(No Model.) 3 Sheets—Sheet 1.

E. DUMMER.

PAPER FEEDING MECHANISM.

No. 414,147. Patented Oct. 29, 1889.

Fig. 4.

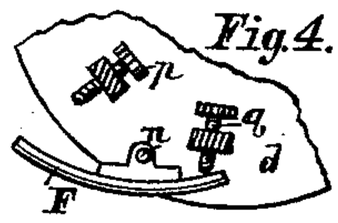


Fig. 3.

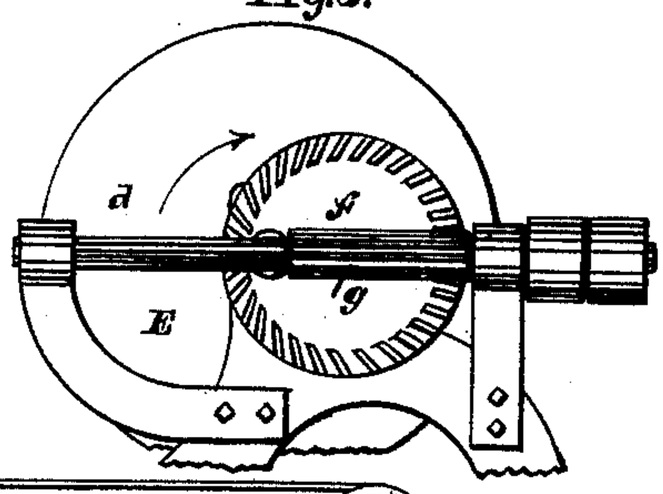
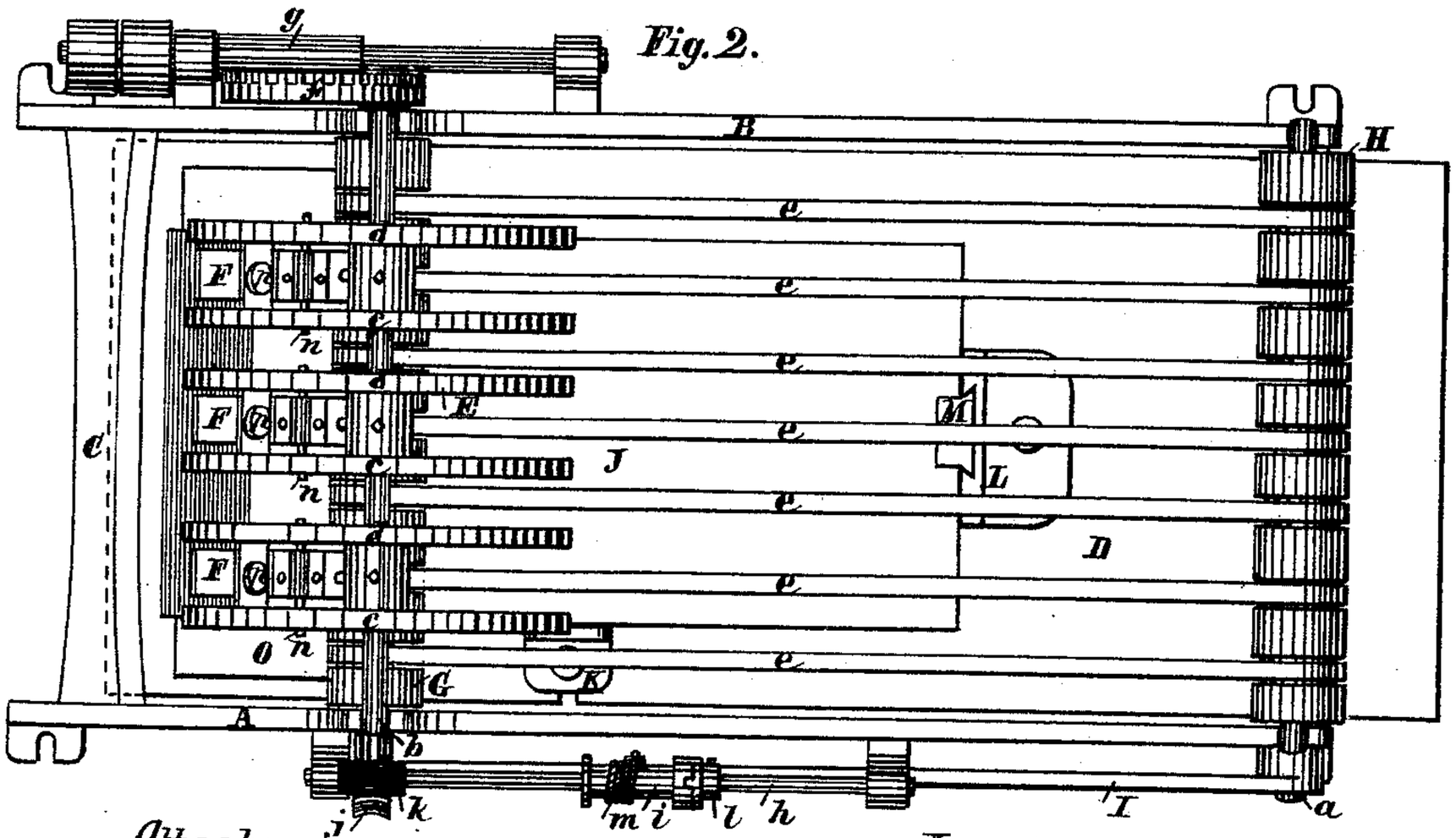


Fig. 1.

Fig. 5.

Fig. 2.



Attest;

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C. H. Richardson.

Inventor;

Edward Dummer.

(No Model.) 3 Sheets—Sheet 2.

E. DUMMER.

PAPER FEEDING MECHANISM.

No. 414,147. Patented Oct. 29, 1889.

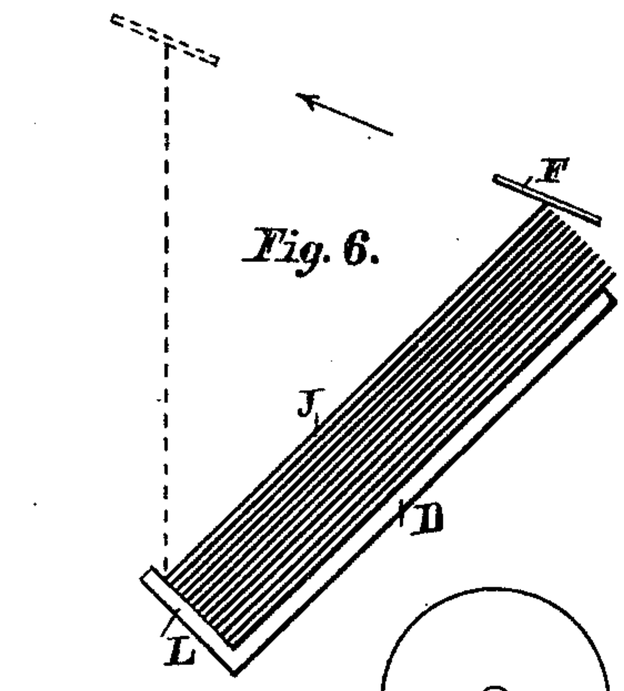

Fig. 6.

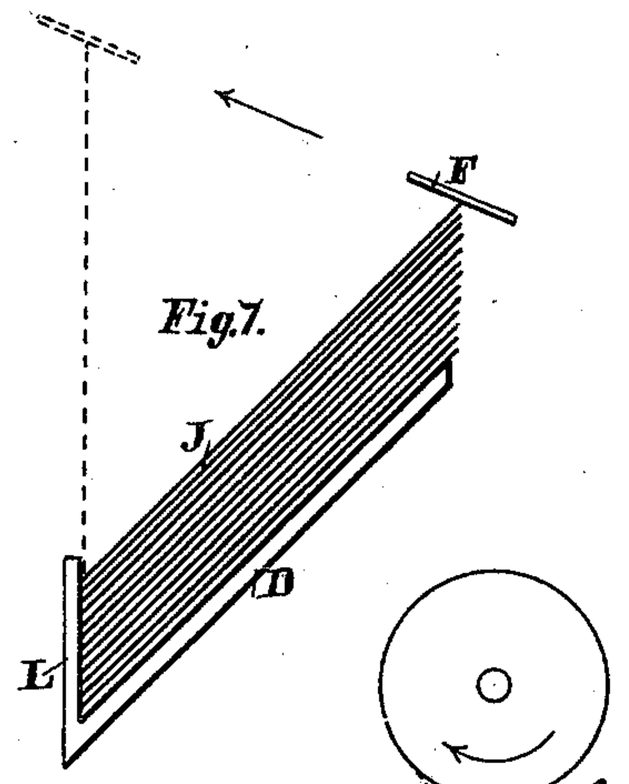

Fig. 7.

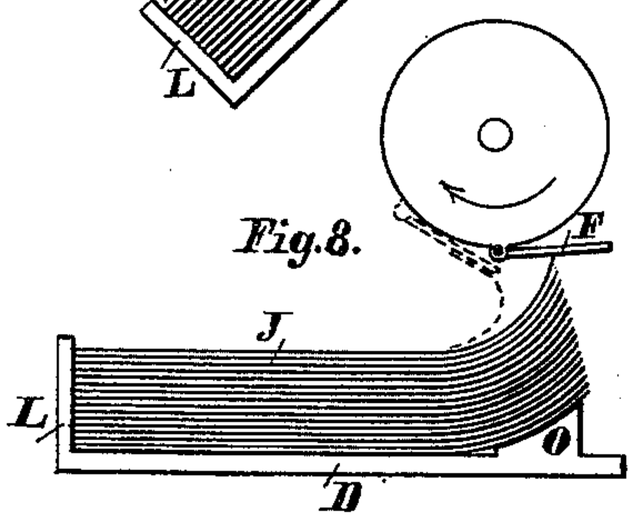

Fig. 8.

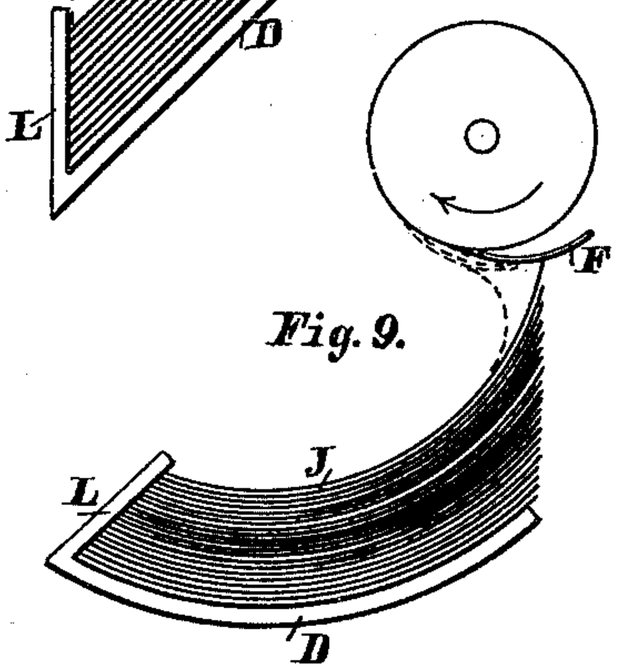

Fig. 9.

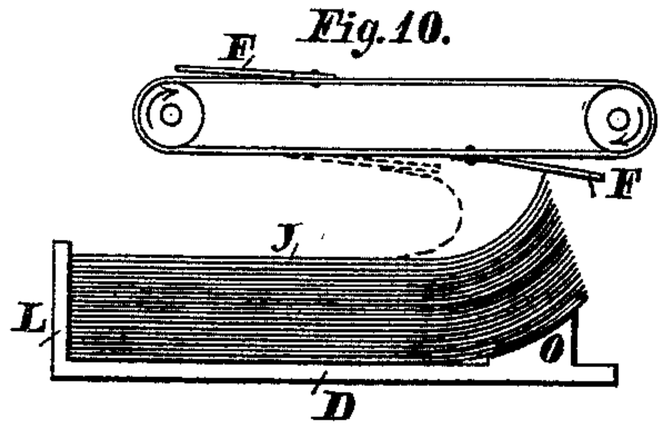

Fig. 10.

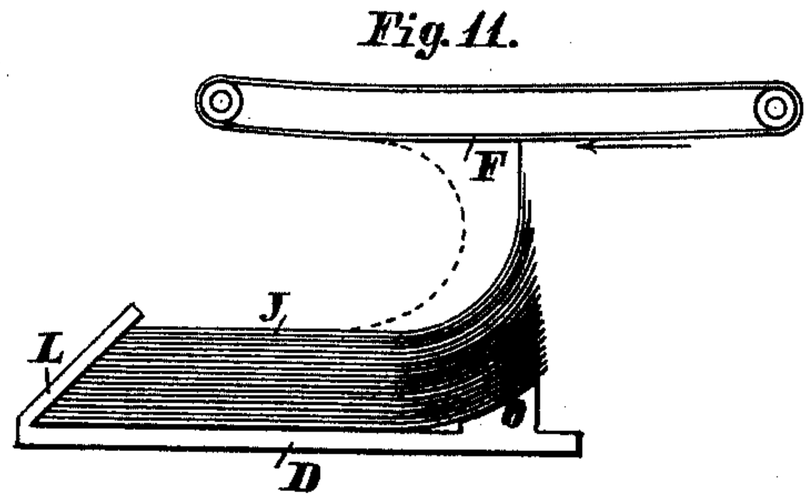

Fig. 11.

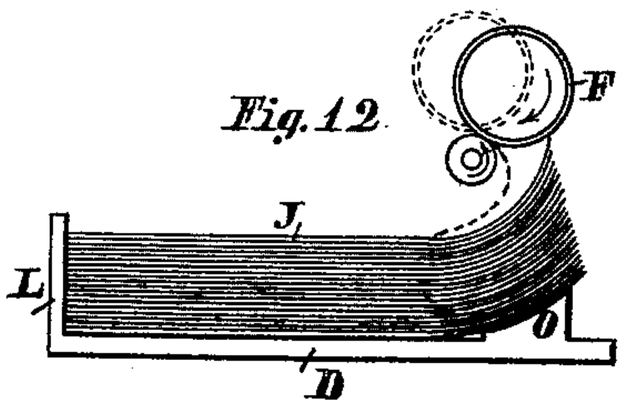

Fig. 12.

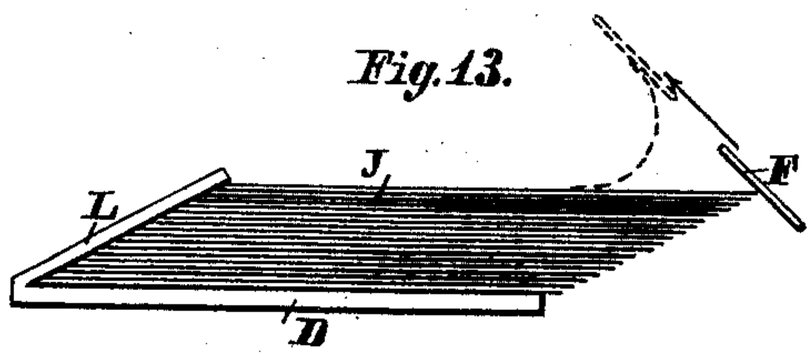

Fig. 13.

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(No Model.) 3 Sheets—Sheet 3.

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PAPER FEEDING MECHANISM.

No. 414,147. Patented Oct. 29, 1889.

Fig. 14.

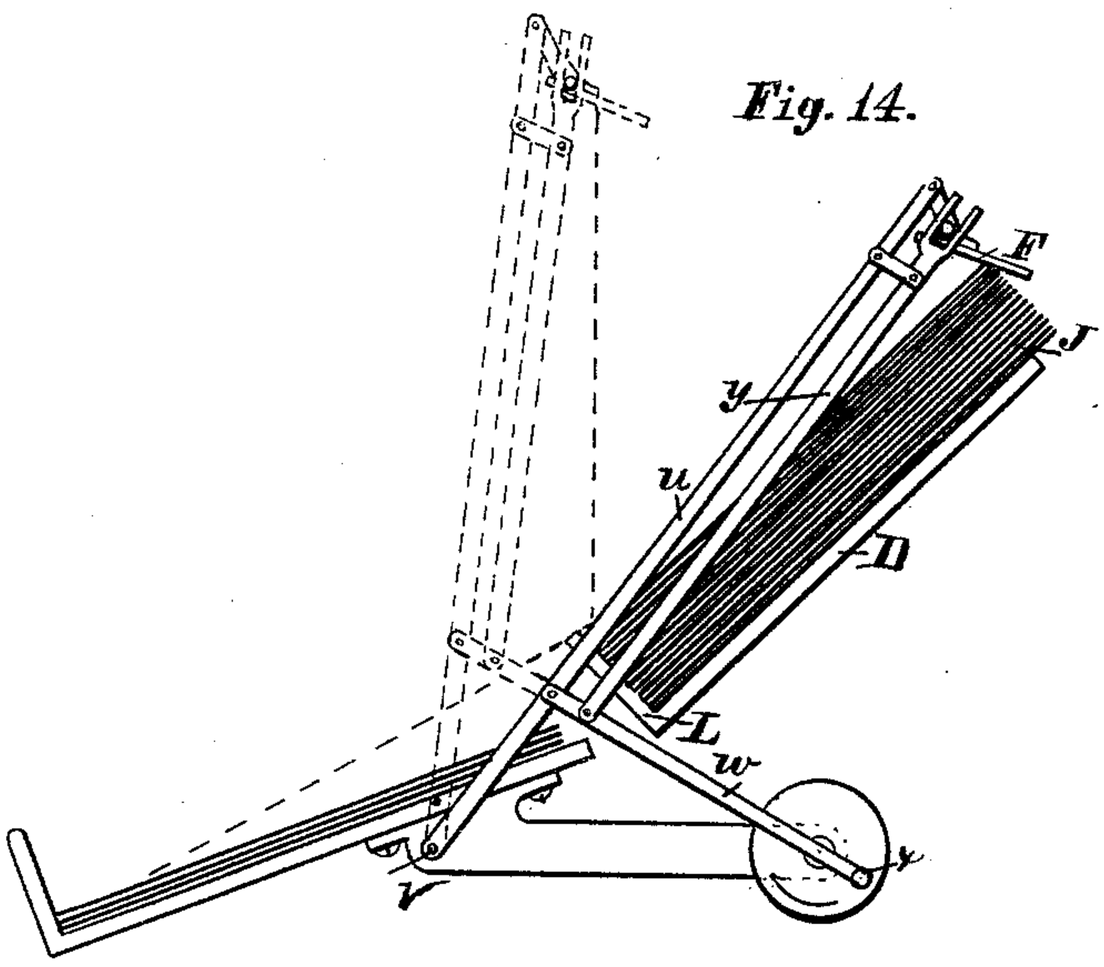


Fig. 15.

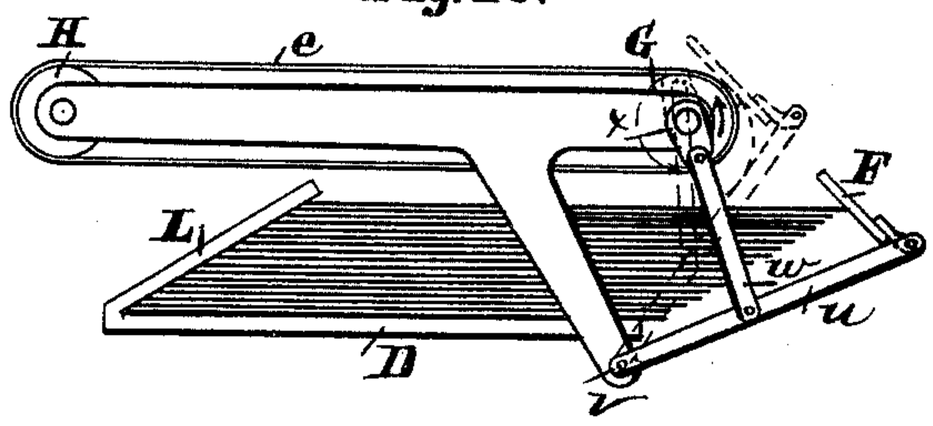
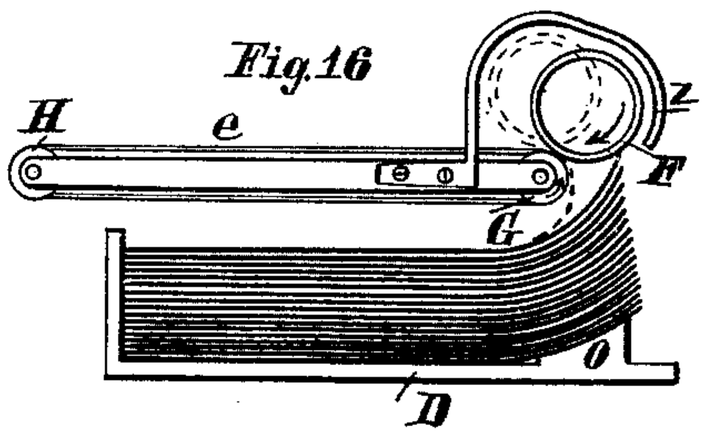


Fig. 16



Attest;

John B. Aitken,

Geo. J. Mann.

Inventor;

Edward Dummer,

UNITED STATES PATENT OFFICE.

EDWARD DUMMER, OF AUBURNDALE, MASSACHUSETTS.

PAPER-FEEDING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 414,147, dated October 29, 1889.

Application filed April 30, 1887. Serial No. 236,722. (No model.)

To all whom it may concern:

Be it known that I, EDWARD DUMMER, a citizen of the United States, residing at Auburndale, in the city of Newton, county of Middlesex, and State of Massachusetts, have invented new and useful Improvements in Paper-Feeding Mechanism, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to machines for removing sheets of paper singly from a pile or "bank" of sheets and delivering the same as required to be transferred to ruling-machines, printing-machines, &c.

My invention consists, primarily, in an instrument having the nature and office and operated as hereinafter set forth, and which is herein called a "finger."

It also consists in the other novel devices and in the novel combinations of devices hereinafter described.

In the drawings, three sheets, Figure 1 is a side elevation of a machine in and by which my invention may be successfully carried out. Fig. 2 is a plan of the same. Fig. 3 is a side view of the mechanism for obtaining an alternate fast and slow motion. Fig. 4 shows a side view of one of the fingers, and illustrates the manner of supporting and adjusting the same; and Fig. 5 is a face view of a finger. Figs. 6 to 16, inclusive, being the illustrations on Sheets 2 and 3, will be explained hereinafter as required to set forth more fully than can be done by the figures on Sheet 1 the nature and office of the finger, the improved method of and means for banking the sheets, and such modifications as appear to need special description.

Referring now to Sheet 1, the frame of the machine consists of the side portions A and and B, suitably stayed by cross-pieces, as the cross-piece C. It is desirable that this frame should be of such form as to present no obstruction to prevent readily placing the bank of paper on the table D. This table is pivoted at *a*. A shaft *b* is supported in suitable bearings at the sides of the machine and bears that which, when considered as a whole, may be regarded as a cylinder. This cylinder E is preferably made up of as many pairs of disks *c* and *d* as may be necessary. Each pair of disks supports and carries a finger F. For feeding sheets of paper of not great width only one finger, and hence only one pair of disks, is necessary; but for wider sheets two or more may be required. Three fingers and three pairs of disks are shown in the drawings of the machine, each pair being adjustable on the shaft *b*, a set-screw being shown in the hub for that purpose. Under the cylinder E is a roller G, the two gripping a sheet when placed between them. When each sheet, after having been removed from the bank, is to be carried to a distance, tapes or endless bands *e* may be employed, as is customary. They may extend around the roller G and a roller H, the latter located at the distance required from the roller G.

The motive power may be applied directly to the shaft of the roller G, and preferably so, to make the simplest machine and when great speed is not a desideratum. Revolution of the roller G will cause revolution of the cylinder E. The roller H will also be revolved by means of the tapes or bands *e;* but when rapid feeding is required a varying motion is imparted to the cylinder E, so that at one part of each revolution the motion may be slow, for the purpose hereinafter specified, while the full revolution may be in a very short space of time. This may be done by means of the well-known mechanism comprising an eccentric toothed wheel *f* and a toothed cylinder *g*. The power being applied to the shaft of the cylinder *g*, the cylinder E will be revolved, causing revolution of the roller G. A shaft *h* bears a drum *i*, and may be revolved by a gear *j*, which engages with a worm *k* on the shaft *b*. The drum *i* may be caused to revolve with the shaft *h* by means of a clutch *l*, fastened to this shaft, or may remain stationary or be revolved independently of the shaft by being disengaged from this clutch. The clutch and drum may be adjusted lengthwise on the shaft *h*, a set-screw being shown in the clutch for this purpose. A lever I is pivoted at *a*, and is connected rigidly with the table D. A rope or chain *m* has at the lower end an adjustable connection with the lever I, as shown, and may wind at the upper part on the drum *i*. Each finger F may swing freely on or in the cylinder E, being pivoted by means of a shaft or pins *n* in the disks *c* and *d*. The body of a finger F may be adjusted lengthwise, so as to be more or less out of balance on the shaft or pins *n*, by means of set-screws *o*, which extend through a slot in

the finger and into a block on the shaft or pins *n*, as shown. The limit of the distance which the finger may swing in either direction—that is, to carry the outer end outward from or inward between the disks *c* and *d*—may be gaged and fixed by means of the set-screws *p* and *q*. The outer surface of the finger F should be a friction-surface, and may be, to produce the required friction, slightly rough. Rubber slightly corrugated or roughened presents a good effective surface.

The bank of paper J is placed on the table D against a gage K or gages, which need be only at one of the two sides. One end of the bank is placed against a gage or bracket L. A pressure-block M, preferably beveled at the lower side, as shown, bears on the bank at this end, and may move downward as the bank is lowered, being guided by the gage or bracket L. Its pressure may be increased by a weight N. The block M prevents the sheets from being accidentally displaced at this end. It is preferred that the edge of each sheet at the other end project somewhat beyond the edge of the adjacent lower sheet. This may be caused by bending or curving the bank. An adjustable block O under this end of the bank, and which may be regarded as part of the table, will, together with the body of the table, support the bank and preserve its shape when bent or curved, as shown. The outer edges of the sheets forming the bank and the central line of the cylinder E should be approximately at equal distances from the pivot *a* of the table D, and this distance should be of proper length with reference to the distance of the line of contact of the cylinder E with the roller G from said pivot, in order to have each sheet of paper gripped by this cylinder and roller before the finger loses its hold upon the sheet. The curvature of the sides A and B opposite the edges of the sheets, being a part of a circle swept from the center *a*, may serve as a guide when placing the bank in the machine. A gage of such curvature may be placed opposite any desired part of this end of the bank. Power being applied, as stated above, revolution of the drum *i* will cause the rope *m* to be wound up, and hence the table D to be swung upward to bring the edge of the upper sheet of the bank within range of the finger or fingers F. The drum *i* and clutch *l* being suitably adjusted on the shaft *h* and the rope *m* on the lever I, the swinging movement of the table and bank may be in proportion to the lowering of the bank caused by removing sheets therefrom. At a part of each revolution of the cylinder E the finger or fingers F will be brought in contact with the edge of the uppermost sheet, the face of the finger or fingers meeting said edge. Each finger will press against this edge by gravity, since the outer end of the finger is at greater distance from the shaft or pivot-pins *n* than the inner end. Owing to the friction of the finger on the edge of the sheet that portion of the sheet near this edge will be carried along by the finger until the sheet is gripped between the cylinder E and roller G, the sheet being moved somewhat in a direction as if rolled upon itself, and substantially as indicated by the dotted line at *r*. The sheet will then be lifted and removed from the bank by the cylinder and the roller G and by the tapes or bands *e* carried and finally deposited onto a receiving-table or platen beyond the roller H.

In order that the finger may be sure to engage with the edge of the sheet and not slip thereon, it is desirable that the motion of the finger should be moderately slow while it is in contact with said edge. After the sheet has been gripped by the cylinder and roller the movement may be very rapid while the sheet is being removed from the bank and the finger returned to the position required to engage with the next sheet. Such movements are provided for by the toothed cylinder and eccentric toothed wheel above specified. The finger F being pivoted, the outer end will be swung between the disks *c* and *d*, so as not to impede the movement of the cylinder E upon and with the roller G. When the finger has passed over the center of the cylinder E, it will be swung by gravity, its outer end being carried outward into position to meet the edge of the next sheet. Thus the operation will continue until the bank is exhausted and each sheet has been carried singly to the required place of deposit.

It is the office of the table D to support the bank and to bring the edges of the sheets within range of the finger. It should not, however, be understood that it is needful that the movement of the table after the removal of each sheet should be just equal to the thickness of a sheet, or just equal to the distance from the edge of one sheet to that of the next. The edges of quite a number of sheets may be so brought at once within such range of the finger that they will be operated upon individually by the finger and removed singly from the bank. In fact, were the bank not of great depth the table D might be fixed in a suitable position to remain stationary during the feeding of all the sheets. When the table is to be moved during the feeding, it is, however, convenient and simplifies the mechanism to have it in continuous motion, as set forth; but such motion need be only approximately proportional to the lowering of the bank, owing to the wide range of the finger. Pivoting the table is also only for convenience and simplicity. Any movement of the table—such, for instance, as sliding it bodily—so as to bring the edges of the sheets into proper position with reference to the finger and the cyiinder and roller would be sufficient to perform the required work. While the edge of each sheet before being acted upon by the finger should be brought to a suitable position with respect to the line of contact of the cylinder E with the roller G, since the finger will only maintain its hold for a cer-

tain distance, yet this position need not be at a definite line, but may be anywhere through quite a space, depending somewhat on the thickness of the paper, degree of curvature of the bank, &c.

Supporting and carrying the finger by means of the cylinder E results in very simple mechanism, the cylinder being of sufficient diameter to allow each sheet to be carried out of the way before another is moved, and forming with the roller a gripper in the most convenient position. The finger must press somewhat against the edge of the sheet. Springs or other contrivances might be used to get this required pressure; but it is gained in the simplest manner by gravity, as set forth. Different thicknesses of paper require different degrees of this pressure; but the range is quite large for any degree. The means of adjustment shown is very efficient, since the amount of overbalancing-weight of the finger is easily gaged and fixed.

For the eccentric toothed wheel and cylinder *g* other well-known devices for obtaining the varying movement above specified might be employed. However, in much feeding of sheets of paper a uniform movement of the cylinder E, of suitable speed for the finger when in contact with a sheet, would be fast enough for all practical purposes.

My machine is very simple. Its movements are continuous and rotary. It provides for adjustments which, for the most part, need not be nice, but rather approximate, and which adapt the machine for feeding sheets of paper of wide range with respect both to thickness and superficial area. In fact, only the size of the table determines the limit as to greatness of superficial area, while the machine is suitable for exceedingly small sheets.

In many cases a paper-feeding machine is required for only feeding sheets of nearly one thickness and one size. For such work many of the devices for adjustment might be dispensed with. The machine would thus become very simple for performing work as difficult as feeding sheets of paper has ever heretofore been regarded.

It is well known in the art of feeding sheets of paper by machinery that the most difficult part of the operation is to lift or separate each single sheet, or a portion thereof, from the bank without moving two or more sheets. After such separation has been made the sheet may be comparatively easily gripped and placed wherever desired. Therefore I deem it desirable to set forth more fully those elements of my invention by which this difficult operation may be successfully performed, and which constitute the fundamental and hence the most important features of the invention. In doing this I will refer particularly to the figures on Sheet 2 of the drawings, wherein certain devices are designated by the same letters as those devices on Sheet 1 which have a similar office.

I now call attention, first, to that part of my invention which relates to the formation in the machine of the pile of sheets of paper or bank J. When each sheet is quite thick, there is no necessity for forming the bank differently from the ordinary way—namely, so that it is of the shape of a rectangular solid, as illustrated in Fig. 6. If, however, the paper is not very thick, but still so thick that it is not desirable or practical to curve or bend the sheets, I shape the bank so that each sheet while it remains flat projects at one side or end of the bank beyond the adjacent underlying sheet. This may be done by simply dropping the mass of sheets upon a support consisting of an inclined table D and a gage or bracket L at an acute angle with the table, as illustrated in Fig. 7. If the paper is still thinner, but so thick that, while the mass of sheets may be curved or bent, it is desirable that the bank be flat while operated upon in the machine, the bank may be formed by suitably manipulating the mass of sheets so that each sheet will project, as above specified, and then placed in the machine on a horizontal flat table, as illustrated in Fig. 13. A pile of sheets of ordinary paper is quite flexible, and it is practicable to curve or bend it, and by such curving or bending to cause each sheet to project, as above specified. I prefer to do this and to have the bank in the machine thus formed. The bank may be curved through a part of its length or width, and be thus maintained in the machine by the body D of the table and a block O, which is thus a part of the table, as illustrated in Figs. 8, 10, 11, and 12. This method is preferable when the sheets are of any considerable size. The bank may, however, be curved throughout, and so held in the machine by a curved table, as illustrated in Fig. 9, which of course would be the way when the sheets are quite small.

Figs. 9 and 11 illustrate the combination of both methods of forming the bank—namely, by first manipulating the mass so as to cause each sheet to project, as above stated, and then curving the same. This method is desirable, and may be at times necessary when the sheets have very ragged edges or vary somewhat in size. Not only does the table constructed as shown for a curved bank maintain the curvature of the bank, but assists in giving the right curvature to the mass of sheets while being placed thereon.

In all the above-specified novel ways of forming the bank in the machine there is the generic idea of causing an edge of each sheet to extend beyond the corresponding edge of the adjacent underlying sheet, while curving the bank is a specific way of attaining this result.

While referring to the figures on Sheet 2, I next set forth more in detail the nature, mode of operation, and certain modifications, which appear worthy of special attention and illustration of the instrument F, herein called a "finger," by which is made the first movement

of each sheet in lifting or separating it from the bank. This finger may be a rigid piece, as illustrated in Figs. 6, 7, 8, 10, and 13. It may be flexible throughout—a simple flexible piece attached to a carrier, as designed to be illustrated in Fig. 9, or a loose band passing about pulleys, as shown in Fig. 11. It may be carried by suitable mechanism so as to follow the edge of the sheet while in contact therewith and while lifting the same from the bank, as indicated by Figs. 6, 7, and 13; or it may follow, lift, and carry said edge, owing to its being flexibly connected or hinged to a carrier, as in Figs. 8 and 10, or to its being itself flexible, as shown in Figs. 9 or 11, or by being itself bodily movable by the sheet, as illustrated in Fig. 12. In Fig. 10 the finger is shown attached to an endless band passing around pulleys, and in Fig. 12 as a cylinder or shell roller of small weight, which, being revolved by the roller underneath, will seize the edge, against which it slightly bears, and move the same, which in turn will force the roller-finger backward, as indicated by the dotted lines. The finger should be carried in a continuous direction in that part of its passage where it may come in contact with a sheet, as it would be when connected with the cylinder or endless band. Its return movement is simply to bring the finger into position for action on the next sheet.

In each of the figures on Sheet 2 the position of the finger and of the portion of the sheet near its edge after the finger has done its work preparatory to the action of suitable grippers is indicated by dotted lines. Throughout all of these illustrations runs the generic idea of a finger propelled, while in contact with the edge of a sheet, in a direction transverse to the plane of the sheet or to the plane of that portion of the sheet near said edge. The specific and preferable way to effect the desired object is to bring the finger in suitable relation to each sheet by means of a cylinder located with reference to the bank substantially as in the machine illustrated on Sheet 1. The finger may have a reciprocating movement, as is supposed to be the motion of the finger shown in Figs. 6, 7, and 13. Mechanism for such motion of the finger is illustrated in each of the Figs. 14 and 15, in which the finger is pivoted to a rod u, which is itself pivoted at v. This rod may be swung by means of a connecting-rod w and a crank x. By the action of the crank and a parallel rod y, pivoted to the rods u and w, as shown in Fig. 14, the finger will be lowered to be in contact with the edge of a sheet when at and moving away from the bank of paper, and will be raised on its return, so that the finger will touch and hold the edge of each sheet and release the same when required.

In order to make clear that the sheets may be lifted completely from the bank and be thereafter conveyed away when the finger takes the form or is operated as illustrated by the figures on Sheet 2, it is sufficient to say, with reference to Figs. 8, 9, 10, and 11, that the roller G may be supposed to be directly under the finger and carrier therefor to assist in gripping and conveying the sheet, as in Fig. 1. If the sheet is of very stiff material, as supposed to be the case in Figs. 6 and 7, and is carried to or slightly beyond a perpendicular position and then released by the finger, it may simply drop onto a receiving board or table and slide into place, as indicated by Fig. 14. If the sheet is flexible, then the reciprocating finger may co-operate with the roller G, as illustrated by Fig. 15.

In Fig. 16 I have shown the finger, when in the form of a light roller, as confined within the limits of its action by bars or wires z. In this case power may be applied directly to the roller G. The roller-finger will fall onto the edge of the sheet and be rotated simply by contact with the roller G, so that the edge of the sheet will be carried over by friction against the roller G, as indicated by the dotted lines, and thereafter conveyed away by the tapes.

In previous machines for feeding sheets of paper, direct action on the upper or exposed surface of the paper has been adopted to remove each sheet from the bank by exhausting the air above the same, by bringing adhesive substance in contact therewith, or by pressing upon the same and sliding the sheet by means of an instrument having a friction-surface. The sheets of a bank adhere one to another to a greater or less degree, and such adherence is not uniform throughout the bank. The edges are caused by a paper-cutter to adhere more or less, but not uniformly. Such adherence and inequality of adherence are difficulties to be overcome. By my method of forming the bank and in my machine the adherence of the sheets cannot impede or vary the operation of removing the sheets. In such a bank the edges that are first moved are already separated. Only a part of each sheet need be moved by the finger before the sheet may be securely gripped. The whole movement of a sheet from its very inception is an actual separation or lifting from the bank. The separation occurs progressively from an edge through the whole length or breadth of the sheet. The curvature of the sheet tends to prevent that portion of the sheet which is lifted from being twisted, cockled, or otherwise misplaced. It also makes possible a greater degree of pressure by the finger against the edge than otherwise might be, since this pressure may thus be largely in the direction of the plane of that part of the sheet adjacent to the finger, and this pressure acts to press the unlifted part of the sheet onto the bank. The rolling movement of the sheet toward itself is natural and easy, and requires that slight amount of force

which will not overcome the resistance of very little friction between the sheet and the finger.

By the word "edge," used hereinbefore to specify that part of the sheet with which the finger must make contact, is meant the extreme edge or the edge face. "Edge face" may be considered the more precise term, and is employed hereinafter in the claims.

I claim as my invention—

1. In a machine for feeding paper, the combination of a shaft *b*, two disks *c* and *d*, adjustable thereon, and a finger F, pivoted between said disks, substantially as specified.

2. The combination of a shaft *b*, two disks *c* and *d* thereon, a finger F, pivoted to said disks, and devices, as the set-screws *p* and *q*, for gaging the distance through which the finger may swing, substantially as set forth.

3. In a paper-feeding machine, a finger F, pivoted to a cylinder and adjustable in a direction transverse to its shaft or pivot-pins, said finger being provided with an exterior friction-surface, substantially as and for the purpose set forth.

4. In combination with a finger F and carrier therefor, means, as the toothed wheel *f* and toothed cylinder *g*, for imparting a varying movement to said carrier, said finger being provided with an exterior friction-surface, substantially as specified.

5. In combination with a cylinder E, carrying a finger F, a table D, for supporting a bank of paper in such relation to the cylinder that the finger will come in contact with the edge face of the sheet, substantially as and for the purpose specified.

6. The combination, with a cylinder carrying a finger F and a roller G to co-operate with said cylinder as a gripper, of a table D, for supporting a bank of paper in such relation to the cylinder that the finger will engage with the edge face of the sheet, substantially as set forth.

7. The combination of a cylinder carrying a finger F, a roller G to coact with said cylinder as a gripper, a roller H, tapes or bands *e*, extending around said rollers, and a table D, located under the roller G and said tapes or bands, substantially as and for the purpose set forth.

8. In combination with a support for a bank of paper, a finger and carrier therefor, whereby the finger is caused to touch the edge face of the sheet and carry the edge of the sheet, substantially as specified.

9. In combination with a pivoted table D, for supporting a bank of paper, a finger and carrier therefor, whereby the inclination of the bank is changed and the finger is caused to touch the edge face of each sheet and carry and bend the sheet, substantially as specified.

10. In combination with a finger and carrier therefor, a table so located as to present an edge face of a sheet to said finger, said table being provided with a raised portion or block O, to form or maintain a bend or curve in the bank of paper, substantially as specified.

11. The combination, with a finger and carrier therefor, of a table so located as to present an edge face of a sheet to said finger, said table being provided with a raised portion or block O, for supporting a curved bank, and with a bracket or gage L, substantially as and for the purposes specified.

12. The combination of a cylinder E, bearing a finger F, pivoted table D, for supporting and moving the bank, a chain or rope *m*, a shaft *h*, bearing a drum *i*, on which said chain or rope winds, and a worm *k* and gear *j*, substantially as described.

13. In a paper-feeding machine, a table D, provided with a raised part to support the bank of paper at or near the end and with a bracket L, whereby the bank is maintained in a bent or curved form, the upper sheet prevented from sliding under the action of a finger pressing against its edge face, and so that an edge of each sheet projects or extends beyond the corresponding edge of the adjacent sheet, substantially as set forth.

14. In a paper-feeding machine, a movable instrument herein called a "finger," in combination with a support or table for a bank of paper located with reference to said instrument so as to present an edge of a sheet of said bank to the same, substantially as and for the purpose set forth.

15. In combination with an instrument herein called a "finger," a support located with reference to said instrument so as to present the edge face of a sheet of paper to the same, said instrument being movable, whereby it will engage with said edge face, and adjustable, whereby the pressure on said edge face may be gaged, substantially as set forth.

16. In combination with an instrument herein called a "finger," a support located with reference to said instrument so as to present the edge face of a sheet of paper to the same, said instrument being automatically adjustable (in position) with reference to said edge face and movable transversely with reference to the edge of said sheet, whereby it will touch said edge face and carry and bend the sheet, substantially as specified.

17. In combination with an instrument herein called a "finger," a support located with reference to said instrument so as to present an edge face of a sheet to the same, said instrument being movable, its movement being variable, whereby it will engage with said edge face and while in contact therewith have a comparatively slow motion, substantially as set forth.

EDWARD DUMMER.

Witnesses:
WM. E. WOODWARD, Jr.,
C. H. RICHARDSON.