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SMALL SIZE PRINTER

The present invention relates to a small size printer designed to effect sheet-feeding and ribbon-feeding with a single d.c. motor, and is more particularly concerned with an overload-preventing structure for preventing an overload from being applied to the sheet-feeding or ribbon-feeding mechanism.

One of the conventional small-sized printers of the type referred to above is described in Japanese Patent Laid-Open No. 133918/1979, by way of example.

Disclosed therein is a serial printer in which a carriage is reciprocated and sheets are fed by a platen by the use of a single pulse motor operable in opposite directions, and the turning force of the pulse motor is transmitted on the one hand to a cam shaft of a head-feeding cam via a head-feeding power transmission system using gears and on the other hand to a sheet-feeding shaft of a sheet-feeding platen via a sheet-feeding power transmission system using gears. The power transmission systems each include a spring type one-way clutch, and are designed to effect head-feeding upon turning of the pulse motor in one direction and sheet-feeding upon turning of the pulse motor in the other direction.

The problem with the conventional small-sized printer of this type is that since a pulse motor operable in both directions is used as a power source and head-feeding and sheet-feeding are selectively effected by controlling the

direction of turning thereof, the control mechanism for the pulse motor is too complicated to permit a reduced production cost. Moreover, the interruption of the operation of the motor at the time of reversal of the pulse motor wastes time and increases the time needed for the whole operation.

The present invention has been accomplished in the light of such problems, and has as its object to overcome them by simplifying the operation with a simplified structure.

In order to achieve the aforesaid object, the present invention provides a printer in which the turning force of a single d.c. motor operable in only one direction is transmitted to a sheet-feed mechanism through a sheet-feeding power transmission means and to a ribbon-feeding mechanism through a ribbon-feeding power transmission means, thereby effecting said sheet-feeding and ribbon-feeding by the use of said single d.c. motor, said printer being characterized in that each of said sheet-feeding and ribbon-feeding power transmission means is provided with a slip mechanism designed such that, when a predetermined load or a load larger than the predetermined load occurs, slippage is caused in said power transmission means to maintain said turning force to below a predetermined level, thereby preventing secondary malfunctions such as failure of gears and burning out of the motor due to an abnormal increase in the load which is caused by, e.g., jamming of printing sheets or an ink ribbon.

Thus, according to the present invention, in the event that during sheet-feeding and ribbon-feeding effected by the turning force of the d.c. motor, an excessive load is applied to the sheet-feeding power transmission means due to, for instance, the occurrence of sheet jamming, or alternatively overloading such as locking of a ribbon cassette occurs due to ribbon jamming which is caused by a ribbon caught by a wire of a wire-dot printer, for instance, the slip mechanism provided in the power transmission means is actuated to keep the turning force of the predetermined size or larger from being applied to the sheet-feeding or ribbon-feeding mechanism, and hence prevents failure of the gears, etc. of said power transmission means and burning out of the coil of the d.c. motor.

The present invention will now be described with reference to the following non-restrictive embodiments illustrated in the attached non-restrictive drawings, in which:

Fig. 1 is a plan view of one embodiment of a small-sized serial printer according to the invention which uses as the power source a single d.c. motor adapted to be operable in one direction to produce a turning force for effecting the reciprocation of a carriage, feeding of printing sheets and feeding of an ink ribbon;

Fig. 2 is a left-hand side elevation view thereof;

Fig. 3 is a right-hand side elevation view thereof;

Fig. 4 is a sectional view showing a sheet-feeding power transmission means forming a part thereof; and

Fig. 5 is a sectional view showing a carriage-feeding and ribbon-feeding power transmission means forming a part thereof.

Referring first to Fig. 1, reference numeral 1 designates a printer body having a guide rail 2 supported at both ends on the printer body 1, and the printer has a carriage 3 slidably mounted on the rail 2, and a printing head 4 attached to the carriage 3.

The carriage 3 is provided with a guide groove 5 which extends in a direction intersecting the longitudinal direction of the guide rail 2, and within which a driving pin secured to an endless belt 6 engages. The endless belt 6 extends around a driving timing pulley 8 and a driven timing pulley 9 which are rotatably supported at a predetermined interval in the longitudinal direction of the guide rail 2.

A platen 10 is mounted in front of the printing head 4, and a sheet-feeding roller 11 is disposed below the platen 10 on a sheet-feeding shaft 12 which is rotatably supported at both ends on the printer 1. A pressure roller 13 is disposed facing the sheet-feeding roller 11, and a sheet-supply port 14 is provided for introducing sheets of material to be printed which are then supplied onto the platen 10 between rollers 11 and 13.

A d.c. motor 16 is secured to the printer body 1 with its drive shaft having at one end a disk 17 provided with a plurality of slits around the axis of said shaft. The disk 17, together with a photosensor 18 provided thereon, comprises a detector for detecting the number of revolutions

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of the d.c. motor 16. The shaft of the d.c. motor 16 also has a motor pinion 19 fixedly mounted thereon.

The motor pinion 19 meshes with a first gear 20 rotatably supported on the printer body 1, and first gear 20 is integral with a second gear 21, which in turn meshes with a third gear 23 rotatably supported on a first support shaft 22 secured to the printer body 1. As illustrated in Fig. 4, the first support shaft 22 rotatably supports a fourth gear 24 in coaxial relation to the third gear 23.

The third gear 23 is integrally provided with a first bevel gear 25, a driving friction shaft portion 26 and an outer shaft portion 27 in coaxial relation to the friction shaft portion 26, while the fourth gear 24 is provided with a driven friction shaft portion 28 having its outer diameter equal to that of the friction shaft portion 26. The friction shaft portions 26 and 28 have fitted thereover a cylindrical coil spring 29, the outside of which is covered by the outer shaft portion 27. The cylindrical coil spring 29 has a diameter slightly smaller than the outer diameters of both friction shaft portions 26 and 28, whereby it engages thereover with a slight interference, so that said coil spring 29 and said two friction shaft portions 26 and 28 form a slip mechanism A on the sheet-feeding side.

The aforesaid slip mechanism A on the sheet-feeding side has a reduced diameter form, and is designed such that a turning force is transmitted between friction shaft portions 26 and 28 through the spring 29 when the turning load force is below a predetermined level, and the diameter of the cylindrical coil spring 29 increases when the turning load force reaches or exceeds the predetermined level due to an abnormal increase in load, which is caused by jamming of

printing sheets or the ink ribbon, so that the spring 29 slips. Reference numeral 22a designates a stop ring locked to the first support shaft portion 22 so as to prevent the disengagement of the fourth gear 24, etc., and adapted to receive a biasing force produced by the cylindrical coil spring 29.

The fourth gear 24 meshes with a fifth gear 31 rotatably supported on a second support shaft portion 30, and the second support shaft portion 30 has a clutch cam 32 and a sixth gear 33 rotatably supported thereon, whereby the turning force of the fifth gear 31 can be transmitted to a sixth gear 33 by turning of the clutch cam 32. The sixth gear 33 meshes with a seventh gear 35 secured to the aforesaid sheet-feeding shaft 12 through an intermediate gear 34.

The clutch cam 32 is provided with a plurality of projections against which a pawl portion of a sheet-feeding lever 36 is rockingly supported on a support shaft 38, and is provided at the end opposite to the pawl portion with an electromagnetic solenoid 39 secured to the printer body 1, which, upon being excited, rocks lever 36 to disengage the pawl portion from the associated projection.

The first bevel gear 25, described above, meshes with a second bevel gear 41 rotatably supported on a second support shaft 40 secured to the printer body 1. The second bevel gear 41 is integrally provided with an eighth gear 42, which in turn meshes with a ninth gear 44 rotatably supported on a third support shaft 43 secured to the printer body 1. As illustrated in Fig. 5, the third support shaft 43 has rotatably supported thereon a tenth gear 45 in coaxial relation to the ninth gear 44.

The ninth gear 44 is integral with the aforesaid driving timing pulley 8, and has a driving friction shaft portion 46 spaced inwardly therefrom by an annular groove, while the tenth gear 45 is provided with a driven friction shaft portion 48 having an outer diameter equal to that of the driving friction shaft portion 46. A cylindrical coil spring 49 is fitted over these friction shaft portions 46 and 48. The cylindrical coil spring 49 is made slightly smaller in diameter than the outer diameters of the two friction shaft portions 46 and 48, whereby it engages thereover with a slight interference, thus forming a slip mechanism B on the ribbon-feeding side constituted by said cylindrical coil spring 49 and the two friction shaft portions 46 and 48.

The aforesaid slip mechanism B has a reduced diameter form, and the turning force is transmitted therethrough when the turning load force is below a predetermined level, and when the turning load force reaches or exceeds a predetermined level, the diameter of the cylindrical coil spring 49 increases so as to slip. Reference numeral 50 designates a disk for preventing the disengagement of the endless belt 6 extending around the timing pulley 8, and a stop ring 51 is locked to the third support shaft 43 so as to prevent the disengagement of the disk 50, the ninth gear 44, etc., said ring receiving a biasing force exerted by the cylindrical coil spring 49.

The aforesaid tenth gear 45 meshes with an eleventh gear 53 rotatably supported on a fourth support shaft 52, and the gear 53 is integrally provided with a twelfth gear 54, which in turn meshes with a thirteenth gear 56 rotatably supported on a fifth support shaft 55 secured to the printer

body 1. The thirteenth gear 56 is integrally provided with an upwardly extending ribbon take-up shaft 57, which engages within an engaging hole 60 formed in a take-up gear 59 of a ribbon cassette 58 during the mounting of said cassette 58 in the printer. Reference numeral 61 designates a ribbon contained in the ribbon cassette 58, a part of which passes in front of the printing head 4, as already mentioned.

It will be seen that the sheet-feeding power transmission means is constituted by the slip mechanism A on the sheet-feeding side, the fourth and fifth gears 24 and 31, the clutch cam 32, the sixth gear 33 and the intermediate gear 34 and the seventh gear 35. The ribbon-feeding power transmission means is constituted by the first and second bevel gears 25 and 41, the eighth and ninth gears 42 and 44, the slip mechanism B on the ribbon-feeding side and the tenth, eleventh, twelfth and thirteenth gears 45, 53, 54 and 56. It will further be seen that the carriage-feeding power transmission means is constituted by the first and second bevel gears 25 and 41 and the eighth and ninth gears 42 and 44.

The operation of the foregoing embodiment will now be described.

As the d.c. motor 16 is actuated, its turning force is transmitted from the motor pinion 19 to the sheet-feeding, ribbon-feeding and carriage-feeding power transmission means, whereby first, the endless belt 6 is moved by turning of the driving timing pulley 8 to reciprocate the carriage 3; second, the ribbon take-up shaft 57 is turned to cause the ribbon 61 to pass in front of the printing head 4; and third, the electromagnetic solenoid 39 is actuated to cause sheets 45 to be fed at the desired times.

When there is an increase in the load applied to the sheet-feeding power transmission means due to sheet jamming, inadvertant forces given to the sheets or the like, the turning force is increased to cause slippage in the slip mechanism A. As long as the turning force is below the predetermined level, then it is transmitted as such. However, if the turning force is increased to or above the predetermined level, then the diameter of the cylindrical coil spring 29 is increased to cause slippage between the friction shaft portions 26 and 28, since the slip mechanism A is constructed as a spring clutch. Hence, even though a load applied to said power transmission means is increased, it is possible to prevent failure of the gears in said power transmission means, burning out of the motor coil by motor locking or the like, since the portion of the turning force exceeding the predetermined level is taken up by the slip mechanism A.

The same is also true of the case where, for instance, a wire on the printing head 4 is caught in the ribbon 61 to cause ribbon jamming, whereby the ribbon cassette is locked, which causes an increase in the load applied to the ribbon-feeding power transmission means. In that case, the turning force is increased to cause slippage in the slip mechanism B and the portion of the turning force exceeding the predetermined level is taken up by the action of this slip mechanism B, as is the case with the aforesaid sheet-feeding power transmission means. It is thus likewise possible to prevent failure of the gears in said power transmission means, burning out of the d.c. motor 16 or the like.

Especially because the spring clutches are used for both slip mechanisms A and B in the instant embodiment and the cylindrical coil springs 29 and 49 are applied in the increased diameter form, it is possible to easily achieve torque control and provide a slip mechanism having high torque stability. Further, since the respective slip mechanisms A and B are independently provided in the carriage power transmission means or as separate means, it is unlikely that printing will be ill timed. It is to be understood, however, that disk type clutches or other clutches may be used as the slip mechanism.

In accordance with the present invention in which a slip mechanism is provided in each of the sheet-feeding and ribbon-feeding power transmission means as described in detail above, it is possible to prevent an overload from being applied to the sheet-feeding and ribbon-feeding mechanisms, even when an excessive load is impressed on the power transmission means by sheet or ribbon jamming, since such excessive load is taken up. For that reason, it is possible to effect sure sheet feeding and ribbon feeding with a simplified mechanism using an inexpensive d.c. motor, and to prevent failure of the gears in the power transmission means, and burning out of the d.c. motor.



CLAIMS

1. A printer comprising:
a single d.c. motor operable in only one direction;
a sheet-feeding mechanism;
a sheet-feeding power transmission means connected between said motor and said sheet-feeding mechanism for transmitting power from said motor to said sheet-feeding mechanism;
a ribbon-feeding mechanism;
a ribbon-feeding power transmission means connected between said motor and said ribbon-feeding mechanism for transmitting power from said motor to said ribbon-feeding mechanism; whereby sheet feeding and ribbon feeding are achieved with said single d.c. motor;

each of said sheet-feeding and ribbon-feeding power transmission means having a slip mechanism therein for causing a slippage in said power transmission means when a load of at least a predetermined size is imposed on said power transmission means for maintaining the turning force being transmitted from said motor through said power transmission means to below the predetermined size.

2. A printer as claimed in claim 1 wherein said slip mechanism is a spring clutch comprising a driving shaft and a driven shaft disposed in coaxial relation to each other, and a cylindrical coil spring fitted over both said shafts, said cylindrical coil spring being engaged with said shafts for being increased in diameter upon an increase in the turning force applied to said driving shaft.



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3. A printer according to claim 1, substantially as hereinbefore described with reference to the drawings.
