Aug. 29, 1961 K. G. ZEUTHEN ET AL 2,998,248

MECHANISM FOR CONVEYING SHEETS OF PAPER ONE BY ONE FROM A SUPPLY, PARTICULARLY FOR USE IN DUPLICATING MACHINES

Filed June 26, 1957 2 Sheets-Sheet 1

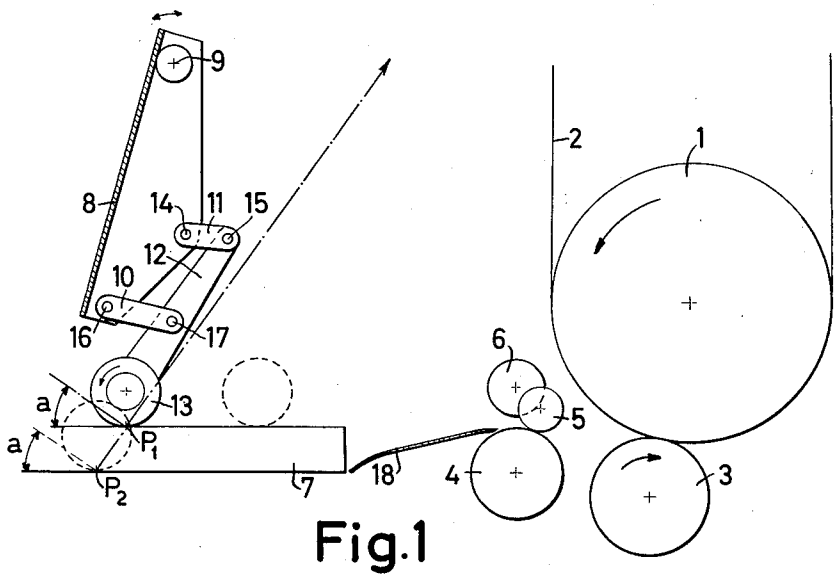


Fig.1

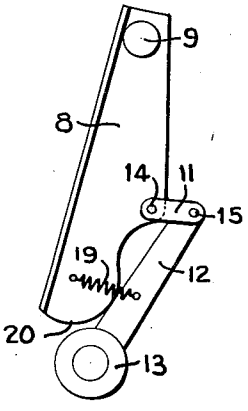


Fig 2

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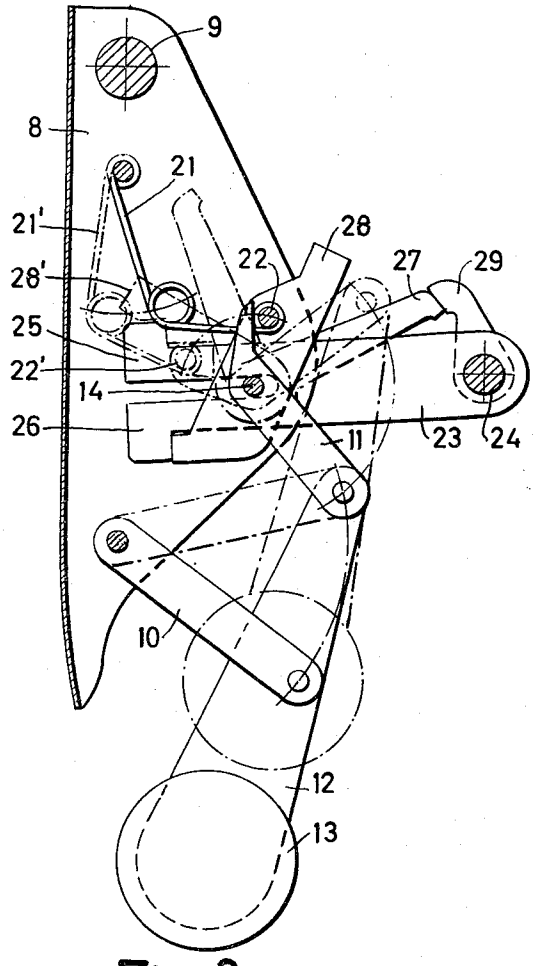


Fig.3

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2,998,248

MECHANISM FOR CONVEYING SHEETS OF PAPER ONE BY ONE FROM A SUPPLY, PARTICULARLY FOR USE IN DUPLICATING MACHINES

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8 Claims. (Cl. 271—42)

The invention relates to a sheet feeding mechanism for duplicating machines of the type having a fixed support for a pile of sheets. The primary purpose of the present invention is to provide a sheet feeding mechanism for conveying sheets of paper one by one from a supply, the feeding mechanism being provided with a pivotal conveying member which is divided into two parts, one of which is a carrying arm and is turnable through a predetermined constant angle and carries the other arm, the feeding part which is a lower end of which moves freely across the uppermost sheet of paper in the case of motion in the backward direction, but grips the said sheet of paper and carries it along with it in the case of motion in the opposite direction i.e. in the forward direction. During the forward stroke the pressure of the feedroller against the uppermost sheet of paper in the supply pile is derived from the gravitational force owing to the weight of the feeding arm.

In the usual conveying mechanisms for duplicating machines, where the feeding arm is rotatably connected to the carrying arm at a point on the latter, no regard has been paid to the changed conditions that prevail as the supply pile gradually becomes smaller, so that the distance between the pivot axis of the conveying member and the point at which the sheets of paper are attacked becomes greater. One of the objects of the invention is to provide a construction that overcomes such problem. If the motion of the point of attack of the conveying member is observed, when the conveying member is in its starting position, while the thickness of the supply pile varies, it will be seen that the point of attack describes a circle. The lifting direction for the point of attack, therefore, varies with the thickness of the supply pile. The angle of attack of the feeding member can be defined as the angle between the normal to the lifting curve of the point of attack and the plane of the sheet of paper. During development work on the invention it was proved that out of regard to attaining the advantageous light pressure, desirable for several reasons, of the feeding member against the paper it is important that this angle does not change perceptibly. If the angle is made too large, the conveying member may be inclined to handle the sheets of paper too heavily and may cause several sheets to be fed to the machine, at the same time, besides causing the formation of undesirable quantities of paper dust. If the angle is made too small, the conveying of the sheets will fail.

In conformity with the above, a mechanism according to this invention is provided wherein a feeding arm is link-connected to a carrying arm at a point of said carrying arm, guiding means being provided for guiding the feeding arm in a path in which the lifting direction of the point of attack of the feeding arm against the paper remains practically constant independently of changes in the thickness of the supply pile. In the known construction of duplicating machines, in which the feeding arm pivots around an axis on the lower end of the carrying arm, the feeding arm and, thereby, also the carrying arm, have been made comparatively long, so that the angle of attack can vary only within comparatively moderate bounds. However, with the practically applicable dimensions said angle cannot become even approximately constant. In the construction, according to the present invention, the feeding arm is guided in such a way that instead of describing a circle, the point of attack describes a curve where the tangent on the stretch of the path used does not change its direction perceptibly, and the construction offers the advantage that the dimensions can be kept small in a way without having any unfortunate influence on the constancy of the angle of attack. While gaining the said advantages there is also created the possibility of making the dimensions of the duplicating machine smaller, because the conveying mechanism, according to the invention, does not take up as much space as the known mechanism having a pivotally mounted feeding arm if the latter are to have an angle of attack which does not diverge too much from the most advantageous, when the thickness of the paper pile diminishes.

The angle of attack in the starting position of the conveying mechanism, where the uppermost sheets of paper are to be disengaged from the pile, should be of a suitable order of magnitude—for ordinary purposes approximately 35°—but may then without any detrimental effect decrease slightly, e.g. to 25°.

The mechanical production of the lifting curve desired by coupling the feeding arm to the carrying arm and guiding it in relation to the latter may be performed in many different ways, but particularly expedient is, according to the invention, an embodiment in which the feeding arm is connected to the carrying arm by means of two connections which force two points of the feeding arm to describe two circles with their centres in the carrying arm and so located that the tangent to the curve of motion of the point of attack along a stretch corresponding to the thickness of the supply pile practically has a constant direction and preferably forms an angle the value of which is between 65—55° to the surface of the sheet of paper.

The invention will in the following be further described with reference to the diagrammatical drawing in which

FIG. 1 illustrates the parts of a duplicating machine necessary for understanding the invention,

FIG. 2 shows another embodiment of the mechanism according to the invention and FIG. 3 shows in detail some of the operating members.

1 in FIG. 1 designates a duplicating machine roller in a two-roller duplicating machine with a silk screen 2 and a printing roller 3. Rolls 4, 5, and 6 are components associated with a precision conveying mechanism which is the subject matter of the applicants' application No. 664,618. 7 designates the supply pile of sheets of paper which are to be fed one by one to the precision conveying mechanism. The mechanism according to the present invention for conveying the sheets of paper one by one consists in the embodiment example shown of a carrying arm 8 which can rotate around an axis 9 and which by means of two links 10 and 11 carries a feeding arm 12 which is provided at its lower end with a conveying roll 13, the circumference of which consists of friction-providing material, e.g. rubber. The link 11 has two axes of rotation 14 and 15, and the link 10 two axes of rotation 16 and 17.

The carrying arm 8 is, in a way, known per se operated from the main shaft of the duplicating machine through a mechanism causing the carrying arm to be swung backwards and forwards through a certain angle V. The roll 13 is, in a way, known per se arranged for being turned only in the backward direction, i.e. when the roll, after a forward motion to the right in the figure, is once more led to the left. Such a function may be provided by means of a ratchet wheel and a pawl or by means of a free-wheel clutch of a suitable design.

If the paper pile is removed and the carrying arm 8 is arrested in a certain angular position, and the feeding arm

is then moved upwards and downwards, the points 15 and 17 are forced to describe parts of circles, of which the circle described by the point 17 has a larger radius than the circle described by the point 15. The radii of the circles here mentioned and the location of the centres 14 and 15 are chosen so that the angle of attack *a* of the roll 13 at the point of contact P_1 on the sheet that at any moment is uppermost in the paper pile 7 in the starting position of the carrying arm 8 to the far left is practically constant. The angle of attack *a* is determined by the angle between the surface of the paper and the normal to the lifting direction of the point of attack P_2—P_1. During the lifting, the point of attack P_1 on the conveying roll 13 describes a curve of a higher degree, and the angle is therefore measured in relation to the tangent of the curve or more correctly in relation to the normal to this tangent. When a sheet of paper is advanced, by the carrying arm 8 turning through the angle V around the axis 9, it slides along a guide 18 into the clearance between the two rolls 4 and 5. The distance to be covered by the sheet of paper becomes slightly longer as gradually the height of the supply pile decreases, and regard can be paid to this fact by the dimensioning of the mechanism for conveying the sheets of paper, so that the conveying motion becomes slightly longer for each successive sheet of paper in the pile. The angle of attack may in the starting position of the conveying mechanism be about 35°. The mechanism is conveniently so dimensioned that the angle of attack keeps within the limits 35–25° during each individual advance of one and the same sheet of paper.

In the embodiment shown in FIG. 2 the carrying arm and the feeding arm are connected by a single link 11 and with a spring 19 which forces the feeding arm 12 into contact with a convex surface 20 on the carrying arm 8. The contour 20 is so shaped that the angle of attack for the roll 13 against the sheets of paper remains substantially constant. At the same time the spring 19 gives the feeding arm 12 a slight pre-stress in the downward direction so that a constant contact of the roll 13 with the uppermost sheet in the supply pile is ensured.

When the pile of paper is exhausted, or sometime before, the feeding can be discontinued as will appear from the more detailed FIG. 3 in which one side or flange of the U-shaped carrying arm or member 8 is cut away so that those parts which normally are covered and protected by the carrying arm can be seen. The two parallel sides of the carrying arm are fixed on the shaft 9 which is oscillated forward and backward through an angle corresponding to the feeding movement desired as indicated by V in FIG. 1. The axle 14 around which pivot two links 11 (of which only one is shown), is mounted pivotally in the sides of the carrying arm and carries in fixed connection with the axle a U-shaped switching member 28 having two resting positions 28 and 28′ shown in full line and dotted respectively. A conventional mechanism comprising a spring 21 and a pin 22 protruding from the switching member 28 and into an archshaped slot (not shown) in one side of the carrying arm 8 stabilizes the two resting positions. Change over from one resting position to the other is attained by means of a bifurcated arm 23 which is secured at one end to an axially displaceable shaft 24. The two prongs 25 and 26 of the arm 23 are adapted to contact, for instance, by means of protrusions (not shown) either one leg or the other of the switching member 28 at positions opposite the axle 14 so that when the prong 25 is in the path of one leg of the switching member following the oscillation of the carrying arm 8 the switching member is moved clock-wise during the backward stroke of the carrying arm, and anti-clockwise when the prong 26 is moved into the path of the other leg of the switching member by axial displacement of the shaft 24. The effect of the arrangement described is that the feed roller is raised to inactive position (as indicated in dotted line) in the moment when a tripping arm 27 fixed to the link 11 touches a release arm 29 secured to the shaft 24 and by turning of this shaft releases a spring (not shown) which removes the prong 25 from the path of one leg of the switching member and brings the prong 26 into the path of the other leg of the switching member.

Within the scope of the invention, many other embodiments of the conveying mechanism than those described in connection with the drawing are conceivable. The end of the feeding member need not carry a roll, but may be provided with an optional suited conveying member, or the arm may carry several rolls located side by side. The contour 20 may be formed by the circumference of a rotatable roll mounted on the carrying arm 8 in FIG. 2.

We claim:

1. In a sheet feeding mechanism for duplicating machines of the type having a fixed support for a pile of single sheets; a frictional feeding member, means for moving the frictional feeding member to and fro across the top sheet of the pile and keeping the angle of attack well above zero, said means comprising two parts, one of which is a feeding arm and is movable up and down in relation to the other, which is a carrying arm, said carrying arm being mounted to be oscillated through a predetermined angle and having link means for carrying and guiding in two separate points said feeding arm, said feeding member being carried by the feeding arm and pressing against the top sheet, said link means comprising at least two links each pivotally connected at one end to the feeding arm and at the other end to the carrying arm.

2. In a sheet feeding mechanism for duplicating machines of the type having a fixed support for a pile of single sheets; a frictional feeding member, means for moving the frictional feeding member to and fro across the top sheet of the pile and keeping the angle of attack well above zero, said means comprising two parts, one of which is a feeding arm and is movable up and down in relation to the other, which is a carrying arm, said carrying arm being mounted to be oscillated through a predetermined angle and having link means for carrying and guiding in two separate points said feeding arm, said feeding member being carried by the feeding arm and pressing against the top sheet, said link means comprising a link member and a spring pressing a guiding surface of the feeding arm against a guiding surface of the carrying arm, at least one of said surfaces being curved.

3. In a sheet feeding mechanism for duplicating machines of the type having a fixed support for a pile of single sheets; a frictional feeding member, means for moving the frictional feeding member to and fro across the top sheet of the pile and keeping the angle of attack well above zero, said means comprising two parts, one of which is a feeding arm and is movable up and down in relation to the other, which is a carrying arm, said carrying arm being mounted to be oscillated through a predetermined angle and having link means for carrying and guiding in two separate points said feeding arm, said feeding member being carried by the feeding arm and pressing against the top sheet, said link means comprising at least two links each pivotally connected at one end to the feeding arm and at the other end to the carrying arm, and restricting the lower end of the feeding arm to follow by diminishing sheet pile and fixed angular position of the carrying arm an approximately straight line deviating from a line perpendicular to the upper sheet surface, said feeding arm carrying at its lower end a feed roller bearing against the top sheet by the weight only.

4. In a sheet feeding mechanism for duplicating machines of the type having a fixed support for a pile of single sheets; a frictional feeding member, means for moving the frictional feeding member to and fro across the top sheet of the pile and keeping the angle of attack well above zero, said means comprising two parts, one of which is a feeding arm and is movable up and

down in relation to the other, which is a carrying arm, said carrying arm being mounted to be oscillated through a predetermined angle and having link means for carrying and guiding in two separate points said feeding arm, said feeding member being carried by the feeding arm and pressing against the top sheet, said link means comprising a link member and a spring pressing a guiding surface of the feeding arm against a guiding surface of the carrying arm, at least one of said surfaces being curved, said link means and guiding surfaces restricting the feed roller in any fixed angular position of the carrying arm to describe at least an approximately straight line when moved in relation to the carrying arm through the distance corresponding to the height of the paper sheet pile, said straight line representing the path of the point of attack of the feeding member deviating considerably from a line perpendicular to the sheet surface.

5. In a sheet feeding mechanism for duplicating machines of the type having a fixed support for a sheet pile; means for moving a unidirectionally rotatable feed roller to and fro across and in continuous contact with the top sheet of the pile while keeping the angle of attack in the point of contact between the feed roller and the top sheet well above zero from the beginning to the end of the feeding movement, wherein said means comprises a carrying arm oscillatable from an initial angular position through a predetermined angle, a feeding arm having a lower end carrying said feed roller and at least two links each pivotally connected at one end to the feeding arm and at the other end to the carrying arm.

6. In a sheet feeding mechanism as claimed in claim 5, wherein the angle of attack in the initial position of the feed roller is around 35°.

7. In a sheet feeding mechanism as claimed in claim 5, wherein the angle of attack lies within a range between 35° and 25°.

8. In a sheet feeding mechanism as claimed in claim 5, wherein the angle between the lifting curve of the point of attack of the feed roller and the plane of the top sheet in the initial position of the carrying arm is around 65°—55°.

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