(No Model.) 5 Sheets—Sheet 1.

J. W. OSBORNE.

METHOD OF AND APPARATUS FOR TRANSFERRING DESIGNS.

No. 282,112. Patented July 31, 1883.

Fig. 1.

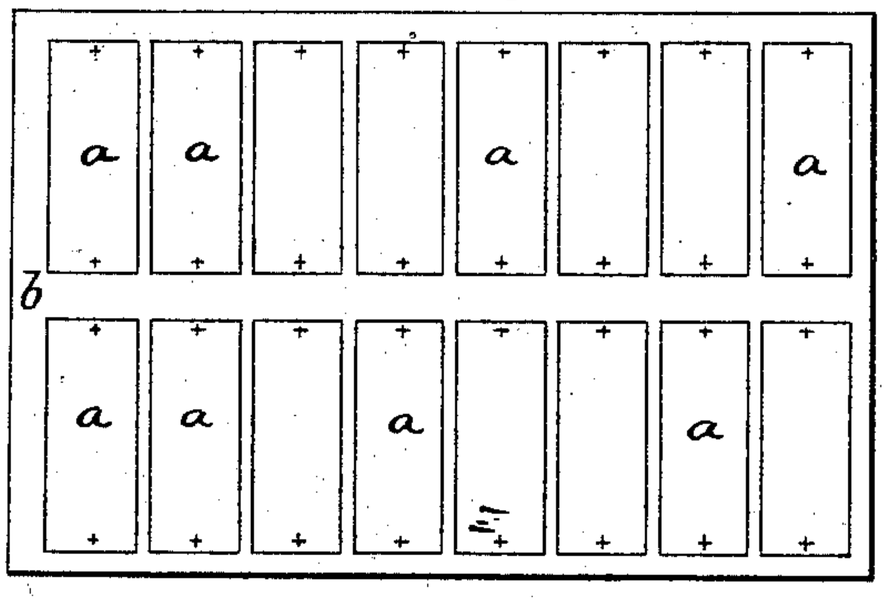


Fig. 2

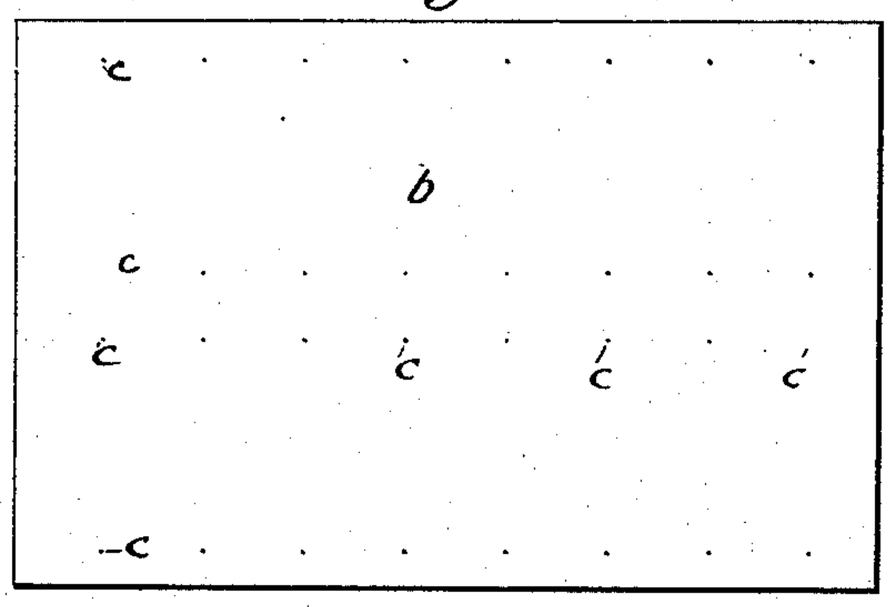


Fig. 3.

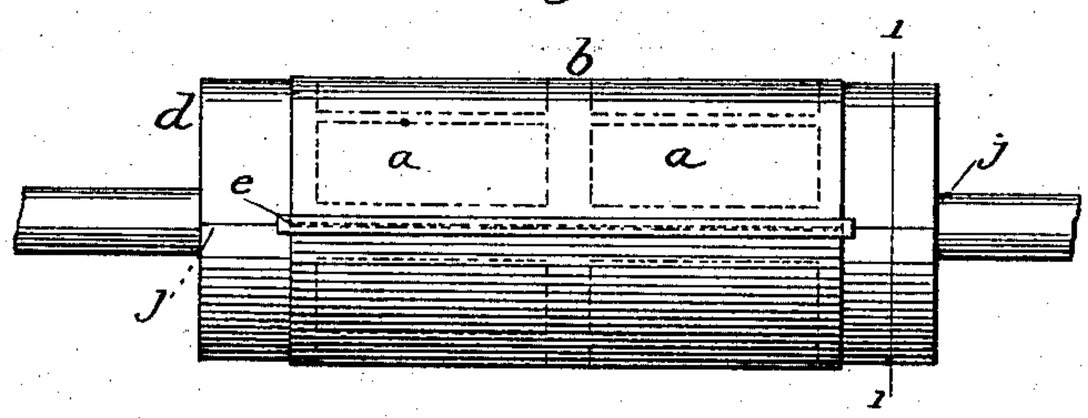


Fig. 4.

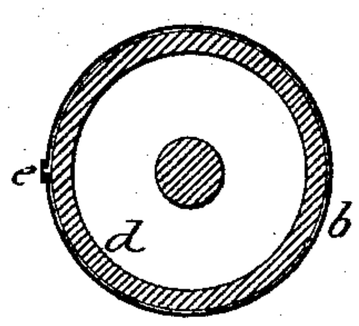


Fig. 5.

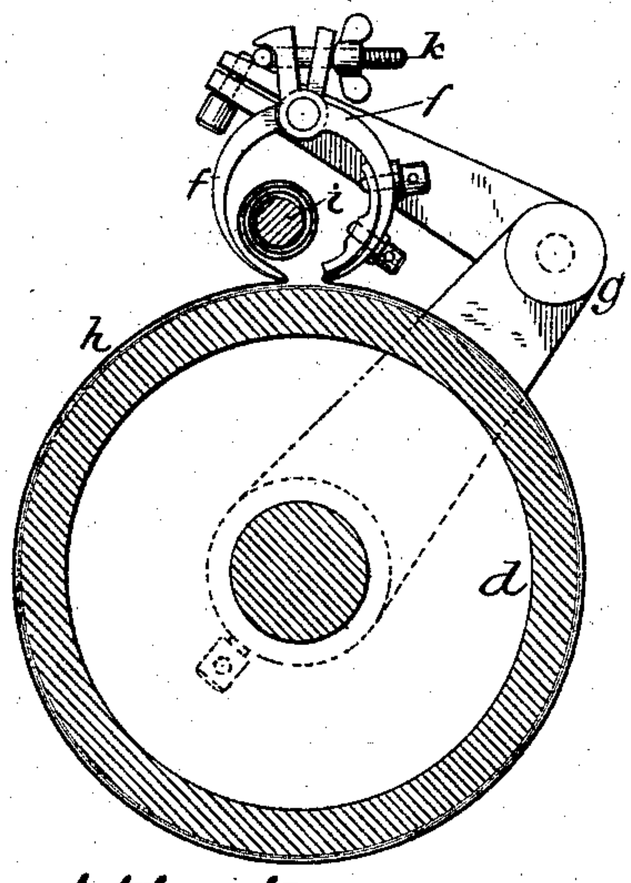
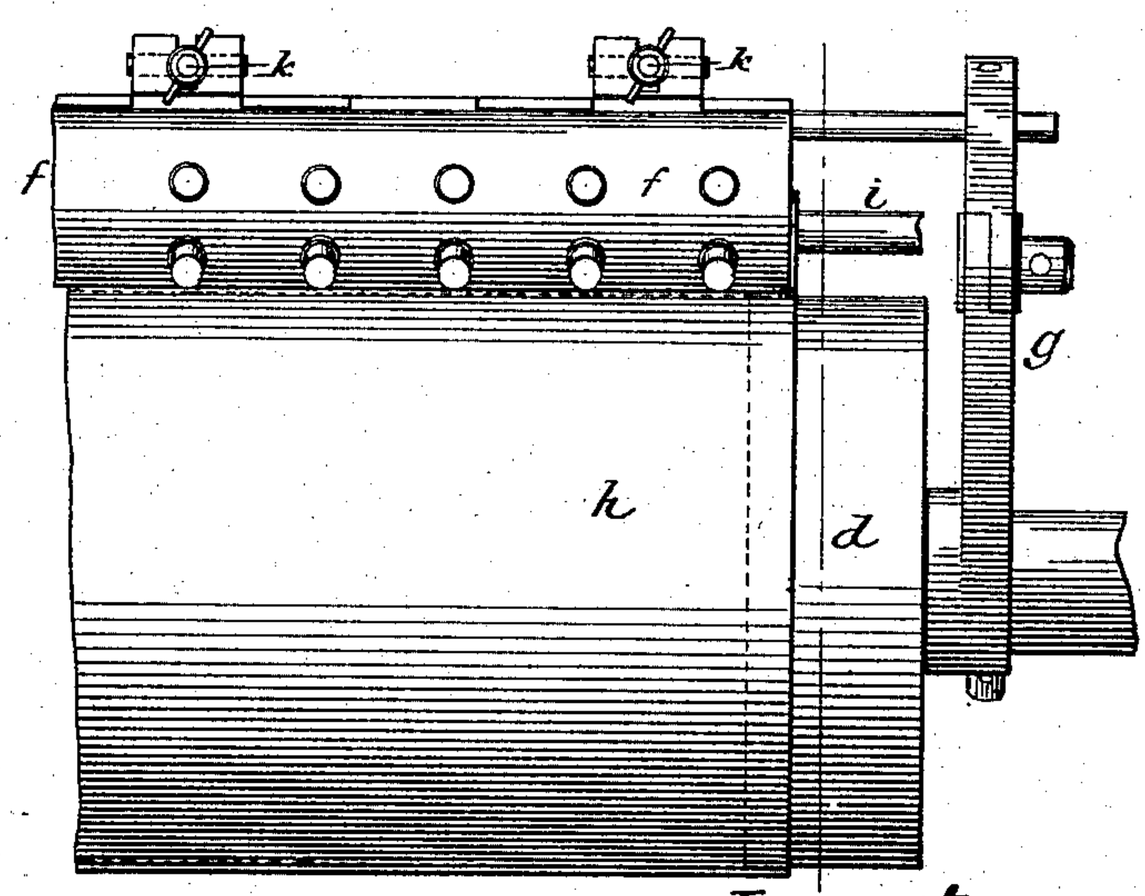


Fig. 6



Attest.

Sidney P. Hollingsworth

Newton Wyckoff.

Inventor.

John W. Osborne

By his attorney

Philip T. Dodge.

(No Model.) 5 Sheets—Sheet 2.

J. W. OSBORNE.

METHOD OF AND APPARATUS FOR TRANSFERRING DESIGNS.

No. 282,112. Patented July 31, 1883.

Fig. 7.

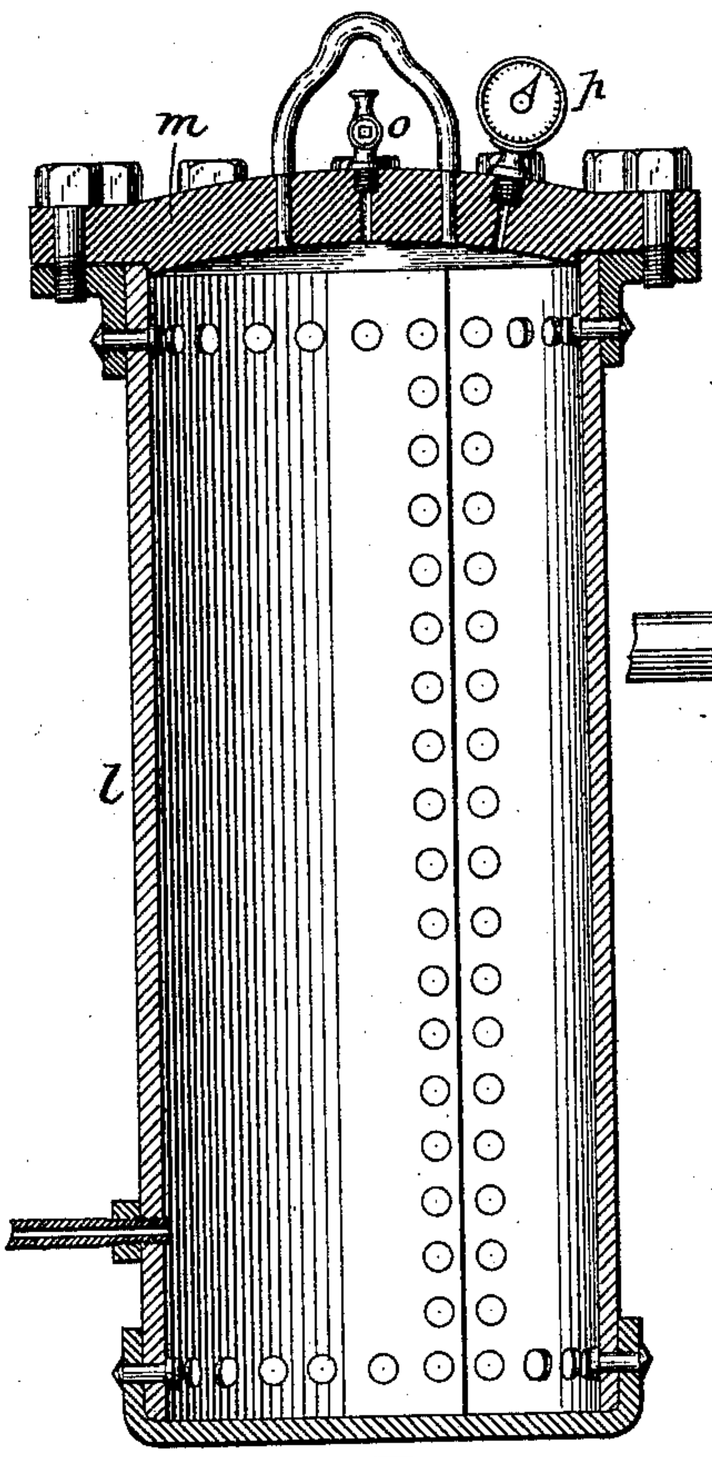


Fig. 9.

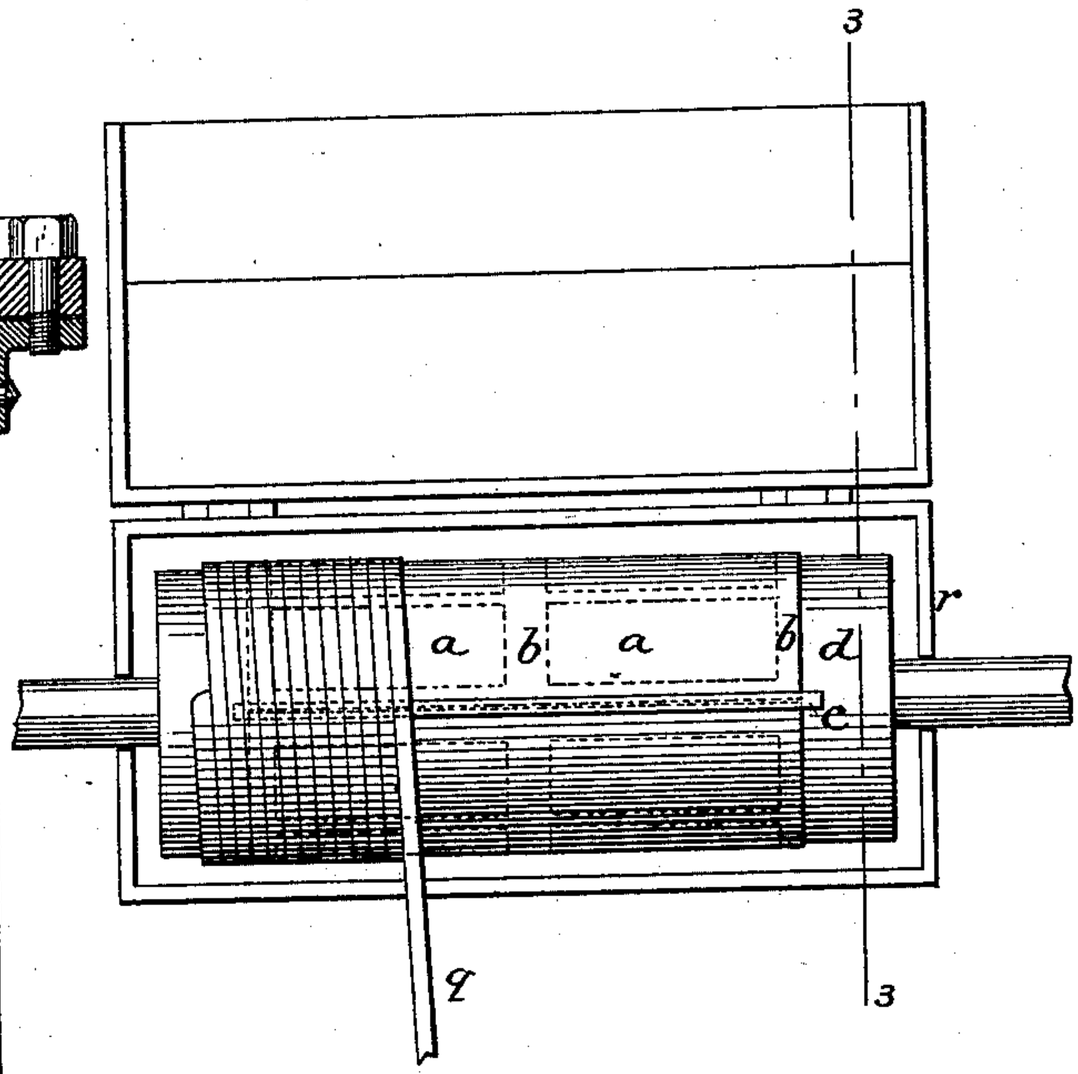


Fig. 8.

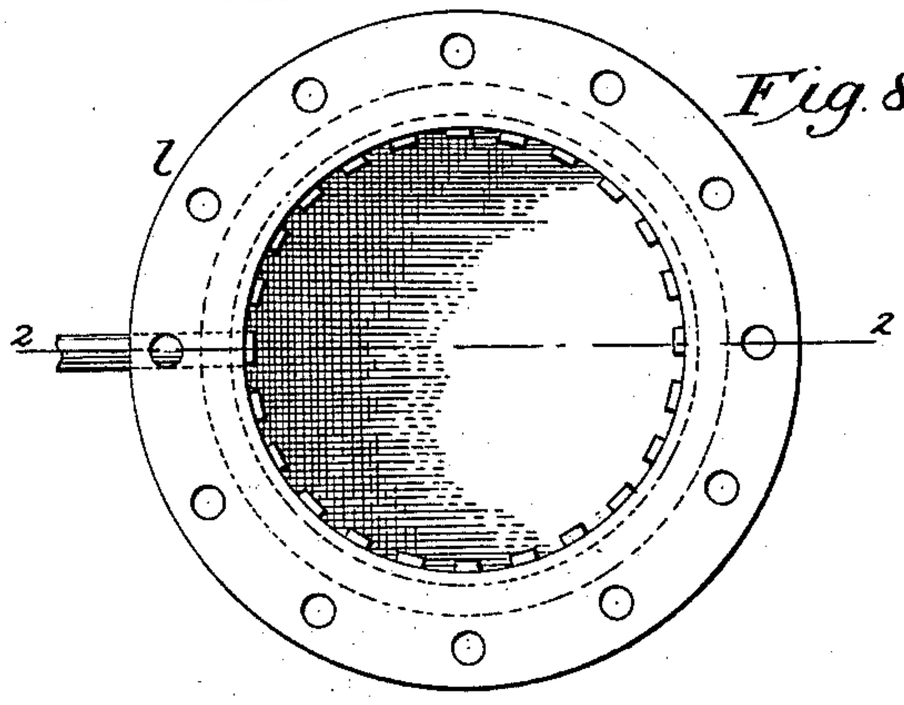
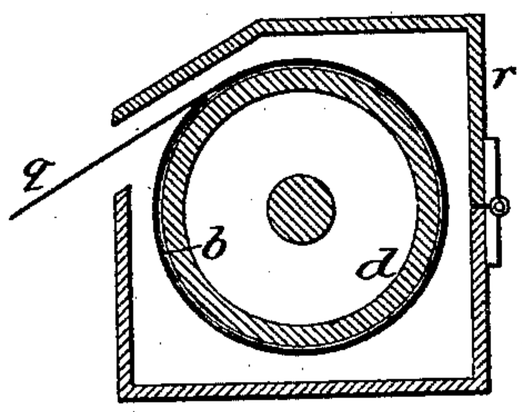


Fig. 10



Attest.

Sidney P. Hollingsworth

Newton Wyckoff.

Inventor.

John W. Osborne.

By his attorney.

Philip T. Dodge.

(No Model.) 5 Sheets—Sheet 3.

J. W. OSBORNE.

METHOD OF AND APPARATUS FOR TRANSFERRING DESIGNS.

No. 282,112. Patented July 31, 1883.

Fig. 12.

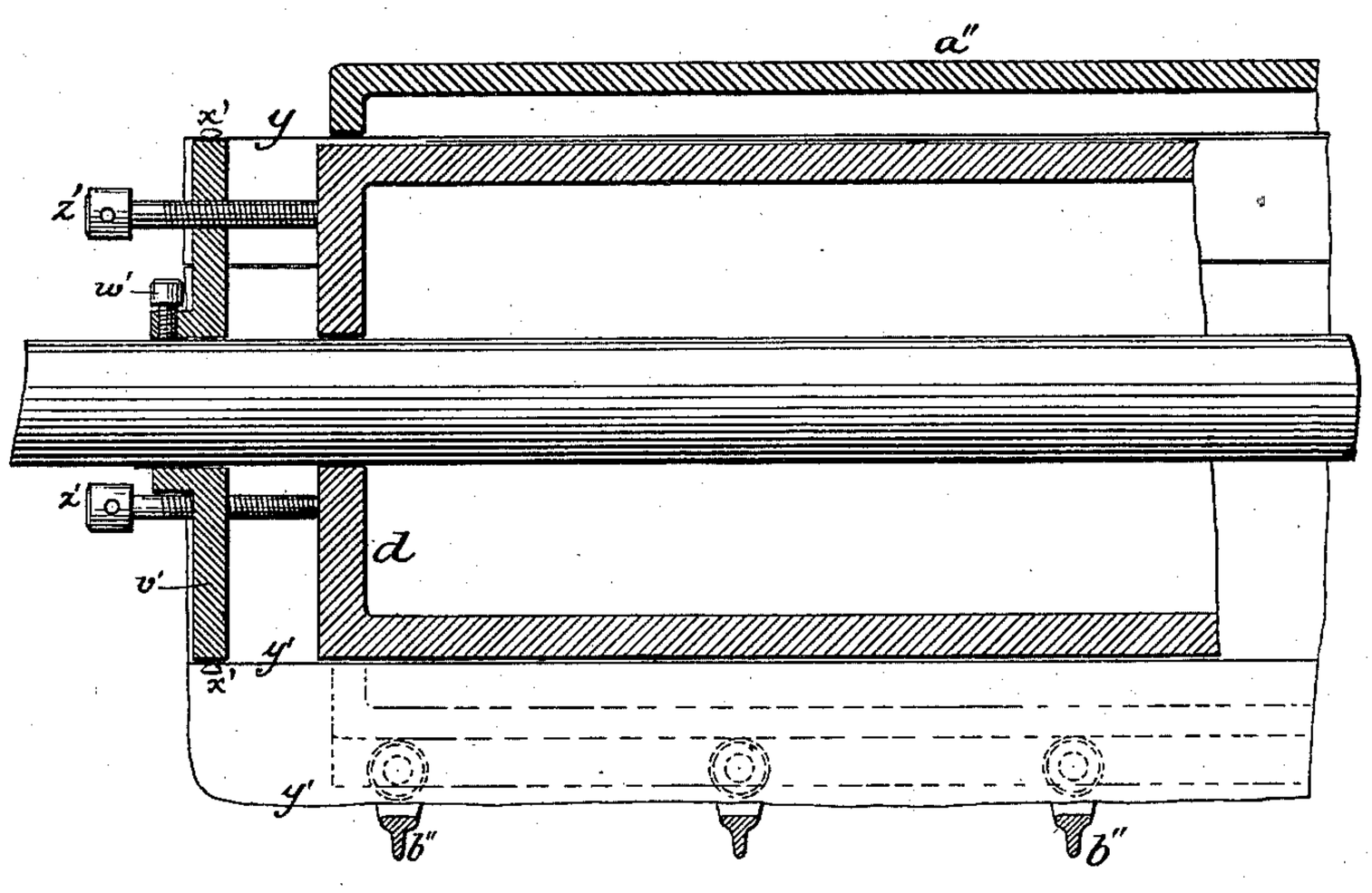


Fig. 11.

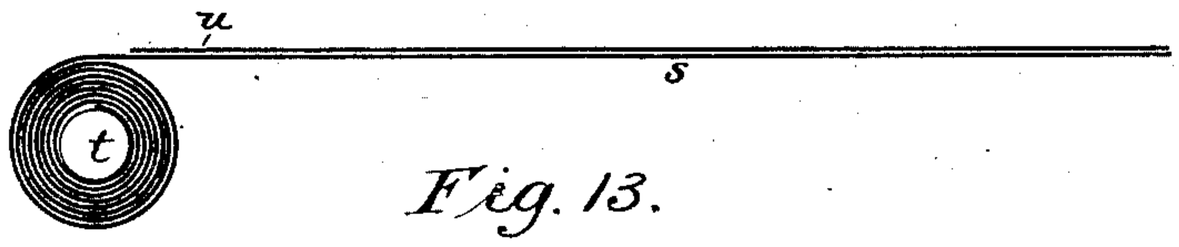
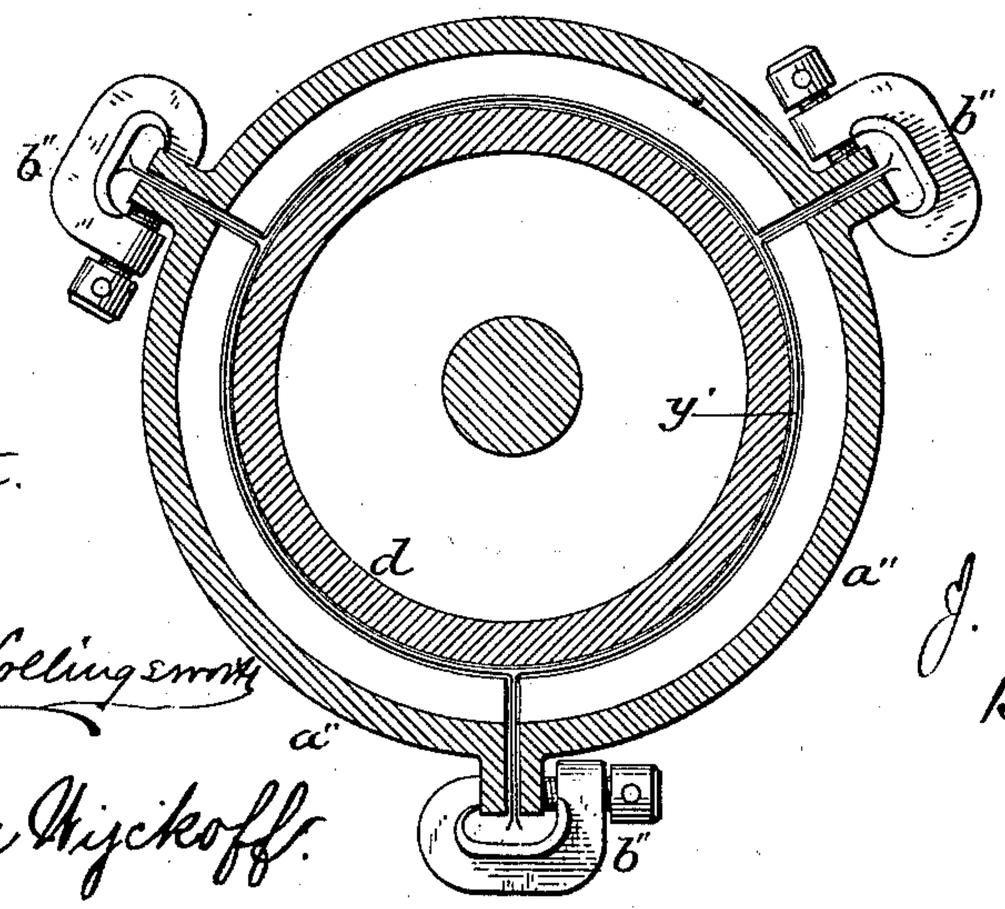


Fig. 13.



Attest.

Sidney P. Hollingsworth

Newton Wyckoff.

Inventor.

J. W. Osborne.

By his attorney.

Philip T. Dodge.

(No Model.) 5 Sheets—Sheet 4.

J. W. OSBORNE.

METHOD OF AND APPARATUS FOR TRANSFERRING DESIGNS.

No. 282,112. Patented July 31, 1883.

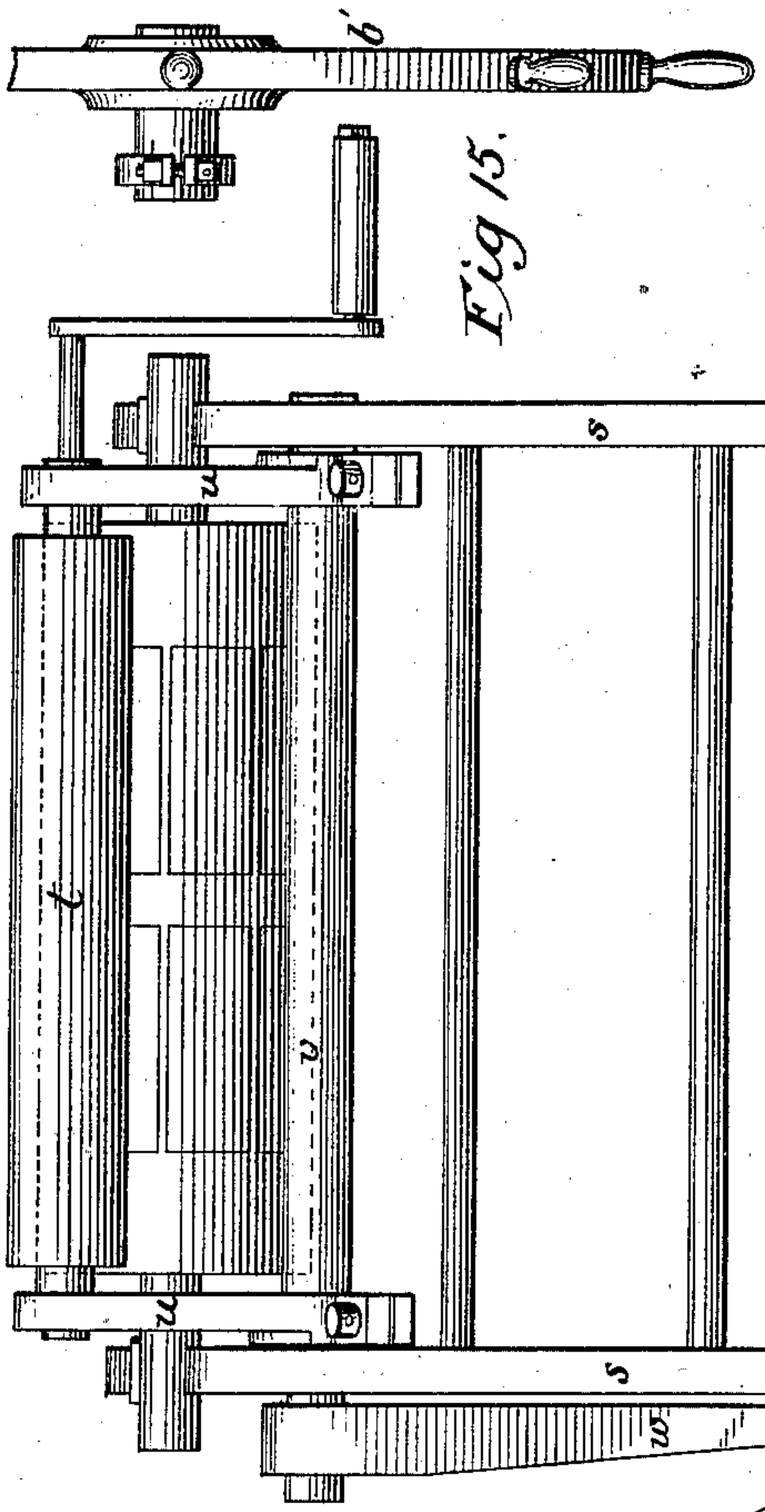


Fig 15.

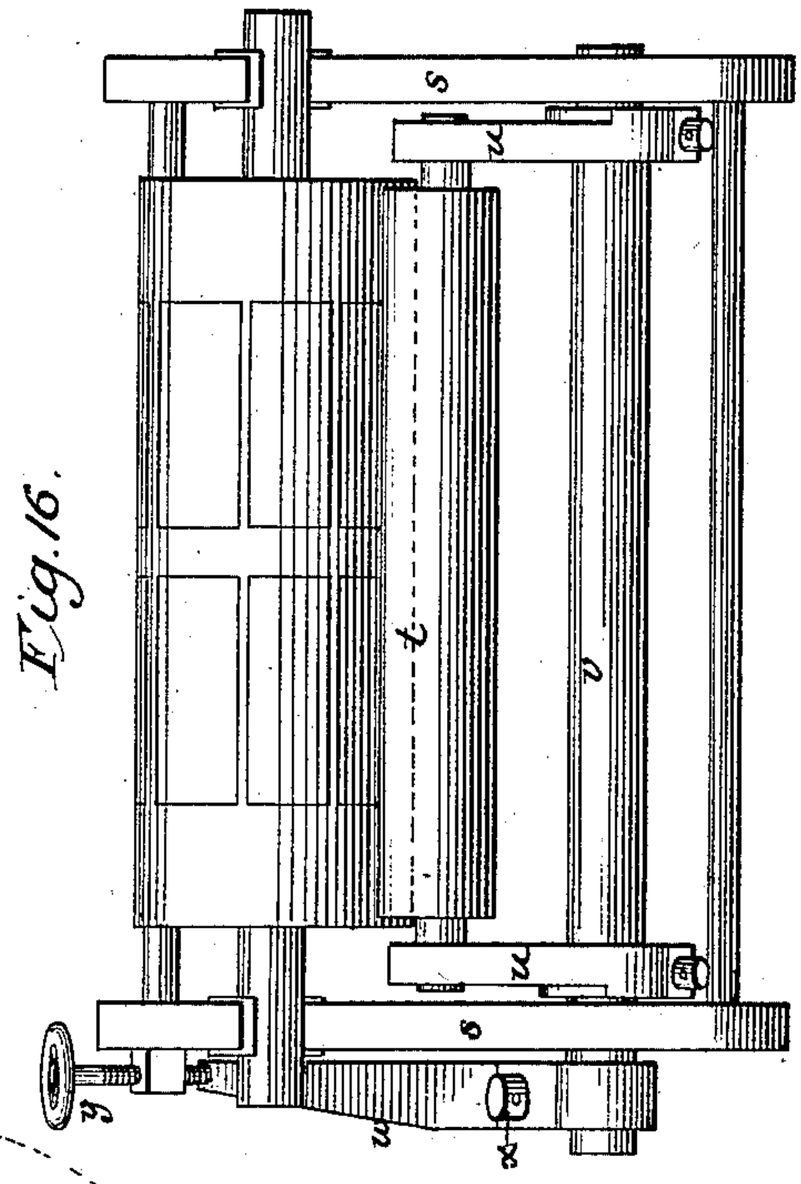


Fig. 16.

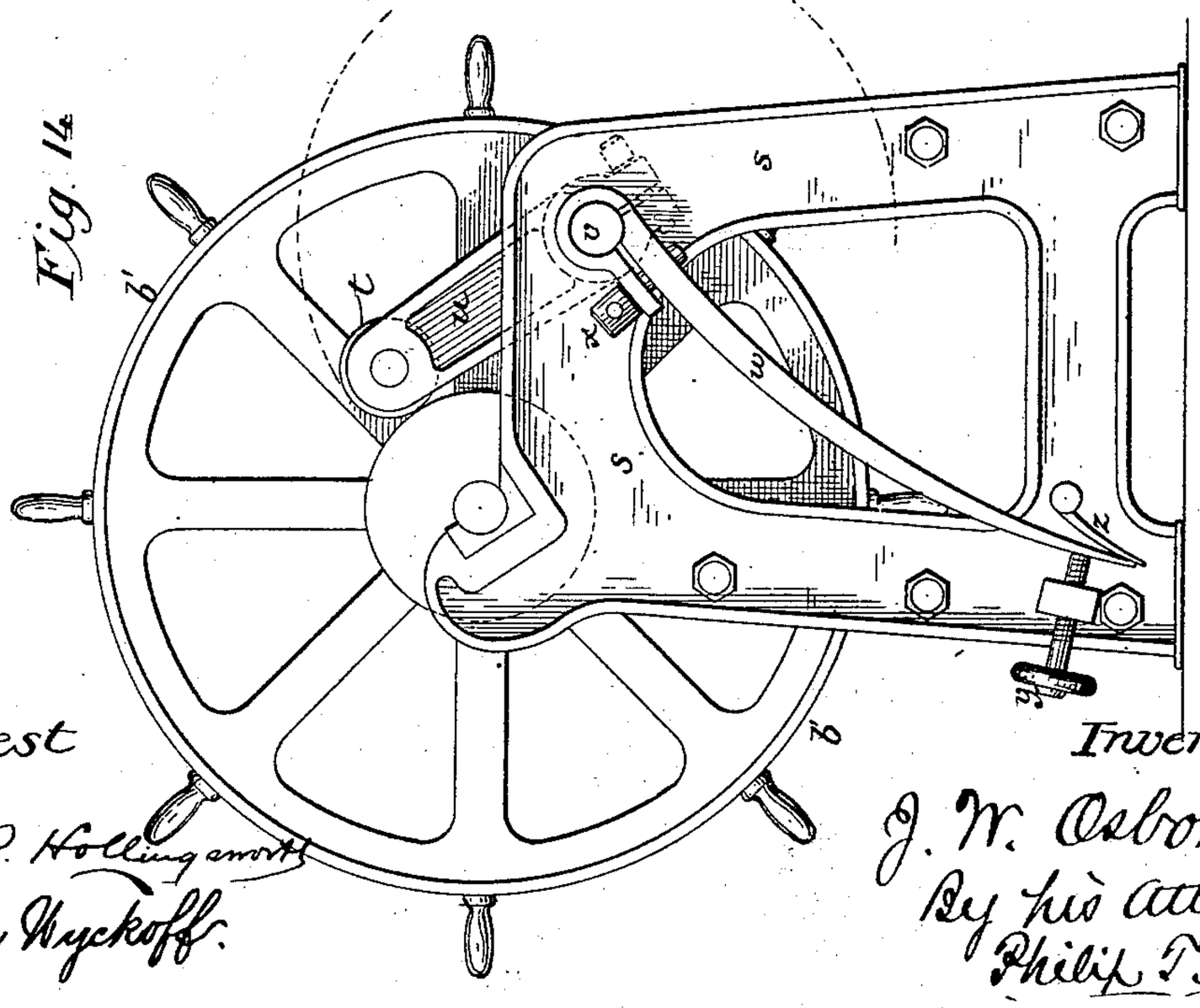


Fig. 14.

Attest

Sidney P. Hollingsworth

Newton Wyckoff.

Inventor.

J. W. Osborne

By his Atty.

Philip T. Dodge.

(No Model.) 5 Sheets—Sheet 5.

J. W. OSBORNE.

METHOD OF AND APPARATUS FOR TRANSFERRING DESIGNS.

No. 282,112. Patented July 31, 1883.

Fig 17.

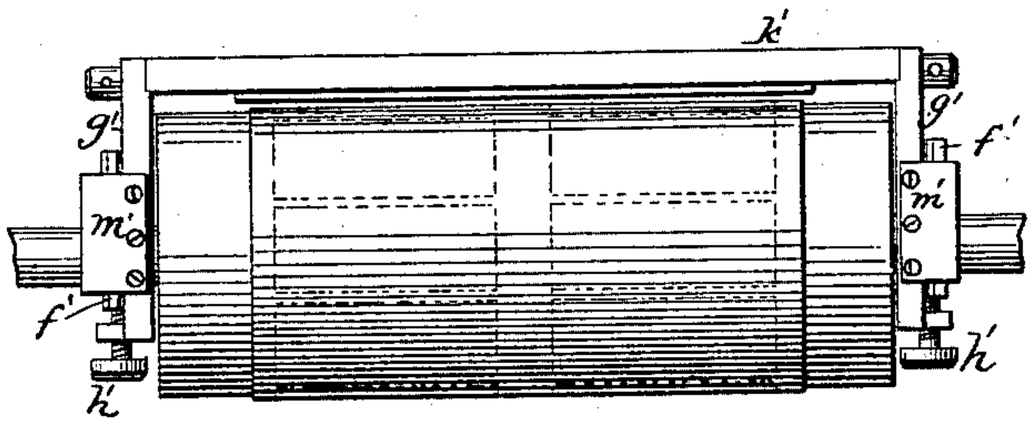
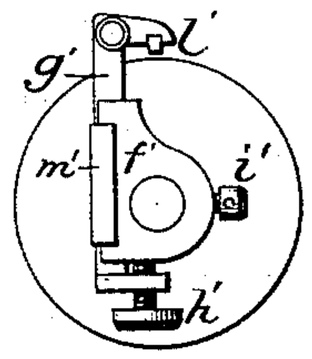


Fig. 18.



Attest.

Sidney P. Hollingsworth

Newton Wyckoff.

Inventor.

J. W. Osborne

By his Atty.

Philip T. Dodge.

UNITED STATES PATENT OFFICE.

JOHN W. OSBORNE, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO WILLIAM H. FORBES, OF BOSTON, MASSACHUSETTS.

METHOD OF AND APPARATUS FOR TRANSFERRING DESIGNS.

SPECIFICATION forming part of Letters Patent No. 282,112, dated July 31, 1883.

Application filed June 24, 1882. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. OSBORNE, of Washington, in the District of Columbia, have invented certain Improvements in Methods of and Apparatus for Transferring Designs, &c., of which the following is a specification.

This invention has reference to the transferring of designs drawn or impressed on paper to solid curved surfaces for printing, ornamental, or other purposes. It is especially connected with the art of lithographic transferring, and with that of preparing cylindrical forms and rolls for calico and other printing.

The object of my invention is to effect the transfer of a design, in suitable ink, to a cylindrical or similarly-curved surface, so that every part of the design may occupy a definite and previously-determinable relation to a line, real or imaginary, upon the surface of said cylinder parallel to its axis, and to the circumference of a circle coincident with the cylindrical surface and at right angles to the axis of the same. The object is, further, to accomplish this result with certainty and precision every time that such transfer is made.

In lithography, when a transfer is made to a flat stone or flat zinc plate, good results are obtainable without serious difficulty, and when such transfers are made to two or more printing-surfaces, each of which has afterward to print in its special color its independent design in register upon the same sheet, and which must therefore be relatively in correct position, the methods now practiced, with the exercise of judgment and care, will insure success. This is not the case, however, when the attempt is made to apply the same methods of transfer to solid zinc cylinders intended for printing, or to copper cylinders for the printing of textile fabrics. It is true that the design may be transferred to such surfaces—that is, it may be made to go over and attach itself thereto; but to make it do this thoroughly and precisely in the place where it is required is a matter of the greatest difficulty, which, as an accomplished practical fact, I have never seen or heard of from others, and which a wide practical experience justifies me in believing has never been done. When, in the practice of lithography, which art involves transferring in its highest development, a design is carried by the application of pressure from the surface of paper to that of a flat stone, from which impressions are afterward to be printed, it is not necessary that the position of the design shall bear any exact relation to the edges of the printing-surface; nor is this necessary even when a number of designs are transferred each to its own stone, all to be afterward printed in register on the same sheet. The printer is in these cases indifferent as to the exact position of the general work, provided every part of it with respect to the other parts is correctly located, because in the press each stone admits of being moved in all directions before it is printed from, and the printer proceeds with this work only after the requisite adjustments have been made, according to the necessity indicated by a greater or less number of trial impressions.

It will be seen, without any lengthy explanation, that analogous adjustments are not feasible when the design is on a solid cylinder; that if, for example, the general direction of the length of the design is in a spiral direction around the cylinder, corresponding to a diagonal position on a flat stone, no possible adjustment applied to the cylinder can make the direction of the design coincident with the cylinder's rotation.

In the process of transferring to a flat stone, the sheet bearing one or more designs, commonly denominated the "transfer-sheet," is properly damped and inverted on the stone as the latter lies in the press. The transfer-sheet is then backed with dry paper, the tympan closed over it, and the pressure applied, usually by means of a narrow projecting edge of wood called a "scraper," which is brought down across one end of the sheet, and from that position caused to travel the entire length of the sheet. During this operation care is taken that the sheet is free to move upon the stone—that is, to stretch and yield under the dragging pressure to which it is subjected.

It will be readily seen that this treatment applied in the case of a transfer to a cylinder would rarely lead to successful results, so far as the accurate location of each part of the work is concerned, and cannot be relied on.

Everything would depend upon starting absolutely right—a difficulty which does not exist in flat transferring—because the slightest swerving of the sheet to the right or left, due to a bad start, or to an excess of pressure at one end of the cylinder, or to unequal damping, or to all these causes combined, would produce an irreparable imperfection. Moreover, it is often very desirable for printing and other purposes to cause a transfer-design to encircle a cylinder in such manner that the design shall be continuous thereon, without beginning or end. The accomplishment of this by the ordinary methods—that is, by applying a dragging stretching pressure to one end of the damp transfer-sheet, so as to stick it fast, and then letting this same pressure traverse the whole, thereby causing the work last attached, which ends the sheet, to meet that which begins it—is possible only by accident. This is so because the number of factors affecting such a result are not only very numerous, but also of a most uncertain character.

The foregoing sketch makes reference only to the most obvious difficulties which attend the problem of transferring to cylindrical surfaces, and is presented to give a clear insight into the object and scope of the manipulations which follow.

As will be hereinafter explained, my method of transferring may be carried out by various appliances differing in construction, and is not dependent upon the specific apparatus hereinafter described, although its use is preferred.

When a transfer to a cylinder by the method I have invented is desired, the surface of the cylinder is turned off perfectly true and the length of its periphery made precisely equal to that of the work which is to go upon it, with the end margins added, if such there be. When a number of such transfers are required for chromatic printing or other purposes, all the cylinders employed are made identical in these respects. A sheet of paper of good quality is next prepared of an exactly true rectangular shape, the width being made sufficient to receive the work which is to be placed upon it, and the length such that when the sheet is damped to the extent requisite for successful transferring, and then caused to encircle the cylinder, its ends will meet edge to edge. With this degree of dampness practical transferrers are quite familiar. Upon this sheet the several pieces of the transfer-paper, if there be more than one, with the designs, commonly denominated the "work," upon them, are disposed so that the spaces and margins are conveniently and rightly placed, and are made fast by touches of paste, as is done in the preparation of transfer-sheets for flat transferring; but the preparation of the transfer-sheet for the purpose which I have in view differs from that ordinarily practiced, in that the position of the work and every part of it is made to maintain its relation to the sharply-cut edges of the rectangular sheet to which the several pieces are attached with the same precision that the several parts maintain their relation to each other. To accomplish this with the extreme accuracy required, mechanical means other than the rule and compass are desirable, (although such tools can be made to answer the purpose with the expenditure of much time and labor,) and this is especially the case when for chromatic printing several transfers have to be made to different cylinders, impressions from which must subsequently register.

Referring to the accompanying drawings, Figure 1 is a face view of the transfer. Fig. 2 is a face view of the templet. Fig. 3 is a side elevation of the printing-cylinder with the transfer-sheet adjusted and secured thereon. Fig. 4 is a cross-section on the line 1 1 of Fig. 3. Fig. 5 is a cross-section, on an enlarged scale, of the printing-cylinder having the transfer-sheet applied thereto and covered by means of an impervious sheet secured by a clamp. Fig. 6 is a side elevation of the same. Fig. 7 is a vertical central section of the vessel employed for applying fluid-pressure to the transfer-sheet. Fig. 8 is a top plan view of the same with the lid or cover removed. Fig. 9 is a top plan view illustrating the manner of applying an elastic strip around the transfer-sheet disposed upon the printing-cylinder, together with the casing employed to retain the sheet in a properly-damped condition. Fig. 10 is a cross-section of the same on the line 3 3. Fig. 11 is an end elevation, illustrating the manner of applying the contractile and impervious sheets jointly to secure radial pressure upon the transfer-sheet. Figs. 12 and 13 are respectively a longitudinal and a cross section of another means of applying radial pressure by the expansive force of plaster-of-paris or equivalent material. Fig. 14 is an end elevation of the transfer-press for applying progressive radial pressure. Fig. 15 represents a front elevation of the same with the end wheel removed. Fig. 16 is a top plan view of the same. Figs. 17 and 18 are respectively a side and an end elevation of the impression-cylinder with the transfer-sheet disposed thereon and secured at its edges by means of a radially-acting clamp.

Fig. 1 illustrates a transfer-sheet, in which *a* represents the several small sheets or impressions or pieces of work which are attached to the main sheet *b*, and which may be repetitions of the same design, or may differ from each other in size and in general outline. These may be made by the hand of an artist or draftsman, but in the great majority of cases will be impressions carefully printed with ink of the proper kind on paper prepared for the purpose, as usual, by giving it a starchy or gelatinous surface, which becomes adhesive when damped. I shall refer hereinafter to these as "transfer-impressions."

There are various ways in which the sheet *b* may be accurately cut and marked; but I prefer, as one of the simplest, the use of the

templet shown in Fig. 2. This consists of a sheet of thin metal made perfectly rectangular and of such length in relation to the circumference of the cylinder with which it is associated that a sheet of dry paper cut to an equal length with the plate will, when damped and expanded for transferring, have a length equal to the circumference of the cylinder. In other words, the length of the templet is to be such that it will produce a transfer-sheet which will, when damped, exactly encircle the cylinder. This length will be fixed by determining experimentally how much space is to be allowed in such case for the expansion of the paper. Through the templet needle-holes *c* are bored at places accurately determined to correspond with the position it is wished to give the "register-marks" on each impression. The register-marks on the pieces *a* are indicated (in an assumed position, for they may be anywhere) by the small crosses in Fig. 1. They are on the original printing-surface, and are printed with the rest of the design, so that their position in reference thereto is invariable.

The sheet of paper *b*, before being cut, is laid dry upon a flat surface. The templet is then placed upon it and carefully held down. The paper is then cut around the edge of the plate, and before either is moved the paper is pricked through the needle-holes *c*. The sheet is then ready, and the transfer-impressions are put in place and attached by passing two needles through the register-marks in each and through the corresponding pricked holes in the large sheet, and thus holding each of the pieces *a* until the spots of paste are applied. The transfer-sheet so prepared is next evenly damped in the manner well known to printers—namely, by placing it between sheets of damp paper. I prefer to carry this damping further than is necessary or desirable for good transferring, the effect and object of which are to cause the sheet to become longer than the circumference of the cylinder *d*. This cylinder has scratched upon its surface a very fine line, precisely parallel with its axis, (preferably applied when the cylinder is in the lathe,) which, for convenience, I shall call a "meridional line," and which is shown at *j*, Fig. 3. The damped transfer-sheet is next caused to encircle the cylinder *d*, so that its two ends meet edge to edge and corner to corner and join exactly over this line, the sides of the sheet being at the same time properly spaced from the ends of the cylinder. The ends of the sheet having been accurately brought together, as described, (which operation is much facilitated by the extra length of the paper,) a narrow strip of adhesive paper, *e*, is laid upon them, so as to quickly unite the two, as shown in Figs. 3 and 4. If the ends of this strip are permitted to extend beyond the sides of the sheet, they may be used to hold the line of junction over the meridional line by pasting them firmly to the surface of the cylinder, as shown in Fig. 3; or the line of junction may be held in place by any simple clamp acting radially—such, for example, as that represented in Figs. 17 and 18, to be hereinafter described. If the adjusting of the edges, as described, is quickly and dexterously done, the sheet will hang somewhat loosely upon the cylinder, and the latter (the journals of which will be supported the while in suitable bearings—such, for example, as those represented in Figs. 14, 15, and 16, to be hereinafter described) may be slowly revolved, so as to equalize the evaporation from the paper. As this proceeds the sheet contracts, and very soon the diminished size will cause it to embrace the cylinder tightly. Beyond this the contraction must not be allowed to go, and to check it further evaporation from the paper must be stopped, which can be done in several ways, hereinafter described.

It will be seen that at this stage we have a transfer-sheet, as shown in Figs. 3 and 4, the two ends of which coincide with a true meridian and the two sides of which lie in planes of circles at right angles to the axis of the cylinder, all parts of the transfer-sheet being in contact with the face of the cylinder, held by a gentle contractile force, and the works upon it occupying definite and previously-determined positions. It will also be seen that this same condition of things can be duplicated with precision upon any required number of similar cylinders at will.

The results attained by the manipulations which have just been detailed may also be obtained, in kind if not in quality, by certain equivalent modifications, which I will now describe, but which I do not recommend, as I believe them to be inferior to the method already set forth.

The rectangular sheet *b*, instead of being cut shorter than the circumference of the cylinder *d*, may be cut longer, so that when the paper is sufficiently damped and then put round the cylinder it will lap upon itself at the ends, which lap can then be pasted down and the contraction allowed to proceed as before. But to insure the correct size and position of the work, one end of the transfer-sheet having been made coincident with the scratched meridional line on the cylinder, the other lapping edge has to be made coincident with a pencil-line accurately drawn on the back of the sheet. The pencil-line in this case cannot be drawn when the templet is in position for cutting the paper, and the position of any line drawn by pencil or pen is much less certain than one scratched with a point; hence the method is not as reliable as that just described. In this second case, too, the two edges of the paper have to be separately adjusted up to the independent lines, whereas in the first described method both edges are brought to the same line and against each other, and when united can be finally adjusted in position and held there.

In the description above given I have stated that the transfer-sheet should be somewhat

overdamped before it is applied to the cylinder, the object being to give time for uniting and adjusting the edges before any strain comes upon them, and to facilitate the uniform contraction of the sheet as a whole after the true position of the line of junction has been fixed. The same ends may be reached by surrounding the cylinder with the transfer-sheet before it is damped or after partial damping, and holding it in an approximately correct position in any convenient way, as by very thin and feeble elastic rings, and then completing the damping and consequent expansion of the sheet without removing it from the cylinder. This can be done by surrounding it with damp paper or cloth, or by placing about the cylinder a vessel or box in which a damp atmosphere is maintained. When the paper has then expanded sufficiently to bring the end edges together on the meridional line, they are united as before, and the damping devices finally removed. There is in theory no objection to this modification, except, perhaps, the danger of the transfer-impressions attaching themselves prematurely; but in practice it will be found less convenient and simple even though the danger named were completely guarded against.

Having secured the accurate application of the transfer-sheet to the cylinder by either modification of the process above described, the next step is to apply pressure to the surface in a manner which will not disturb what has been done, so as to cause the necessary adhesion and perform the function of the scraper-pressure in the ordinary lithographic transfer-press. This I can accomplish in either of several equivalent ways, some of which I will describe.

Figs. 5 and 6 show, on an enlarged scale, the procedure which I believe to be most generally serviceable and efficient. An elastic rubber belt, rather wider than the paper on the cylinder, is wrapped around the same, so as to cover the whole perfectly. This may be done by simply rolling a sheet of thin rubber several times around the cylinder, and finally securing it by elastic bands; but to prevent the possibility of any injurious dragging force causing a shifting or creeping of the paper, I prefer the arrangement of parts represented in Figs. 5 and 6. In these figures, *f* represents a long clamp extending the length of the cylinder and supported from the shaft or journals by the jointed arms *g*, so as to be adjustable in position, as shown. The clamp consists of two curved or semi-tubular pieces hinged together at one edge, and has attached to one of its sides the rubber belt *h*. The mouth of the clamp is adjusted over the junction of the two ends of the paper on the cylinder, united as described, and the thin rubber belt is then made to encircle the whole. The surplus or unused end of the rubber is wound upon a rod, *i*, for which there is room within the clamp, as shown. When the rod or roll *i* has been placed within the clamp, the jaws of the latter are nearly closed, as in Fig. 5, and the T-shaped fastening-bolts *k* placed in position for closing the clamp. The jaw, holding one end of the rubber, is then pressed toward the cylinder to hold it fast, the rubber then tightened by turning the rod *i*, and the clamp finally closed by means of the bolts and their nuts. It will be seen that this operation has hermetically inclosed the transfer-sheet within a close-lying impervious envelope, and that one of its effects is to stop evaporation from the same, and, as a consequence, its further contraction on the cylinder. Pressure is now to be applied, which in this case I accomplish by placing the cylinder *d*, with its attachments, in the strong vessel *l*, (shown in Figs. 7 and 8,) applying and bolting down the cover *m* to close the same, and then pumping in water until it flows from the cock at *o*. This cock is then closed and the pumping continued until the pressure denoted by the gage *p* reaches the desired limit, where it may be maintained for any convenient length of time.

It is obvious that in place of the water any other liquid, air, or gas may be pumped or otherwise forced into the vessel, and that in either case the pressure will be absolutely uniform and simultaneous on all parts of the transfer-sheet and cylinder; also, that in degree the pressure is unlimited, provided the vessel is of sufficient strength, and also that the direction of the pressure is at right angles to the entire surface of the transfer-sheet, tending in no way to shift the same from its position. If a heavy pressure is used and its duration continued long enough, the ink upon the transfer-impressions may be made to go over to the surface of the cylinder with one application of pressure; but with much less pressure and in much less time the adhesive starchy surfaces of the damp pieces bearing the transfer-impressions upon them will have stuck fast, after which there is no danger of a lateral movement or shift in their position. The cylinder *d* may then be removed from the vessel *l*, the rubber covering taken off, and the rectangular sheet *b*, upon which the transfer-impressions were distributed, also removed, leaving the impressions still adherent and unmoved upon the cylinder. These may then be damped in the manner practiced by lithographic transferrers, and pressure again applied; but, as further shifting is impossible, the clamp *f*, with its rubber belt *h*, may be dispensed with, if desired, and a broad piece of thin sheet-rubber, oil-cloth, or oiled silk wrapped about the cylinder, held in place by elastic rings or otherwise, and the whole again subjected to hydrostatic pressure; or local pressure may be applied by means hereinafter described.

In Figs. 9 and 10 appliances are shown whereby I obtain the uniform radial pressure on the cylindrical surface by a method which differs essentially from that which has just been described, the details of which I do not claim in this specification, as I intend making a separate application for a patent for the same. By this second method the cylin-

der, supported in suitable bearings, with the transfer-sheet upon it, the ends being united, as before, is covered over its whole surface, when it has shrunk upon the cylinder to the proper degree, by applying to it a thin ribbon of elastic rubber, *q*. This is wound spirally under moderate tension, beginning on the surface of the cylinder outside the paper and continuing edge to edge until the whole of the paper has been covered and the rubber has passed beyond the same at the opposite end of the cylinder, where it is made fast in any convenient way. In this manner a very slight amount of pressure is produced upon the paper perpendicular to its surface, for although the tensional strain of the rubber pulls laterally from any given point, it nevertheless does so equally in both directions throughout every part of the stretched ribbon, and the resultants are all in the direction of the radius, and although the pressure so obtained may and should be slight if the ribbon used is thin and the tension under which it was wound inconsiderable, still the aggregate effect upon the transfer-sheet will be found usually much more than enough to keep the paper from shifting on the cylinder during its subsequent treatment, which is the special function of the rubber. As such an application of this ribbon of rubber necessarily occupies some little time, it is desirable to stop the further drying and contraction of the paper from the moment when the winding begins. This may be satisfactorily done by inclosing the cylinder in a box, *r*, sponged inside with water, or otherwise wetted, whereby a damp atmosphere is made to surround the paper, and thereby prevent evaporation. This box is left open until the contraction of the paper is sufficient and the winding has commenced, when it is closed; but when the covering with rubber has been completed the necessity for the box ceases, as further evaporation is impossible. A very much heavier and broader band of rubber under stronger tension is next wound over the first in the same manner, and over that another still heavier, with still more tension, and so on repeatedly, the layers of rubber being added until the required pressure is cumulatively obtained. This is soon accomplished if the object in view is only to produce the adhesion of the starchy surface of the transfer-impressions; but the cumulative pressure has to be carried further when it is intended that the ink shall go over. When the latter course is decided on it is well to remove the rubber after the transfer-impressions have attached themselves, to damp the latter from the back, so as to facilitate the letting go of the ink in the well-known way, and then to apply heavy rubber from the beginning under a heavy strain.

Instead of the foregoing method of applying uniform radial pressure, I may also avail myself of the contraction of certain substances, and likewise of the expansion of others, for the application of simultaneous radial pressure to a transfer-sheet placed in proper position and in contact with the surface of a cylinder.

The contractile force of certain fibrous materials I make use of as follows: A web of paper of a width somewhat greater than that of the transfer-sheet and long enough to go several times round the cylinder is prepared by saturating the same with water until its greatest elongation is reached. For this purpose I prefer the material known in trade as "parchment-paper," because of its great strength. A sheet of smooth tin-foil large enough to cover the cylinder and lap slightly is next laid upon one end of the damped web, and the damped transfer-sheet, having been properly applied to and closed upon the cylinder, receives the web of parchment-paper wrapped several times closely about it, after which the end of the web is held in any convenient way.

It will be seen that by the intervention of the tin-foil (which is impervious to moisture) the transfer-sheet will not by this application receive additional moisture from the web, however damp the latter may be made. If said web upon the cylinder is now caused to dry, (which operation may be hastened in various ways,) the parchment-paper will contract with great force, thereby exercising a simultaneous radial pressure upon the transfer-sheet, the intensity of which will depend chiefly upon the number of folds which the web makes upon the cylinder and the degree to which the drying of the same is carried.

Fig. 11 shows the web of parchment-paper *s* damped and rolled for convenience upon a spindle, *t*, with the sheet of tin-foil *w* laid upon it, ready for application.

Figs. 12 and 13 show in longitudinal and in cross section, respectively, one form of the apparatus I employ for the application of simultaneous radial pressure by the employment of an expanding body. In these, *d*, as before, represents the cylinder, which will have on opposite ends of its axle two disks, one of which (seen at *v'* in Fig. 12) can be temporarily clamped by the set-screw *w'*. These disks are provided with a number of studs, *x'*, around their edges.

The cylinder being supported in any convenient way by its axle, and the transfer-sheet having been properly applied thereto in the manner hereinbefore described, three pieces of very thin rubber cloth, *y'*, or similar impervious material, are stretched between the disks and attached to the studs *x'* by means of corresponding holes in the ends of the cloth. Each piece of cloth covers one-third of the cylinder-face; but as each is made much wider than is necessary for that purpose the superfluous margins of the cloth hang outward from the cylinder, the six margins giving three folds of double cloth. The three set-screws *z'* (two of which appear in Fig. 12) are now advanced against the end of the cylinder, by which means the disks *v'* are slightly separated and the cloth gently strained between

them parallel to the face of the cylinder and in contact with it. In this way the cylinder is surrounded with an impervious covering and all further evaporation from the transfer-sheet is stopped. The three hollow cylindrical segments *a''* are next applied between the double folds of cloth, as shown in the figures. These rest upon their ends beyond the transfer-sheet, the curve of which corresponds to that of the cylinder. The segments are then secured in place by the clamps *b''*, the ends of cloth being held between the segments and within the clamps. By these means an annular space divided into three parts by double folds of thin cloth has been established round the transfer-sheet. The cylinder is now raised on end, and the annular space is filled (through suitable openings left for the purpose in the cylindrica egments) with a mixture of plaster-of-paris and water. When this sets and hardens the well-known expansion takes place which accompanies the chemical union of the water with the plaster, and the pressure due to its increase of bulk forces the transfer-sheet into intimate contact with the cylindrical surface below it. When this is accomplished the three pieces of cloth are released from the studs *x'* on the edges of the disks *v'* and the clamps *b''* are removed, after which the three cylindrical segments are easily lifted off, bringing with them the plaster and the cloth adhering to it. These are then separated and the plaster discarded, after which the apparatus is ready for use again. The intensity of the force obtained by this method depends chiefly on two circumstances—namely, the thickness of the stratum of plaster and the proportion which the latter bears to the quantity of water mixed with it.

The two methods for the production of simultaneous radial pressure, which have just been described, are not claimed in detail in the specification, as I intend to make them the subject of a special application for patent; but when simultaneous uniform radial pressure, in whatever way produced, is used to effect the firm attachment of the transfer-impressions only, I then employ local pressure to complete the transfer of the ink, and use for this purpose the press represented in Figs. 14, 15, and 16.

The cylinder is shown in position with its journals resting in half-bearings in the side framing, where they are easily placed. The impression-cylinder *t*, covered with a rubber blanket ground to a true surface, or some equivalent therefor, is carried by the arms *u*, clamped to the heavy cross-shaft *v*, which also has bearings in the frame *s*.

It will be seen that the manner in which the impression-cylinder is connected with the shaft *v* admits of the very accurate adjustment of said cylinder *d*, which bears the transfers, so as to make the surfaces of the two exactly parallel.

The pressure exerted by the impression-cylinder *t* is controlled and graduated through the intervention of the lever *w*, which is clamped on the cross-shaft *v*. This lever consists of a bar of steel, which embraces the shaft, but which may be released or tightened upon it at any time by means of the bolt *x*.

The position of the lower end of the lever or bar is governed by the hand-wheel and screw *y* and the stiff spring *z*. This spring is of sufficient strength to hold the lower end of the lever at all times in contact with the end of the screw, overcoming the weight of the impression-cylinder. When, therefore, the screw is depressed by turning the hand-wheel, the force so exerted is communicated through the lever *w* and shaft *v* to the impression-cylinder *t*, which is thereby made to bear with greater force on the surface of the cylinder *d* or the sheet thereon. When the screw is turned backward, the reverse effect is produced, and the lever being released, the spring will finally lift the impression-cylinder from the surface of cylinder *d*, leaving the latter free to revolve independently, which is frequently an important advantage. This construction facilitates the nice adjustment of the pressure required by the impression-cylinder, and it also gives to that pressure an elastic yielding character, the quality and range of which depend upon the length, thickness, and form of the steel lever *w*.

When a cylinder such as *d* is to be placed in this press, it is lifted high enough to place its journals on the upper horizontal edges of the side framing, *s*, near the bearings, into which it is then rolled; but to do this it is first necessary to get the impression-cylinder out of the way, which is accomplished by slackening the bolt *x*, and then permitting the impression-cylinder, with its sustaining-arms, to descend until they hang downward from the shaft *v*.

The construction of this press, and especially the provision for securing and releasing the lever *w*, enables it to deal with transfer-bearing cylinders which vary from each other in diameter without affecting or interfering with the devices for applying any of the adjustments or making necessary any change of a substantial character.

In applying local pressure successively to the surface of a cylinder in a transfer-press such as I have described, it is generally sufficient to attach a removable crank to the journal of the impression-cylinder in any convenient way, (as by boring out one end of the latter and fixing the crank therein by a pin or feather,) and then causing the impression-cylinder to revolve in contact with the cylinder bearing the transfers. This it will drive without difficulty by the frictional hold taken by the rubber.

Gearing can of course be used to connect the two cylinders, and in the case of very large and heavy form cylinders, where much inertia and friction have to be overcome, its use may be desirable; but experience has convinced me that it can be dispensed with in most cases with positive advantage; and although it is more convenient in most cases to apply the necessary force to the impression-cylinder, and

by it to drive the other, still it is in certain cases advantageous to turn the latter directly, which is best done by means of the removable star-wheel *b'*.

The clamp hereinbefore referred to for the purpose of temporarily holding the edges of the transfer-sheet at the time of its adjustment upon the cylinder is clearly represented in Figs. 17 and 18. This clamp consists of collars *f'*, adapted for application to the journals of the cylinder, and provided with set-screws *i'*, whereby they may be secured rigidly in position thereon.

The collars *f'* are provided with bars *g'*, adjustable by means of screws *h'*. To the outer ends of the bars *g'* there is secured a bar, *k'*, extending from end to end of the cylinder parallel with its outer surface, and provided in its inner edge with a longitudinal strip, *l'*, of rubber or equivalent elastic material. By means of the screws *h'* the bars *g'* may be caused to draw the bar *k'* downward firmly upon the surface of the cylinder or the abutting edges of the sheet disposed thereon, the bar lying meanwhile in a line parallel with the axis of the cylinder. To prevent the sudden or accidental movement of the bar, spring-plates *m'* are applied, as shown in the drawings, to bear with moderate pressure upon the arms *g'*.

I do not claim herein or as part of the present invention the templet, the method of securing the adjustment of the sheet by means of the meridional line, the transfer-press, or the appliances for applying the radial pressure other than the inclosing-vessel. The right is reserved to make all matters and things which are shown or described herein, but which are not specifically claimed, the subject-matter of separate applications.

As regards the application of fluid-pressure to the sheet upon the cylinder, it is obvious that, instead of inclosing the entire cylinder within the vessel, sectional vessels or jackets may be employed to cover only desired portions of the cylinder, and in this manner the pressure may be restricted within the limits of the sheet, or, if required, to a portion only of the surface of the sheet.

Having thus described my invention, what I claim is—

1. In the art of transferring, the method of bringing the ink upon a transfer impression or impressions into contact with a cylinder upon which they are disposed, consisting in subjecting the transfer-sheet upon the cylindrical surface to a fluid-pressure.

2. In the art of transferring, the method of bringing the ink upon a transfer-sheet into contact with the cylindrical surface, consisting in disposing and securing said sheet around the cylindrical surface, then inserting said cylinder with the sheet thereon into a closed vessel, and finally forcing a fluid into said vessel under pressure.

3. In the art of transferring, the method of bringing the ink upon a transfer-sheet into contact with the surface of a cylinder, consisting in first disposing the sheet properly on the surface of the cylinder, and then subjecting the same to a radial pressure acting simultaneously around the entire circumference.

4. The method of transferring to a cylindrical surface a design impressed or drawn in a transferable ink on a paper provided with an adhesive coating, which consists in first laying said sheet around and in contact with the cylindrical surface, then applying a uniform radial pressure simultaneously to all parts of the back of the sheet to cause the adherence of the adhesive surface to the cylinder, and finally bringing the ink forming the design into intimate and forcible contact with the cylindrical surface by the application of local radial pressure along a line parallel with the axis of said cylinder.

5. The combination, substantially as described, of a cylinder, a transfer-sheet adjusted thereon, and an impervious sheet covering the transfer-sheet, an inclosing-vessel, and means for producing a fluid-pressure therein, substantially as set forth.

6. The combination, substantially as described, of a cylinder, a transfer-sheet adjusted thereon, a rubber or equivalent impervious sheet enveloping the latter, a clamp for holding the impervious sheet, and an inclosing-vessel adapted to receive and maintain a fluid under pressure.

7. The combination of a cylinder having a damped transfer-sheet applied thereto and an impervious coating encircling the transfer-sheet, substantially as described, whereby the contraction of the transfer-sheet is prevented.

8. The improved means for securing a sheet of rubber upon a cylinder, consisting of an elongated clamp composed of two semi-tubular jaws hinged together and provided with closing devices, combined with an internal roller having the edge of the rubber sheet attached thereto, substantially as described and shown.

9. The combination of a cylinder adapted to receive a transfer, a transfer-sheet surrounding the same, and a clamp to secure the impervious sheet, provided with sustaining-arms, substantially as described and shown.

JOHN W. OSBORNE.

Witnesses:
PHILIP T. DODGE,
NEWTON WYCKOFF.