MACHINE FOR PREPARING PAPER TO ENABLE PORTIONS TO BE EASILY DETACHED.

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This invention relates to sheets of printed or plain paper either single or bound, such as adhesive labels, postage stamps, prospectuses, cheque books, receipt books, etc., the leaves or parts of which are used as they are required by detaching a portion or portions as the case may be. Hitherto it has been usual to perforate the paper so that the portions required may be easily detached. Many types of perforating machines have been devised but none of these machines are entirely satisfactory or remain so for any length of time. A slight imperfection in the line of perforations renders the part to be detached liable to be torn in the act of detaching or the perforations are uneven and unsightly, while in most cases where the sheets are to be bound the perforations cause a thickening of the pile to be bound, along the line of perforations, and these thickened portions must be hammered down or otherwise flattened, before the sheets can be bound.

The object of this invention is to weaken a sheet of paper along a line or lines across the surface thereof that the sheet may be divided into sections by tearing the paper along the weakened line or lines and to provide a means to achieve that object. The weakening of the sheet of paper is effected by inserting a number of regularly spaced depressions by compressing the paper at those points until an extremely thin film of paper forms the bottom of those depressions which are each separated from one another by a bridge that is integral with and forms an unaffected part of the sheet.

The means adopted for inserting these depressions may be varied and may be either in the form of a hand or power machine, the essential features of which will comprise a wheel or wheels having specially shaped teeth and being rotatably mounted axially parallel with and vertically above a rotatable anvil with which it is suitably geared so that the two will rotate at the same speed but in opposite directions to one another, means for regulating the operative distance between the teeth on the wheel or wheels and that portion of the periphery of the rotating anvil immediately adjacent thereto and for rigidly maintaining that distance so that the pressure exerted upon the paper by it in passing between them will be equal, a stripper device for stripping the paper from the specially shaped teeth, means for depressing the wheel or wheels to its or their operative distance from the rotatable anvil and for releasing same when each operation is completed, means such as a counterweight or its equivalent for automatically raising the wheel or wheels sufficiently to enable paper to pass freely between it or them and the rotating anvil and means for driving the latter either by hand or mechanical power.

In the accompanying drawings—
Fig. 1 is a perspective view of a machine embodying the essential features necessary for carrying my invention into effect, a portion of the bridging beam being cut away to enable the parts behind it to be more clearly illustrated.

Fig. 2 is a sectional elevation taken on the line A—A of Fig. 1 but with certain parts cut away to economize space.

Fig. 3 is a front view of a toothed wheel, the counterweighted lever by which it is carried, a portion of the shaft that rotates the wheel and also that upon which the counterweighted lever is mounted, the pressure regulating screw and a portion of the stripper device.

Fig. 4 is a sectional elevation of the cam mechanism by which the pressure roll, that depresses the counterweighted lever arm is operated.

Fig. 5 is a diagrammatic view of the combined cam and trip lever by which the pressure shaft is rotated through an arc in opposite directions.

Fig. 6 is a sectional elevation taken through the line of depressions and showing portion of the wheel in operation.

Fig. 7 is a plan view of a portion of a sheet of paper showing a line of depressions therein.

The machine shown in the drawings is an adaptation of a well known type of perforating machine, certain parts of which have been removed and replaced by those necessary for carrying my invention into effect.

In the formation of the depressions 10 in the paper 11 provision must be made for fine adjustments of the wheel 12 to ensure that a thin film of paper is left to form the bottom of each depression and the shape of the teeth 13 thereon must be such that the possibility of cutting or perforating the paper is eliminated, for it will be seen that if this happens the teeth upon the wheel would contact with and be destroyed by the anvil 25.
The pressure wheel 12 is therefore tapered on each side towards its periphery, the teeth being formed by a suitable number of equally spaced radial incisions 14. They will be thick in the plane of rotation but narrow and slightly convex across their faces. The machine may be provided with any suitable number of these pressure wheels, each one being mounted in bearings 15 carried at the forward end of a lever arm 16 the rear end of which is shaped to form a counterweight 17. Each lever arm 16 is slidably mounted upon a shaft 18 and provided with a set screw 19 to enable it to be fixed to the shaft temporarily at any desired position. The shaft 18 is mounted at each end in bearings 20 formed in the bearing blocks that are secured in any suitable manner to the respective standards 21 that also serve to support a table 22 upon which the work will be performed. Each of the wheels 12 will be keyed or otherwise rigidly secured upon a shaft 23 one end of which will be supported in a loose fitting bearing 24 to enable it and the wheels 12 secured thereon to be slightly raised by the counterweight 17 on the lever arm as will be hereafter explained. Vertically below the wheels 12 and parallel with the axial line thereof is a rotatable anvil 25 that is mounted in suitable bearings carried by the standards 21. One end of the rotatable anvil is extended so that it may be driven by any suitable and convenient means and will be provided with a gear wheel 26 that meshes with a gear wheel 27 rigidly secured to the shaft 23 so that the shaft 23 and rotatable anvil 25 will rotate at the same speed but in opposite directions to each other. That portion of the rotating anvil lying between the standards 21 should be of the same diameter as the wheels 12 in order that their peripheral speed shall be equal. The rotatable anvil 25 is positioned so that its axial line is below the table 22 the upper surface of the table being approximately tangential to the uppermost peripheral surface of the anvil. This arrangement is effected by providing the table 22 with a longitudinal slot 28 the underneath edges of which are bevelled in order that the anvil may project upwardly into the slot 28 and preferably a fraction above the upper surface of the table.

Pressure is applied to the wheels 12 by means of a pressure shaft 30 the ends of which are mounted in bearings in the respective standards 21 so that the axial line thereof will lie in the same vertical plane with the axial lines of the shaft 23 and rotatable anvil 25. The pressure shaft 30 is provided with a longitudinal flat 30a to enable it to function as a cam in the following manner. The forward end of the lever arm 16 is provided with a screw threaded vertical hole to receive an adjusting screw 31. The location of this adjusting screw is such that in its operative position its axial line will lie in the same plane with, but at right angles to the axial line of the shaft 23 and that of the rotatable anvil 25 and will be provided with a lock nut 32 for the purpose of locking it in any required position. Unless the pressure shaft 30 be of an abnormally large diameter there is an uncertainty as to the pressure exerted upon the heads of the adjusting screws 31 owing to a slight bending of the shaft. To eliminate this possibility a bridging beam 33 is provided with ends adapted to be rigidly secured to the respective standards 21 by the bolts 34. The bearings for the pressure shaft 30 are formed partly in the bearing blocks 25 and partly in the underside of each of the respective ends of the bridging beam 33, the underside of the latter being provided with a preferably semi-circular longitudinal recess 36 to receive the shaft. In this manner the shaft may be partly rotated in one direction so as to apply downward pressure when the circular portion of its periphery engages with the upper surface of the head of the adjusting screw 31 thereby depressing the pressure wheel or wheels 12 against the counterweight or weights 17 and when rotated in the opposite direction so that the flat 30a thereon lies horizontally above the screw, permitting the counterweight or weights to come into operation for the purpose of lifting the wheels 12 a short distance. The vertical movement of the wheels 12 is only required for the purpose of enabling a sheet of paper to pass freely between the teeth on the wheel and the anvil so that the amount of movement necessary is the shaft 23 being free at one end and secured loosely in bearings at the other end will permit of all the vertical movement that is required.

In order to insure that the teeth 13 on the wheel or wheels 12 shall not remain in engagement with the depressions 10 formed in the paper as it passes between the wheel 12 and the rotatable anvil 25 a stripper plate 29 is secured to the underside of the lever arm 16 by the screws 37. It is provided with a forwardly projecting foot piece 38 that lies horizontally and in close proximity to the upper surface of the table 22. The foot piece will have a central longitudinal slot 39 through which the wheels may partly project as will be seen by referring particularly to Figs. 1 and 2 in the accompanying drawings. The forward extremity of the foot piece is bent upwardly in order to form a guide for the paper as it is being fed into the machine.

The means adopted for partly rotating the pressure shaft 30 may be varied and may be operated either by hand or mechanical power. The appliances shown in the accom-
panying drawings are such that either means may be used. They comprise a lever 40 one end of which is rigidly secured to a projecting end of the pressure shaft 30 the other end being connected at 40° to the upper end of a connecting rod 41. At Figs. 1 and 2 of the drawings the lever 40 has been drawn downwardly by the connecting rod 41 thereby rotating the pressure shaft 30 so as to bring the circular portion of its periphery into contact with the head of the screw 31 whereby the lever arm or arms 16 and wheel or wheels 12 are depressed. In this position the paper may be fed into the machine by the feed rollers 42 and 43, arranged in any well known manner so that they rotate at the same peripheral speed as the wheels 12 and rotatable anvil 25. The paper passes thence under the upturned portion of the foot piece 33 and from thence passes between the depressed wheel 12 and anvil 25 when it receives the line of depressions 10. Having left the rear end foot piece 38 of the stripper plate 37 the paper will be received by and passed outwardly by the rollers 43 and 49 which will be arranged similarly to the feed rollers 42 and 43. When the paper has passed from between the wheel 12 and rotatable anvil 25 or when it reaches a predetermined point the connecting rod will be moved upwardly and in doing so will move the lever 40 causing the pressure shaft 30 to move through an arc so as to bring the flat 30° thereon to a horizontal plane above the heads of the screws 31. During this movement immediately the circular periphery of the pressure shaft 30 leaves the head of the screw 31 the counterweights (or their equivalents) will operate so as to slightly raise the forward end of the lever arm or arms 16 and the wheel or wheels 12 and shaft 29 connected thereto.

The connecting rod 41 could be operated by a treadle attachment. The means shown however consist of a gear wheel 44 mounted upon a stud shaft 45 rigidly secured on one of the standards 21 and meshing with a gear wheel 46 rigidly secured upon projecting end of the rotatable anvil 25. The extended end of the rotatable anvil may also be provided with a hand wheel 47 by which it may be rotated by hand when disconnected from the power. Upon the outer face of the gear wheel are two pins 48 and 49 that are secured in suitable positions but at different radial distances from the centre of the wheel. These pins 48 and 49 operate a stop device 50 that is secured upon a short shaft 51 carried in bearings formed in the boss 52 in the bracket 53 that is rigidly secured to the standard 21. Integral with or rigidly secured to the tripper 50 is a cam 53 the function of which is to move the connecting rod 41 longitudinally up and down as the tripper 50 is moved first through an arc in one direction by the pin 48 striking and depressing the toe piece 48a of the tripper and then through an arc in the opposite direction when the pin 49 strikes and depresses the toe piece 49a. The operation of the cam 53 will be seen more clearly illustrated at Fig. 5 of the drawings but as it and the parts associated therewith are well known in the art to which this invention belongs it is not considered necessary to enter into any further detailed explanation.

I claim:

1. A machine for the purpose herein described, comprising a driven shaft, a plurality of wheels mounted therewith and having peripheral teeth, a rotatable anvil mounted in bearings below and axially in the same vertical plane with the driven shaft, adjustable means for maintaining the toothed wheels at a predetermined distance from the rotatable anvil, means whereby the driven shaft and rotatable anvil may be driven in opposite directions so that the wheels upon the driven shaft and the rotatable anvil will travel at the same peripheral speed and means for feeding the paper between the toothed wheels and the rotatable anvil.

2. A machine for the purpose herein described, comprising a driven shaft a plurality of wheels mounted on said shaft and having suitably spaced teeth, a rotatable anvil mounted below and axially in the same vertical plane with the driven shaft, adjustable means for depressing the toothed wheels and maintaining them rigidly in the depressed position for a given period and at a predetermined distance from the rotatable anvil, means for automatically raising the wheels a predetermined distance when they are released by the depressing means, means whereby the driven shaft and rotatable anvil may be driven in opposite directions so that the wheels and the rotatable anvil will travel at the same peripheral speed and means for feeding the paper between the toothed wheels and the rotatable anvil.

3. A machine as claimed in claim 2, characterized in that the wheels are slidably mounted upon the driven shaft and are each secured in bearings carried near one end of a lever arm that is slidably mounted upon a shaft pivotally secured in suitable bearings, the other end of each lever arm being provided with a counter weight adapted to raise the corresponding wheel when released by the depressing means.

4. A machine as claimed in claim 2, wherein in adjustably mounted lever arms are provided for mounting the wheels and having counterweights connected therewith and wherein the depressing means consists of a pressure shaft arranged parallel with the axial line of the wheels and above the ends of the lever arms by which they are carried, said pressure shaft being arranged in suit-
ably mounted bearings and having a longitudinal flat portion whereby its action will be that of a cam, depressing the underlying end of each lever arm while the circular portion of its periphery contacts therewith and permitting it to be raised by the counterweight when the longitudinal flat portion is brought into juxtaposition with said lever arm, the driven shaft being so mounted in bearings as to permit it to rise with the wheels that are mounted thereon, and means for partially rotating the pressure shaft alternately in opposite directions.

5. A machine as claimed in claim 2, wherein adjustably mounted lever arms are also provided for mounting the wheels and means such as screws and lock nuts for the purpose of regulating the distance between the wheels and the rotatable anvil when the lever arms are in their fully depressed position.

6. A machine as claimed in claim 2, wherein a tripper device is associated with each wheel and includes a slotted foot that lies transversely above the rotatable anvil so that the wheel projects slightly through the slot when the wheel is in the depressed position, the forward end of said slotted foot being turned upwardly to form a guide under which the paper will pass as it is being fed into the machine.

7. A machine as claimed in claim 2, wherein adjustably mounted lever arms are provided for the wheels and wherein the depressing means includes a rotatable shaft having a flat portion and a circular portion, and means such as a bridging beam for preventing the pressure shaft from bending when the circular portion of its periphery contacts with the lever arms.

In testimony whereof I have signed my name to this specification.

WILLIAM WALTER WARRINGTON.