

(No Model.)

5 Sheets—Sheet 1.

D. S. CLARK:

APPARATUS FOR SCORING, CUTTING, AND PRINTING CARDBOARD BOXES.

No. 591,209.

Patented Oct. 5, 1897.

Fig. 1.

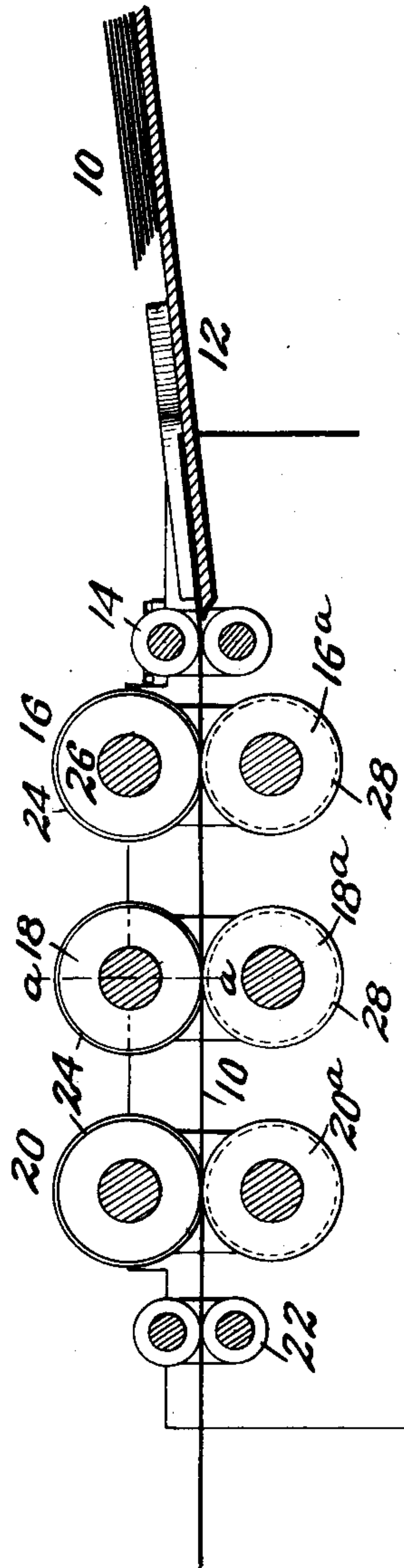


Fig. 2.

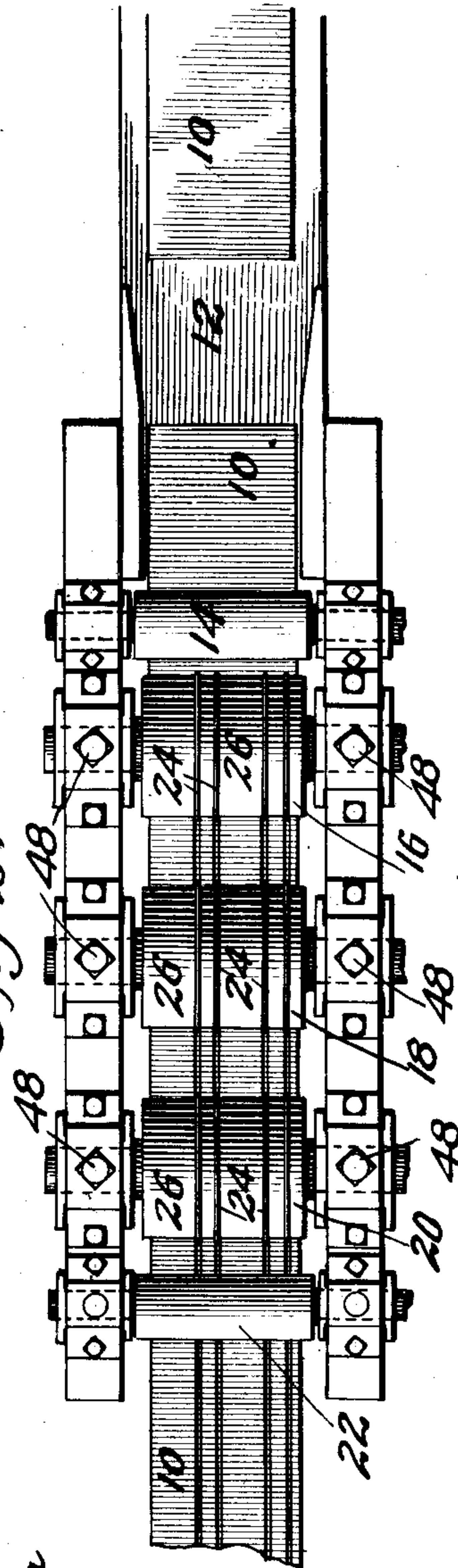
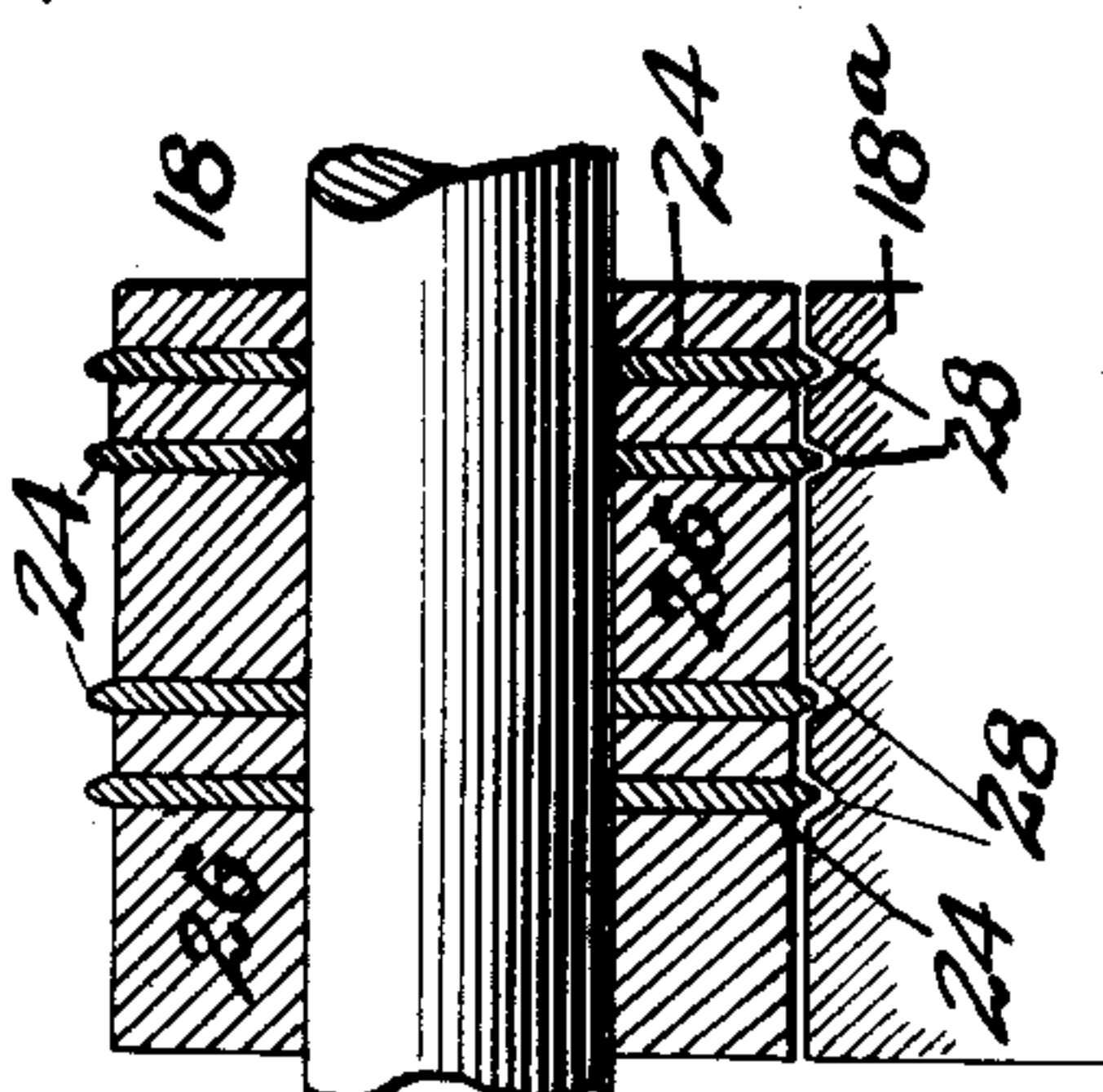


Fig. 2a.



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(No Model.)

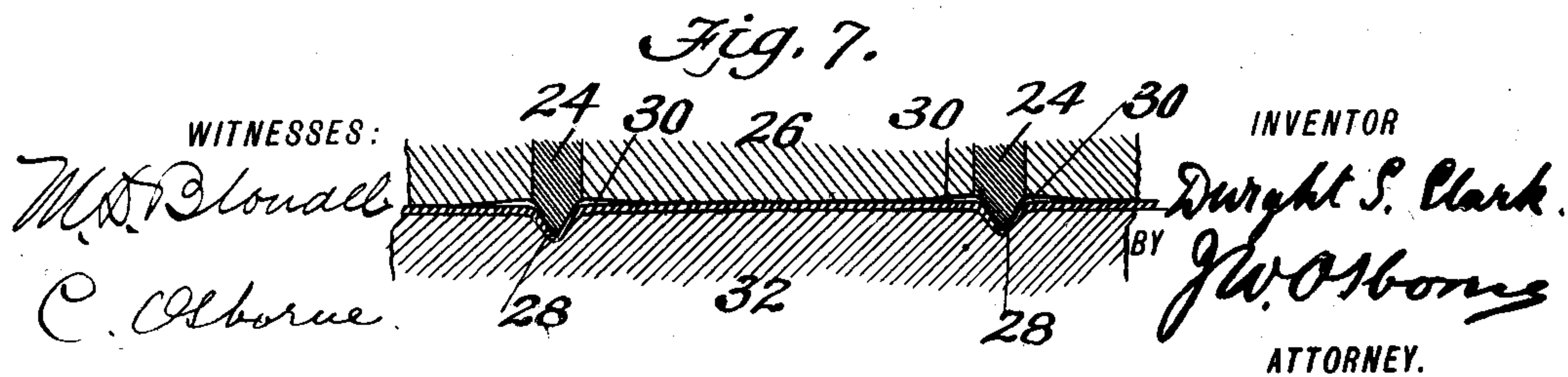
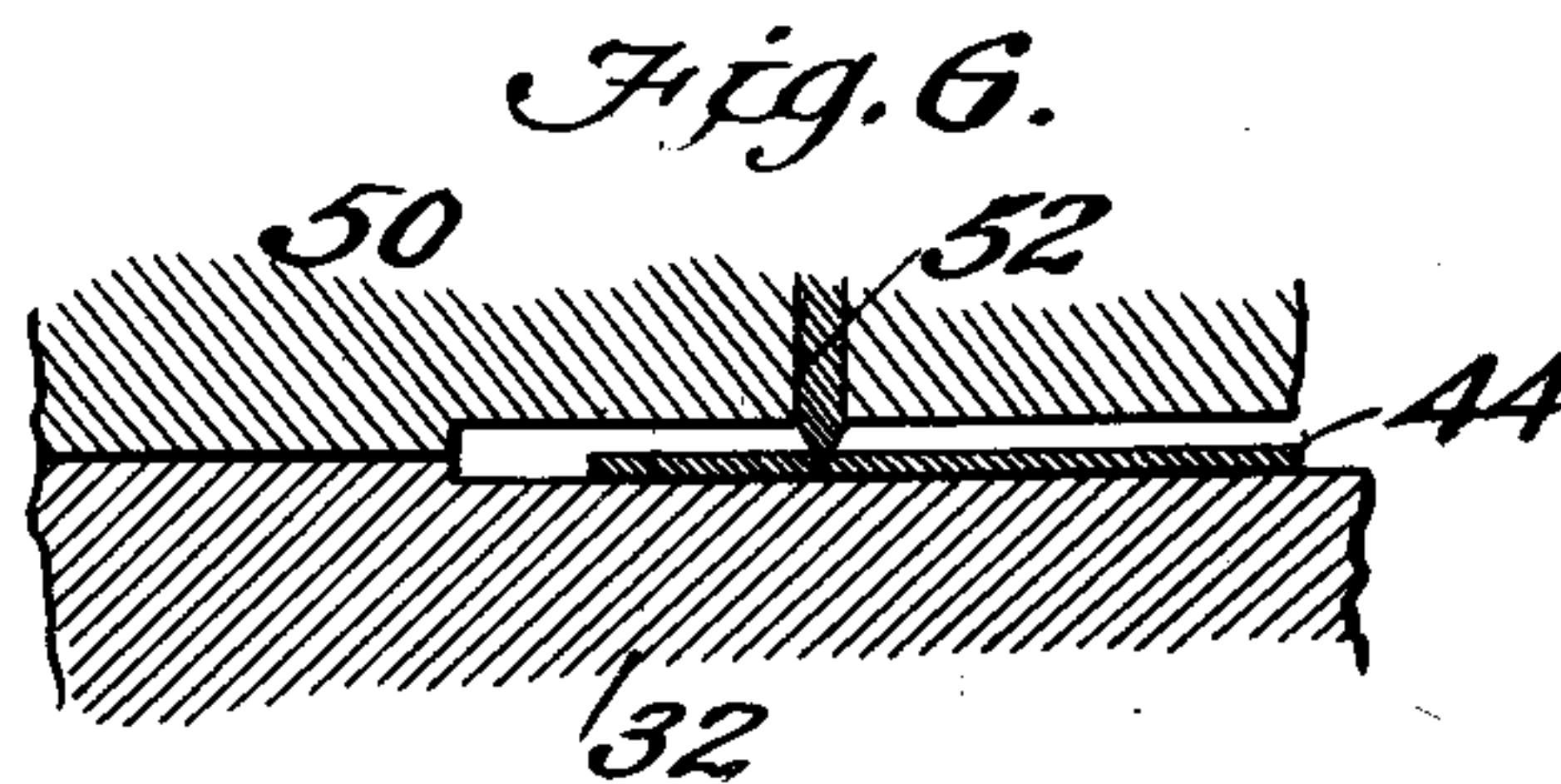
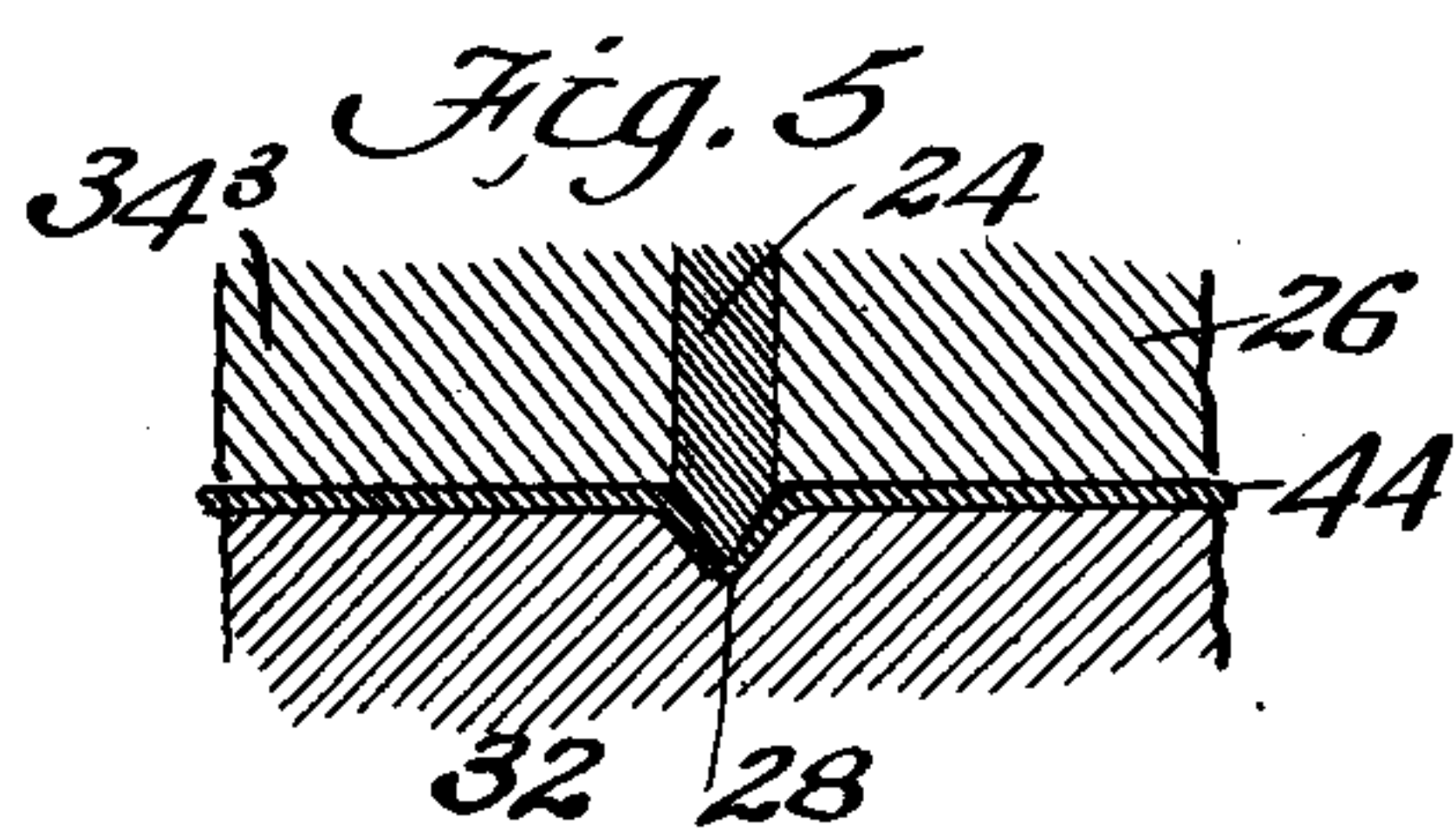
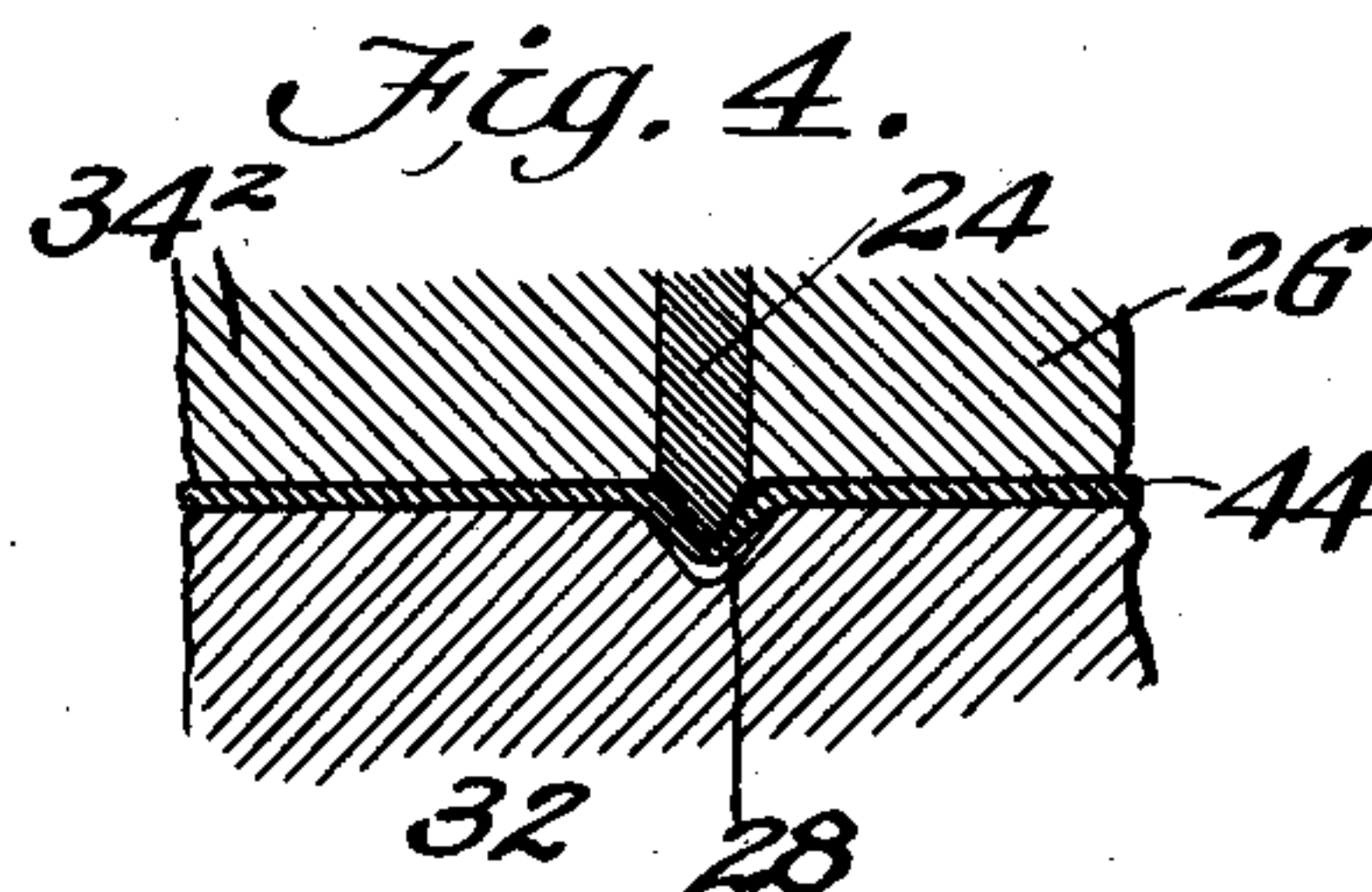
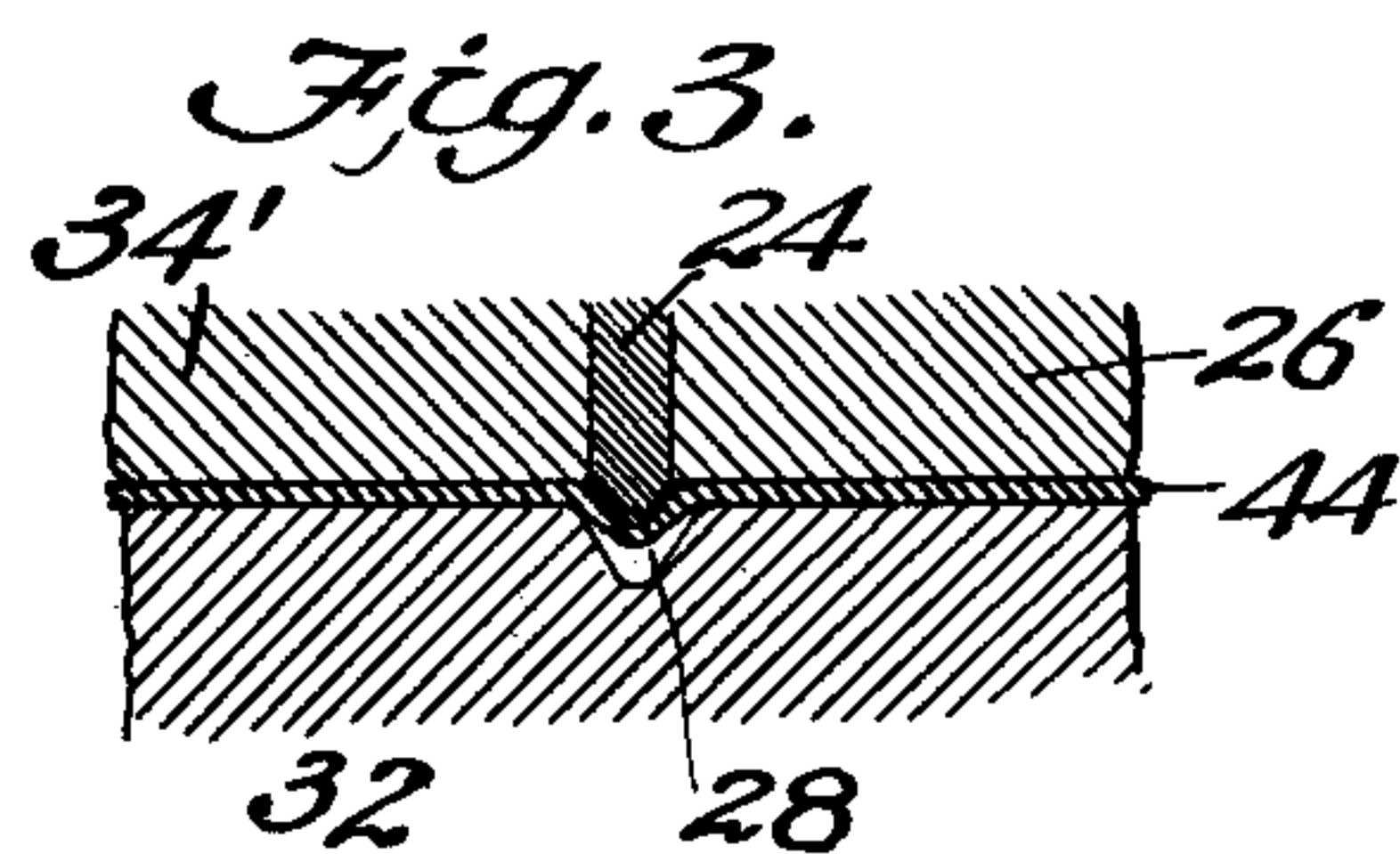
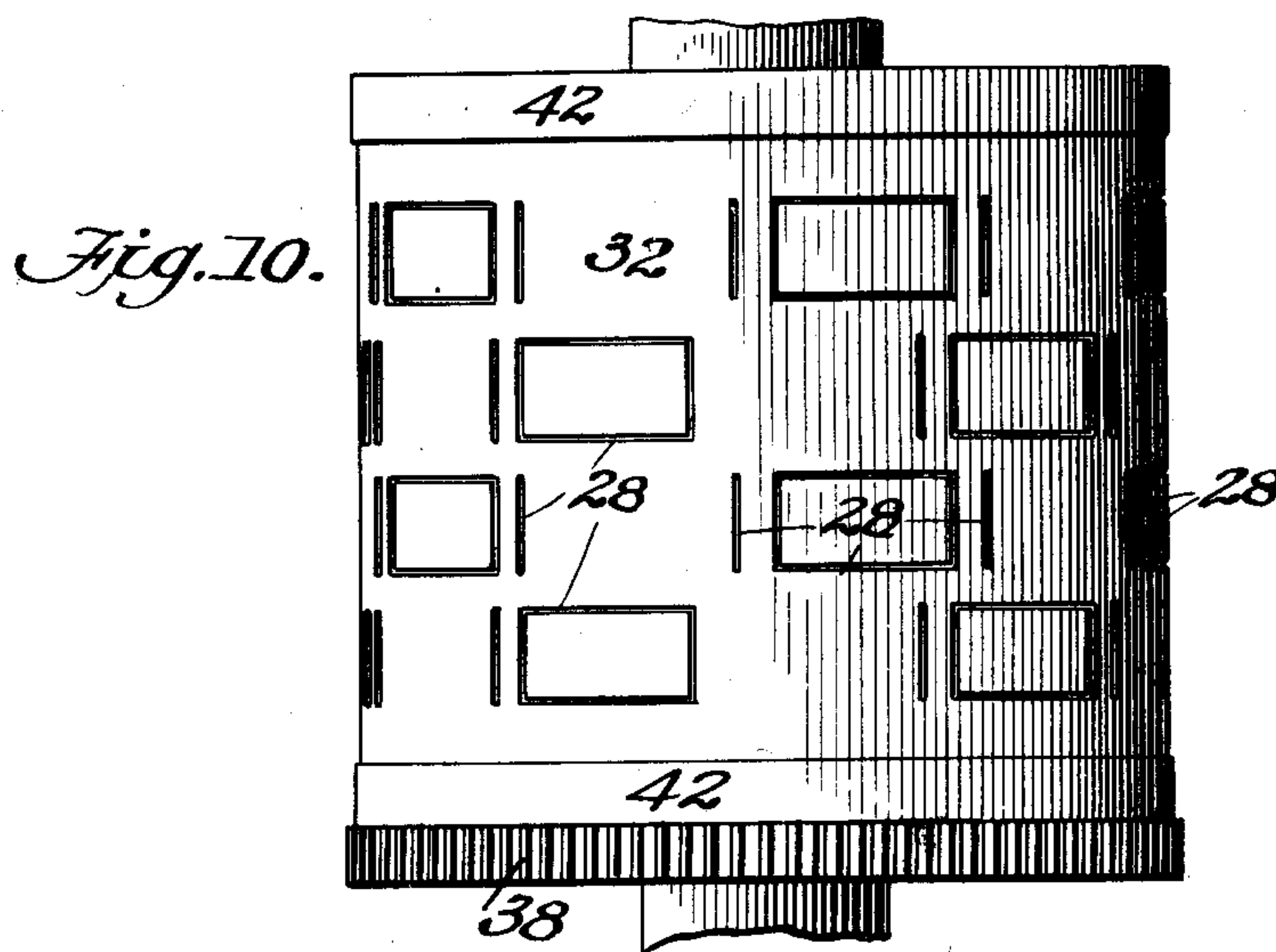
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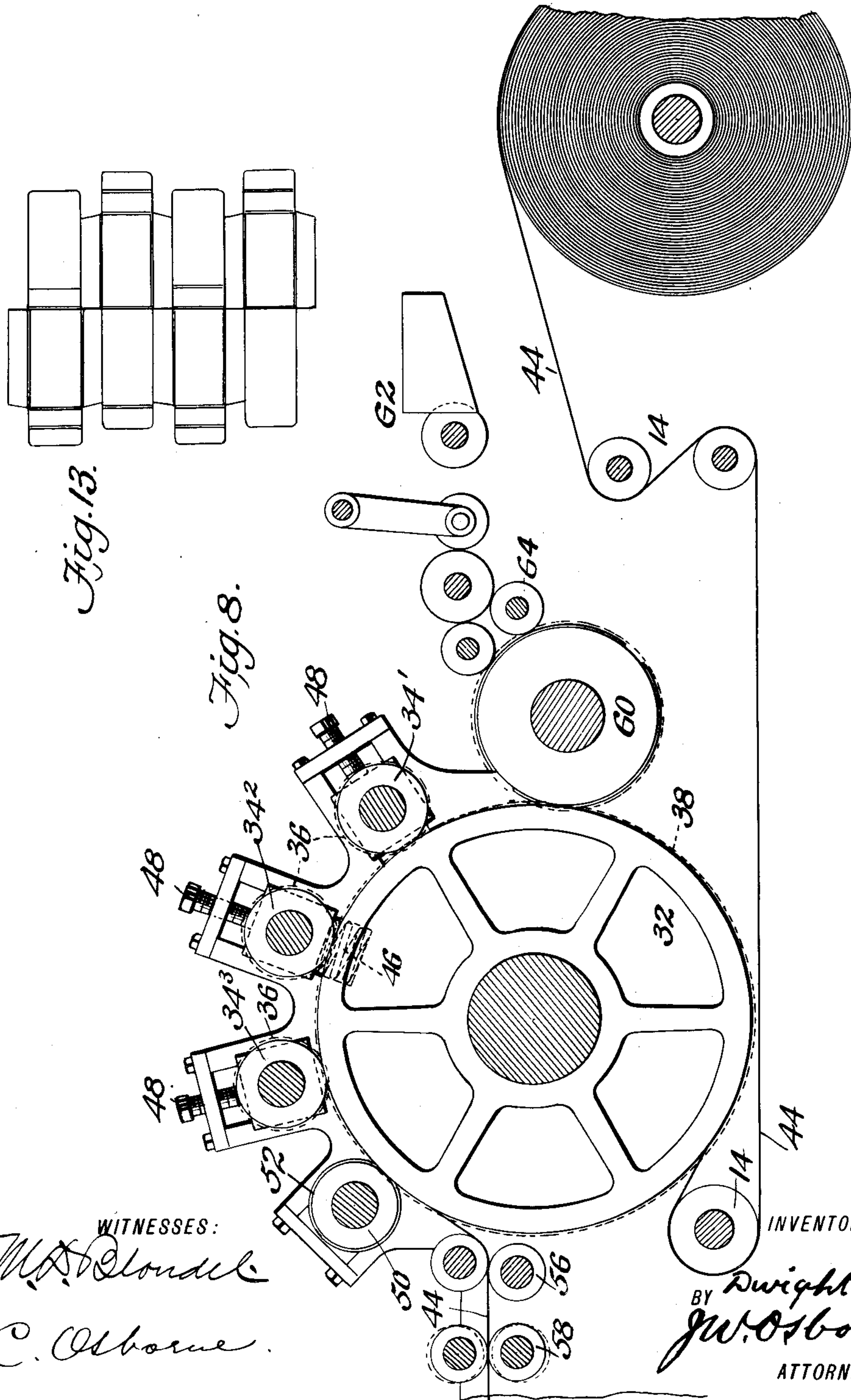
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Patented Oct. 5, 1897.



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(No Model.)

5 Sheets—Sheet 4.

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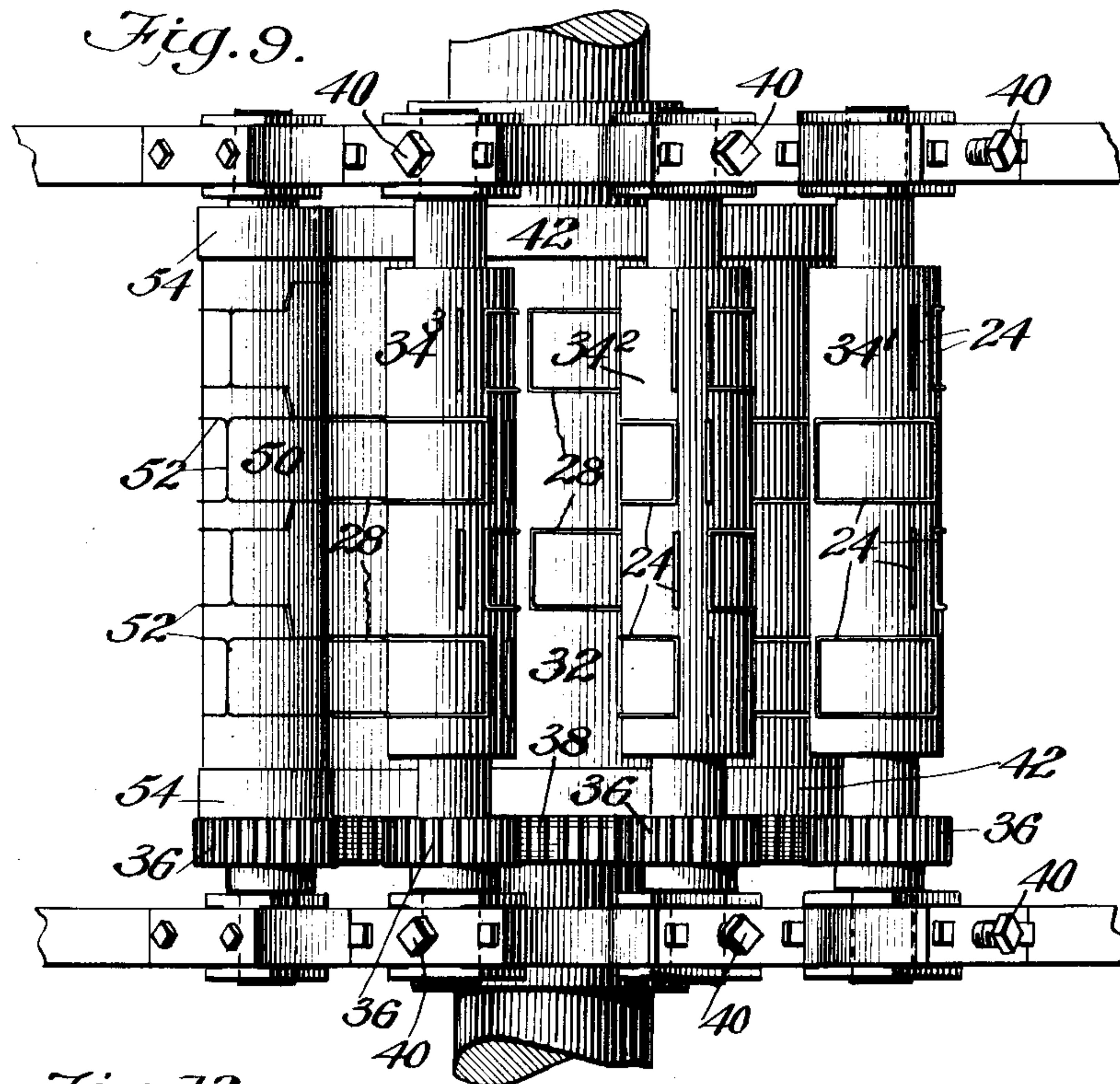


Fig. 12.

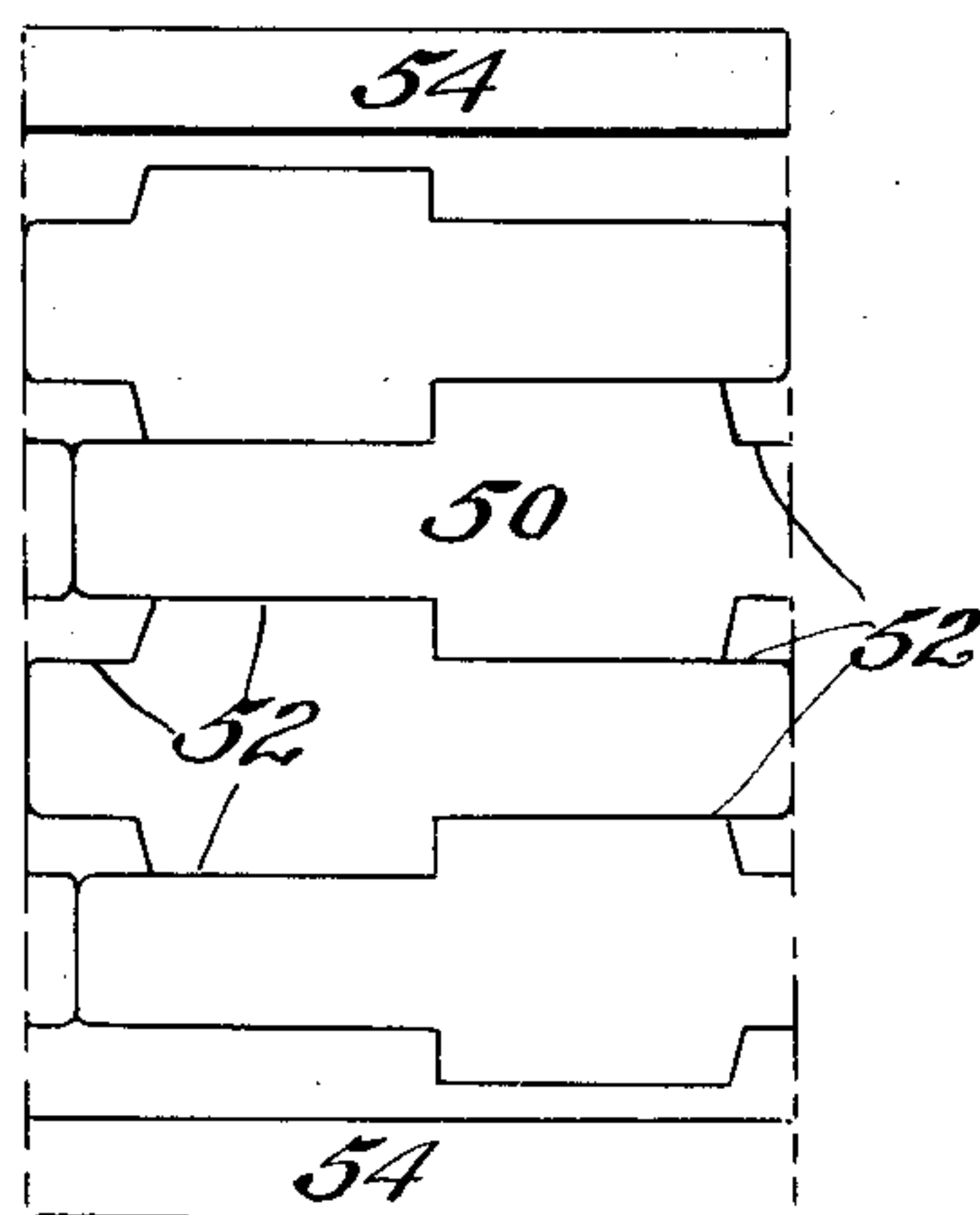
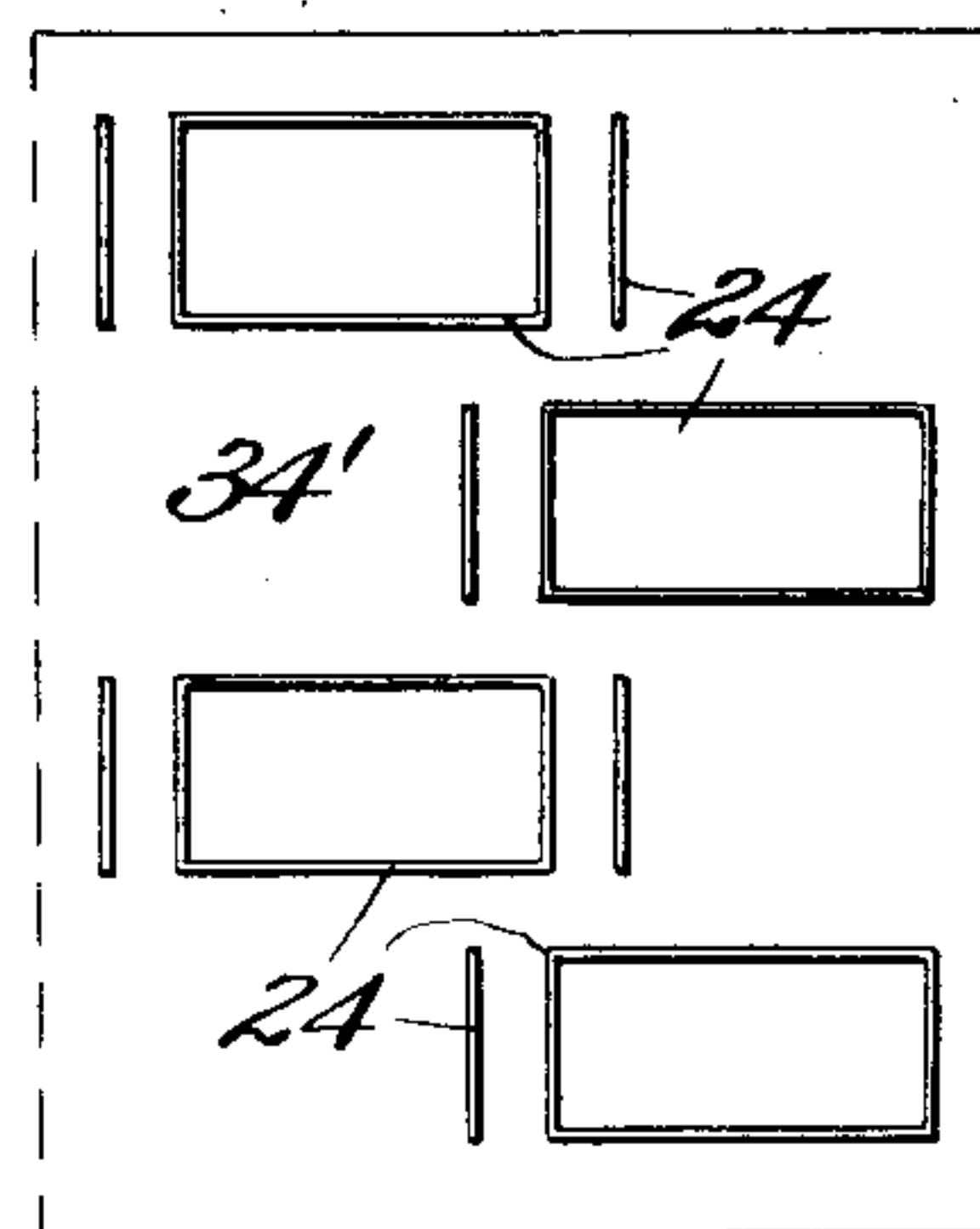


Fig. 11.



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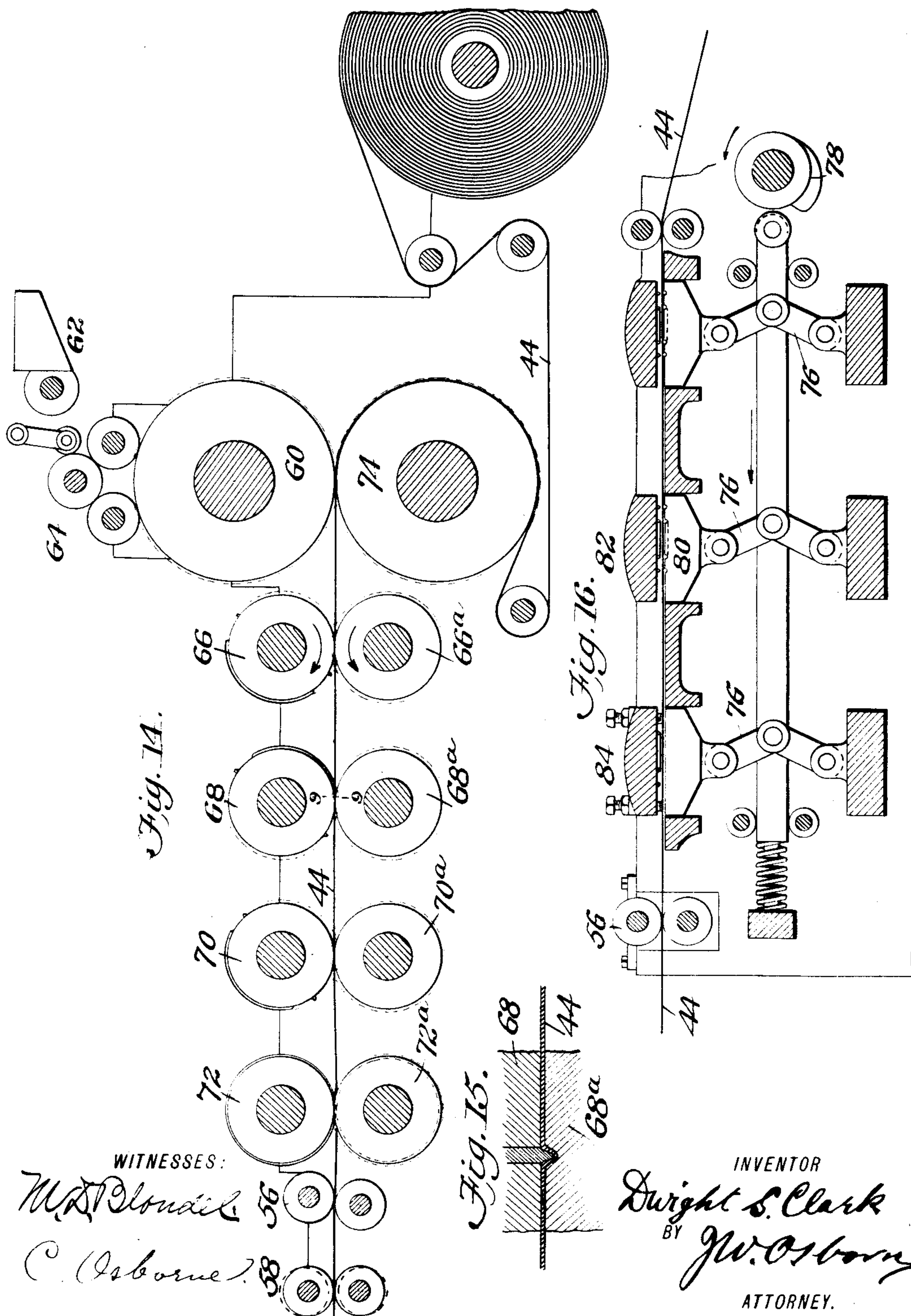
5 Sheets—Sheet 5.

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APPARATUS FOR SCORING, CUTTING, AND PRINTING CARDBOARD BOXES.

No. 591,209.

Patented Oct. 5, 1897.



UNITED STATES PATENT OFFICE.

DWIGHT S. CLARK, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO WILLIAM H. FORBES, OF SAME PLACE.

APPARATUS FOR SCORING, CUTTING, AND PRINTING CARDBOARD BOXES.

SPECIFICATION forming part of Letters Patent No. 591,209, dated October 5, 1897.

Application filed July 30, 1896. Serial No. 601,058. (No model.)

To all whom it may concern:

Be it known that I, DWIGHT S. CLARK, a citizen of the United States, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented an Improved Apparatus for Scoring, Cutting, and Printing Cardboard Boxes, of which the following is a specification.

This invention is related to a large number of machines for making and folding paper boxes. It is especially designed to facilitate the manufacture of such from cheap material difficult to manipulate by established methods, but quite satisfactory for its purpose in other respects.

In the drawings which illustrate my invention, Figures 1 and 2 represent in elevation from the side and in plan my scoring-machine in its simplest form. Fig. 2^a is a longitudinal section of a scoring-cylinder enlarged, with part of another. Figs. 3, 4, and 5 are exaggerated longitudinal sections of parts of the scoring-cylinders with the scoring-rules in cross-section. Fig. 6 is a similar section of a cutting-rule. Fig. 7 illustrates a modified construction of the scoring-cylinder body. Fig. 8 shows in side elevation, diagrammatically, a press for printing, scoring, and cutting small box-blanks from a web. Fig. 9 is a plan of the same. Fig. 10 is a plan view of the large cylinder in the above. Fig. 11 is the face of one of the scoring-cylinders flattened out. Fig. 12 is the face of a cutting-cylinder flattened out. Fig. 13 is a unit piece of cardboard that has been scored and cut with the waste parts removed. Fig. 14 shows, diagrammatically, in elevation a modified form of a printing, scoring, and cutting press. Fig. 15 is a partial section of two opposing cylinders. Fig. 16 shows a modified form of scorer in elevation and partial section.

In the manufacture of paper boxes the cardboard-blanks therefor are cut out by sharp rules or blades set on edge and forced by pressure through the stock in configurations corresponding with the outline which the blanks are to have. While this is being done, those lines upon the blank which cross it where it is subsequently to bend to form the sides and ends of the box are also indented, but not cut, by blunt rules forced

against them to a sufficient depth. The effect of this scoring operation is to stretch, draw out, and rearrange the fibers locally without cutting them and thereby fit them for bending definitely on straight lines without breaking. In the art of box-making these operations have been long practiced with perfect success, and in many cases they are sufficient and satisfactory; but it sometimes happens that box-stock is made of poor material, having a short fiber and little cohesion, and it may then prove to be impossible in the way described to indent the sheet sufficiently with the scoring-rules without breaking its surface and affecting in consequence both the strength and the appearance of the box edges and angles. I accomplish a successful scoring of such poor stock by pressing against the lines to be scored with a blunt rule, but to such a partial extent only as shall produce no overstrain or break. Then in the same indentations I apply the pressure a second time, forcing the blunt rule deeper, then a third time or a fourth, if necessary, into the same depression, whereby the required flexibility without rupture will be reached; for I have discovered that while a sudden impact with the blunt rule will break the fiber if it is forcible enough to do what is wanted a series of gentler cumulative impacts accomplishing a like indentation will not do so, probably because time is allowed for the strained and displaced fibers to recover in virtue of their elasticity and rearrange themselves after one impact and before the next again tries them.

In Figs. 1 and 2 a scoring-machine of simple construction is shown in which stock of the poorest quality may be successfully scored in parallel lines. In this case the sheets (marked 10) are in the form of long strips, and one of them has been fed from the feed-board 12 to the feed-rollers 14 and is passing through the scorer. The indentations in this machine are accomplished by three pairs of scoring-cylinders, (marked 16 and 16^a, 18 and 18^a, 20 and 20^a.) One of these cylinders, 18, enlarged, is shown in longitudinal section, with part of lower roll 18^a, in Fig. 2^a. It will be seen that the upper is the indenting-cylinder, the indenting rules or blades (which take the form

of thin flat steel disks or rings) projecting from the body of the cylinder by the full amount with which they are to enter the paper. It will also be noted that the relief on the upper cylinder corresponds with a depression on the lower or intaglio cylinder. When, therefore, in my scorer the sheet presented by the feed-rolls 14 is caught between 16 and 16^a and is pulled onward by the drawing and delivering rolls 22, the indentations produced by the action of the relief-rule on the upper cylinder and which appears upon the upper surface of the paper has its counterpart in a corresponding projection on the under side of the same, so that the material of which the cardboard is composed is not simply thrust aside to the right and left when the impact of the rule takes place, but is in large part bent downward into the hollow grooves below it and thereby flexed more or less sharply on the blunt edge of the blade which depresses it.

In the machine illustrated in Figs. 1 and 2, while the upper cylinder 16 effects but little, that marked 18, running along the same lines on the paper, does twice as much, presses the stock still farther into the hollows in the cylinder 18^a, and when at last the sheet reaches 20 and 20^a the full indentation is given it, because the rule in relief on the cylinder 20 has the full height above the body of that cylinder. By proceeding in this way I am enabled without loss of time to effect by three impacts what it would be impossible to get of serviceable quality with one, the process of scoring in accordance with my invention being a sequence of acts.

Persons familiar with the art will also perceive that I depart widely from the usual construction of scoring-rolls or any other scoring surfaces or forms. In such the rules stand high—that is, much higher than the thickness of the cardboard to be scored; but in my invention I make the relief offered by the rules such that when the latter have penetrated and displaced the stock downward as far as the rule can depress it then the body of the cylinders (as in the case of 16 and 16^a, 18 and 18^a, 20 and 20^a) shall be respectively in contact with both sides of the stock between them. This provision is of much importance, for the stock being held fast at the time when the rules indent it cannot escape or buckle, and in consequence receives the indentation with precision. This advantage would follow if only a single pair of scoring-cylinders were used, (which with good stock is obviously feasible,) but it is especially valuable when two or more pairs of cylinders are indispensable to do the work upon poor stock, each scoring rule or disk or ring having then to register with the indentation on the paper from the rule that preceded it, wherein it is aided by the fact that the body of each pair of cylinders holds the paper fast at all times.

Figs. 3, 4, and 5 are partial longitudinal

sections of the adjacent surfaces of the cylinder-bodies just described, showing part of the scoring ring or rule 24, the body of the upper cylinder 26, the depression in the lower cylinder 28, and the paper 10, held between the scoring pair. These figures are much exaggerated for the purpose of making intelligible the manner in which the successive scoring takes place. It will be seen that in Fig. 3 the projection of the rule or ring is very little, that in Fig. 4 it is greater, and that only in Fig. 5 is it sufficient to fill the whole of the intaglio groove in the lower cylinder with the depressed stock. As I have explained, stock of very poor quality can be scored by the means set forth herein with so much certainty and success that its inferior quality internally does not manifest itself in the appearance of the finished work; but a still lower grade may also be worked, which I accomplish by cutting away an annular sloping depression on the body 26 of the upper cylinder close to the scoring-ring, as at 30 in Fig. 7. This is so restricted that sufficient of the body of the upper cylinder remains unaffected by it to hold the paper from swerving. The effect of this sloping depression is to render easier the drawing and rearranging of the fibers and other material constituting the stock in the paper to be scored, the conditions being such that the necessary stretch of the material is extended over a much larger area than when it is concentrated substantially over the intaglio groove, and the strain on any one part is thereby decreased, which, as a consequence, decreases the risk of rupture.

In Figs. 8, 9, and 10 my invention is shown in a much more elaborated form. In the machine illustrated in these drawings a completed box-blank of simple construction is cut from the stock presented as a web and the folding-lines are scored at the same time. Advantage is also taken of the necessary thickness of the stock to print upon its face from a form-cylinder adapted for that purpose and constituting an integral part of the machine. In this machine the large intaglio cylinder 32 (see Fig. 10) carries all the depressions which are to be entered in register by the scoring-rules on the small cylinders 34¹, 34², 34³. Each of these scoring-cylinders has upon its surface the rules or projections necessary to score one unit in length of the box-blanks placed side by side. Such a unit is shown in Fig. 13, the waste stock being removed. Fig. 10 shows in plan the intaglio cylinder 32, with its bearers and gear, but removed from the machine.

Fig. 11 represents the surface of one of the scoring-cylinders flattened out, and it is also a unit in length, which goes evenly into the perimeter of the large cylinder 32. The cylinders 34¹, 34², and 34³ are geared to 32, and therefore they return each of them to the same place and each enters all the depressions in every unit of surface that passes under it. The bearings in which the small cyl-

inders run are supported on stiff springs, as indicated at 46, in a very usual way, and by means of the screws 48 the cylinders are set down so as to enter the stock, which is flush with the bearers 42.

As in the machine for parallel scoring, hereinbefore described, the cylinder 34' enters the cardboard least, 34² more, and 34³ the most of all three. Beyond these scoring-cylinders is the cutting-cylinder 50. This carries upon its surface the sharp rules or blades 52, which are shown in Fig. 9 and also in Fig. 12, where the whole surface of this cutting-cylinder with its bearers 54 is shown flattened out. When this cylinder is set down solidly on the bearers, the cutting-rules register with the scoring already done upon the web 44, but the sharp rules do not go quite through the cardboard, enough of cohesion being left between the blanks to admit of their leaving the machine still as a web by way of the guide-rolls 56. Beyond these the breaking-rolls 58 run continuously at a surface speed a little in excess of that at which the paper is traveling, and by reason of their closing suddenly at short intervals on the paper, by the action of mechanism well known in this art for the purpose, they tear off and separate the blanks, which fall into a receptacle below.

As already intimated, this machine is especially designed for combination with a form-cylinder adapted to do a limited amount of printing on the outside of the box-blanks. The cylinder for this purpose is shown at 60. It is twice the diameter of a scoring-cylinder, and each half prints on the web 44 as it passes in register with the blanks and always on the same relative place. This form-cylinder is driven by the intaglio cylinder, as all the others are driven. It is inked from the fountain 62 by the form-rollers 64. It will be readily seen that whatever printed matter it is desirable should appear upon a paper box will not cross a cut or scored line, and I have furthermore discovered that such printing as is desired in one color upon the outside of a box can be well done without any packing on the impression-cylinder, (which the intaglio cylinder becomes under the circumstances,) the box-stock itself acting as packing. Ordinarily it is the practice to print such cardboard as is used for paper boxes upon packed surfaces, but it would not do to use a blanket or other packing in this machine, as it would immediately be worn and cut to pieces and, apart from that, would utterly defeat the very accurate register of the rules essential to the successful prosecution of my invention. I print accordingly on the bare metal, relying on the thickness of the stock employed, (which is the same as the height of the bearers,) making it act, so to say, as a packing for itself.

The machines described are sufficient for a great deal of work; but they obviously admit of much change without affecting, essentially, the principles involved.

In Fig. 14 a modified construction of a box-blank scoring and cutting machine, in combination with a relief-printing apparatus, is shown diagrammatically in side elevation. In this machine the three relief-cylinders 66, 68, and 70 run against the intaglio cylinders 66^a, 68^a, and 70^a, respectively, each pair scoring a complete unit of the blanks distributed upon the web 44. Analogously to the previous case the cylinder 72 has sharp rules upon it which cut out the blanks against the metal surface of 72, or, rather, they cut through the stock almost to the metal, being, as before, kept from it by the bearers on this pair of cylinders for, as before, the double purpose of keeping the rules sharp and causing the web to leave the cutters still in a connected and manageable state to the rolls 56 and 58. This machine takes the stock from a roll, and it passes to the scorers first over an impression-cylinder 74, where it is printed twice for every revolution of the form-cylinder 60, or once for every unit of length. All these several pairs of cylinders are geared together as pairs, and all of them are driven by one horizontal shaft carrying bevel-gears meshing into corresponding bevel-gears on the cylinder-shafts in a manner well understood by skilled mechanics and not herein claimed.

From what has been said and from the fact that I have hitherto shown and described rules on cylinders only it must not be inferred that my invention is not applicable to other well-known methods of scoring.

In Fig. 16 a diagrammatic scoring-press is shown in which the web 44 is fed intermittently between bed and platen presses worked by toggles 76 and the cam on the shaft 78. The platens 80 rise in this case, and the rules in the beds 82 above them indent the stock. The two first may be regarded as capable of doing the scoring successfully and the last device, acting intermittently, draw the web through a unit of the work upon it every time. The stop-screws 84 are to prevent the cutting-rules from blunting themselves on the platen and really play the part of the bearers 42 and 54 in the other machines.

It should be explained that the term "rule" is retained in this specification as indicating a projection for cutting or scoring in whatever way the same may be made, because a printers' rule, sharp and blunt, was and still is in universal use for that purpose; also, it should be understood that paper-stock which has been scored or indented is folded subsequently in making the boxes so that the depression becomes the external angle of the box and not, as might be supposed, the internal, which would result from still following up the bend given the stock by the indenting-rule. One effect of this is to secure the most stretched and weakest fibers in the indented stock a release from strain when the scoring is completed, which the subsequent folding of the box diminishes still further.

4
In this specification I have invariably shown the scoring-rules as registering with and entering corresponding depressions in the surface against which the scoring is done, so that the cardboard-stock is depressed and forced into such depressions or grooves. This course has been followed, because the intaglio surface is of controlling importance in the production of good work; but I do not wish it understood in consequence that a scoring done against a flat or ungrooved cylindrical surface would have no effect or give no aid in the folding of a paper box. On the contrary, when the stock is very thick the effect is considerable, and in all cases a line scored upon a flat surface will determine the line on which the stock will bend, though it may and probably will break more or less in doing so, even when my method of progressive scoring is used to help it. The increased flexibility of a line scored upon a hard surface seems to be due to the compression and thinning of the stock under the rule, which simply on that account must bend more easily than other parts of the blank, but also to the actual destruction of some of the fibers caused by the heavy and exceedingly local pressure and the weakening of the cardboard accordingly. The best possible result that can be had without the grooved surface, which embosses the under side of the stock, is far short of what is wanted, and the intaglio surface can rarely be dispensed with profitably.

In the foregoing the term "cardboard" as employed is meant to include the several varieties of stock used in the manufacture of folding paper boxes and like receptacles. One such very common variety is composed of a short and dark-colored filling covered or coated at the time of its manufacture (generally on one side only) with a thin paper of better quality both in texture and color. The indentation of such stock takes place upon the covered side, which becomes the outside of the box, and any rupture of such covering weakens its angles and shows at once the dark filling below. This explanation is made to show the importance of progressive scoring described and claimed in this specification.

50 What I claim is—

1. A machine for scoring cardboard having a plurality of scoring-rules of similar outline, a bed on which the cardboard rests, and means for actuating the different rules successively to operate on the same line of the cardboard, the succeeding rule compressing the same scoring-line to a greater extent than the preceding rule, in combination substantially as described.

2. A machine for scoring cardboard having a plurality of scoring-rules and a plurality of corresponding intaglio depressions, means for actuating the rules to operate in succession on the same portion of cardboard and compress it to successively greater extent into the successive depressions, and means for moving the cardboard from one operative

position to another, all combined substantially as described.

3. In a machine for scoring cardboard, a plurality of blunt scoring-rules of identical outline but progressively greater projection, a similar number of surfaces having intaglio depressions corresponding to the outline of the scoring-rules, means for passing the cardboard from one scoring couple to the succeeding scoring couple, and means for simultaneously compressing scores of like outline, but of progressive compression on the cardboard, in combination substantially as described.

4. In a machine for scoring cardboard, a plurality of cylinders having scoring-rules of like outline but of successively greater projection relatively to the opposing cylinder, a similar number of cylinders coupled in surface movement with the rule-cylinders, and means for driving the cylinders at similar surface speed so that the same line of cardboard shall be acted on successively by the rules and compressed to successively greater extent, in combination substantially as described.

5. In a machine for scoring cardboard, a plurality of pairs of cylinders coupled together to rotate with equal surface speed, one cylinder of each pair having a blunt scoring-rule projecting therefrom, the succeeding cylinder having a rule of similar outline but greater projection, the cylinders coupled to said rule-cylinders having intaglio depressions corresponding in outline to the rules, and means for driving all the cylinders so that the rules on succeeding cylinders shall operate on the same line of cardboard as the preceding rule, all combined substantially as described.

6. An organized machine for scoring and printing cardboard, having a plurality of blunt scoring-rules of similar outline but of successively greater projection arranged to successively compress the same lines of cardboard as the sheet moves from one to the other, and a printing couple having form and impression surface actuated at similar speed as the scorers, to print on the cardboard as the scoring progresses, all combined substantially as described.

7. In an organized machine for scoring, printing, and cutting cardboard, the plurality of cylinders driven at similar surface speed and having scoring-rules of like outline but successively-increasing projection to operate on the same surface of the cardboard, a printing and an impression cylinder moving at the same surface speed and connected to the scoring-cylinders, and coupled cutting-cylinders driven at like surface speed, all arranged to operate on a continuous strip of cardboard, substantially as described.

8. In a scoring-machine, a scoring-cylinder consisting of blunt rules on edge inclosed and supported by the cylinder-body and extending beyond the general parallel surface of said

body to the extent only that the cardboard is entered or displaced by the rules, with inclined annular spaces or depressions in the cylinder-face close to each projection; in combination with an intaglio cylinder placed oppositely in relation to the scoring-cylinder and registering therewith, but removed therefrom by nearly the thickness of the cardboard to be scored; substantially as described.

9. In a scoring-machine two or more scoring-cylinders in sequence having rules in relief upon the surfaces increasing in elevation from the first cylinder to the last; in combination with and geared to a large intaglio cylinder provided with grooves to receive the projecting rules upon the scoring-cylinder in register, with means for feeding the cardboard to be scored to and under the scoring-cylinders, and with means for driving all the cylinders; substantially as described.

10. A box-blank machine consisting of the following elements: two or more scoring-cylinders acting in succession; in combination and in operative proximity with an intaglio cylinder and in register with the depressions

in the same; with a cutting-cylinder also in operative relation and in register with the intaglio cylinder; with bearers on the latter and on the cutting-cylinder to keep the cutters positively from actual contact with the metallic surface cut against; and with means for conveying the cardboard to and from the machine; substantially as described.

11. A box-blank machine consisting of the following elements: a form-cylinder carrying printing matter in relief, in operative relation with a bare intaglio cylinder, provided with bearers and in combination with the same; with two or more scoring-cylinders placed in operative proximity to the intaglio cylinder and in register therewith; with a cutting-cylinder having bearers and registering with the intaglio cylinder, with means for inking the relief matter on the form-cylinder; and with means for conveying the cardboard to and from the machine; substantially as described.

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Witnesses:

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