, and thereby imparting said designs to said printing-forms in accurate predetermined positions.

73. The improvement in the art of making registering printing-surfaces which consists in preparing a series of rigid, hollow, continuous, cylindrical printing-forms and a series of rotary form-supports therefor, said printing-forms and form-supports being made of a permanent predetermined size and shape to adapt them to fit removably and replaceably one upon the other in an exact predetermined position both longitudinally and circumferen-



tially, and so that each form-support is adapted to fit in a preestablished seat in a transfer-press; preparing a series of basic surfaces having component designs adapted to be imparted by contact; bringing said basic surfaces and said printing-forms mounted on their form-supports into positive rolling contact in said transfer-press, a basic surface and a printing-form together, in accurate predetermined cooperating relation both longitudinally and circumferentially by the aid of preestablished guides and with reference to the attainment of register in the subsequent conjoint use of said printing-forms as printing-surfaces in a printing-press and without the usual empiric adjustment, and thereby imparting said designs to said printing-forms in accurate predetermined positions.

74. The improvement in the art of making registering printing-surfaces which consists in preparing a series of curved shell-like printing-forms and a series of rotary form-supports therefor, said printing-forms and form-supports being made of a permanent predetermined size and shape to adapt them to fit removably and replaceably one upon the other in an exact predetermined position both longitudinally and circumferentially and with reference to preestablished guides, and so that

each form-support is adapted to fit in a preestablished seat in a transfer-press; preparing a series of basic surfaces each consisting of a rigid transfer-base having a removable transfer-sheet thereon bearing a component design adapted to be imparted by contact; bringing said basic surfaces and said printing-forms mounted on their form-supports into positive rolling contact in said transfer-press, a basic surface and a printing-form together, in accurate predetermined cooperating relation both longitudinally and circumferentially by the aid of preestablished guides and with reference to the attainment of register in the subsequent conjoint use of said printing-forms as printing-surfaces in a printing-press and without the usual empiric adjustment, and thereby imparting said design to said printing-forms in accurate predetermined position, and etching said printing-forms for the purpose of developing them into printing-surfaces for said designs.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EDWARD HETT.

Witnesses:

EDWIN SEGER,

GEO. W. MILLS, Jr.