Jan. 28, 1964 E. E. KNITTEL 3,119,394

POWER DRIVEN ROTATING CARD FILES

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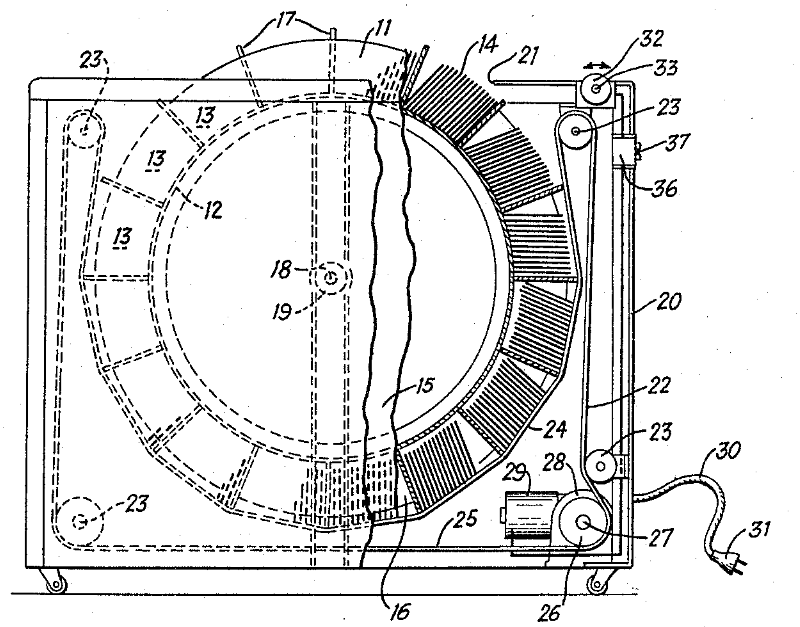

Fig. 1

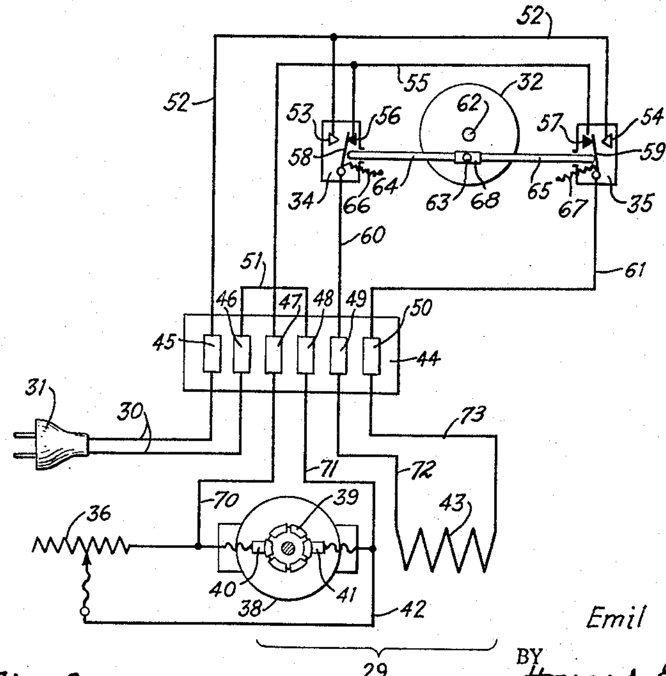

Fig. 2

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POWER DRIVEN ROTATING CARD FILES

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This invention relates to improvements in rotary card files of the type which carry cards in a substantially radial position along the periphery of a large wheel or drum rotatable about a horizontal axis. When a card is to be inspected, removed, or inserted, the wheel or drum is rotated to bring the respective card or group of cards to the top.

Card files of the aforementioned type are generally enclosed in a cabinet having an access opening at the top, and it is necessary to bring the desired group of cards into the proper position with respect to the access opening.

In the interest of efficiency of operation this should be done not only quickly, but also positively to avoid the danger of overshooting the position in which the wheel should come to rest. Good positional control is important, particularly when the wheel is rotated at a high rate of speed.

It has been proposed to motorize rotating card files by an electric motor in order to obtain higher rotational speeds than would normally be attained by manual operation. It was found necessary to supplement the electric drive by a mechanical brake to insure accurate positioning of the desired group of cards and avoid overshooting.

Rotating card files are known in which the wheel or drum is driven by a capacitor-start motor, supplemented by a spring-loaded mechanical brake which normally keeps the wheel arrested and is released by a solenoid during periods of operation of the motor.

The known arrangement has several disadvantages. The mechanical brake requires adjustment from time to time to compensate for wear and, failing such adjustment, overshooting occurs. The brake action is not always uniform and is influenced by temperature and humidity conditions. Also, the brake mechanism produces noise.

A relatively high starting current is required because a solenoid must be energized at the same time the motor draws its maximum starting current, leading to the danger of overloading regular light circuits in offices where several motorized files are in use. Last, but not least, the equipment is complex and expensive because of the need of a solenoid operated brake in addition to the motor.

According to the invention the wheel drum is braked electrically by the same motor which drives it. A series wound motor is employed in combination with an armature shunt to arrest the drum or wheel of the file quickly upon deenergization of the motor.

The invention is based on the recognition that the braking effect of an armature shunt of a series-wound motor increases at a higher rate for decreased resistance values of the shunt than the decrease in the speed incidental to the shunting of the armature. I have found, for example, by experiments and tests that the application of a certain shunting resistance which reduces the motor speed to one-half of its original speed reduces coasting of the motor not by one-half, as might be expected, but to a substantially higher degree.

This phenomenon is conveniently expressed by comparing the revolutions per minute of the motor drive with the number of revolutions the drive coasts after the current is shut off. For different ohmic values of the shunting resistance a coasting factor may be computed as the quotient of coasting revolutions divided by motor speed and a braking factor may be computed by dividing the motor speed by the coasting revolutions.

If the application of a certain shunt were to reduce the coasting revolutions in the same ratio as the drive speed, in which event both the coasting factor and the braking factor would remain substantially constant, no unusual result would be produced.

I discovered, however, that for progressively decreased ohmic values of the shunt the coasting factor is reduced sharply and the braking factor, hence the braking efficiency, is increased greatly.

I further discovered that the aforementioned phenomenon becomes even more pronounced if the series-wound motor, shunted as previously mentioned, is combined with a card wheel or drum. It will be shown for example that in a wheel or drum filled with cards to its full capacity the application of a certain shunt reduces the coasting factor to less than one-fourth of the figure for the non-shunted assembly while the braking factor is increased fourfold.

It is therefore possible by application of the invention to obtain highly efficient braking of a rotating card file at relatively high operating speeds, and it is even possible to vary the operating speed within desirable limits. The braking is positive, uniform and silent, not dependent on conditions of temperature, humidity, or mechanical adjustment. The driving and braking unit is extremely simple and considerably less expensive than the known combination of a capacitor motor and a solenoid controlled brake used for the same purpose.

The various features and advantages of this invention will appear more fully from the detailed description which follows accompanied by drawings showing, for the purpose of illustration, a preferred embodiment of the invention. The invention also resides in certain new and original features of construction and combination of elements hereinafter set forth and claimed.

Although the characteristic features of the invention which are believed to be novel will be particularly pointed out in the claims appended hereto, the invention itself, its objects and advantages, and the manner in which it may be carried out may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part of it, in which:

FIGURE 1 is an elevational view, partially diagrammatic, of a preferred form of card file embodying the invention; and

FIGURE 2 is a wiring diagram of the electric drive on the file of FIGURE 1.

In the following description, and in the claims, various details will be identified by specific names for convenience. The names, however, are intended to be generic in their application. Corresponding reference characters refer to corresponding parts in the figures of the drawings.

The drawings accompanying, and forming part of, this specification disclose certain specific details of the invention for the purpose of explanation of its broader aspects, but it is understood that the details may be modified in various respects without departure from the principles of the invention, and that the invention may be applied to other forms of files than the ones specifically shown.

The invention may be applied to any of the known rotatable card files in which the individual file cards are disposed about the periphery of a card retaining wheel mounted on a horizontal axis.

The known card files may be divided into two groups, one in which the cards are mechanically attached to the wheel itself in a manner permitting removal of individual cards, and another group in which the cards are carried in individual peripheral compartments and prevented from falling out by a removable belt extending over the compartments within the lower portion of the wheel.

In both instances the cards are arranged in a substantially radial position with respect to the wheel axis and are free to tilt somewhat to one side or the other with respect to the precise radial position.

It will be sufficient to describe the invention in its application to the latter type of card file. Details of construction are described in my prior Patent 2,517,678, dated August 8, 1950, and it will be sufficient to limit the present description to its major elements.

FIGURE 1 shows the file as comprising a wheel 11 having a peripheral wall 12 about which a plurality of compartments 13 for file cards 14 are arranged. The compartments 13 are formed by lateral flanges 15 and 16 of the wheel extending a certain distance beyond the peripheral wall 12. Substantially radial partitions 17 subdivide the annular space between the flanges into the individual compartments 13. The partitions 17 may be slightly taller than the cards 14 and relieve the cards from the tension of a card retaining belt about to be described.

The wheel 11 is rotatable about a horizontal axis 18 supported in bearings 19 of a support 20 which is preferably in the form of a cabinet closed on all sides, except on top where the top portion of the wheel protrudes through an access opening 21.

An endless belt 22 extends around rollers 23 in the cabinet in such a manner that one run 24 engages the tops of the partitions 17 within the lower portion of the wheel to prevent the cards from falling out of the compartments. The return run 25 of the belt extends over a drive pulley 26 on the output shaft 27 of a reduction gear 28 driven by an electric motor 29.

A power cord 30 fitted with a plug 31 serves to connect the motor circuit to a source of electrical energy, for example a wall outlet, and the motor is controlled by a switch assembly comprising a manually operable actuator shown in the form of a small disk 32 rotatable about a horizontal axis 33. The disk 32 operates a pair of switches 34 and 35 depending upon rotation of the disk 32 in a direction away, or towards, an operator standing in front of the cabinet 20. Each switch 34 and 35 includes a stationary contact pair and a movable contact arm shiftable between the contact pair. The exact details of the switch will be described later. At this point it will be sufficient to state that the switches are arranged in such a way that the motor 29 turns the wheel 11 in the same direction in which the disk 32 is rotated by the operator.

The motor circuit further includes a shunting resistor 36 which is preferably of the variable type and comprises a shaft 37 for adjusting the resistor from the outside of the cabinet. For this purpose the shaft 37 may be slotted for turning with a screwdriver or a coin in a manner known in the resistor art.

FIGURE 2 shows the circuits of the invention in diagrammatic form. The motor 29 has a wound armature 38 including a commutator 39 contacted by brushes 40 and 41. The variable resistor 36 lies parallel to the armature, one end of the resistor being connected to the brush 40, the movable contact of the resistor being connected to the other brush 41 by a lead 42. The field winding of the motor is shown at 43.

In an actual installation the various connections are preferably made by means of a terminal block, as shown at 44. The block has six terminals, of which terminals 45 and 46 are the input terminals to which the power cord 30 leads. The brushes 40 and 41 of the motor are connected to terminals 47 and 48 through leads 70 and 71 respectively; and the field winding 43 is connected to terminals 49 and 50 through leads 72 and 73. Terminals 46 and 48 are connected by a lead 51.

A lead 52 extends from terminal 45 to make-contacts 53 and 54 of switches 34 and 35. A second lead 55 extends from terminal 47 to break-contacts 56 and 57 of the switches 34 and 35. The switch arms 59 and 59 are connected to the terminals 49 and 50 by leads 60 and 61.

The disk 32 is diagrammatically shown between the switches of FIGURE 2. It is rotatable about its axis 33 and carries a pin 63. This pin is rotatably received in a bore formed in a sleeve 68. Sleeve 68 is in turn rigidly secured in any suitable manner, such as by welding, to the ends of plungers 64 and 65. Thus, pin 63 is adapted to shift actuating plungers 64 and 65 of the switches 34 and 35, respectively. Specifically, these plungers are shifted axially (to the right or left in FIGURE 2), depending upon the direction of rotation of the disk 32. If the disk is rotated in a clockwise sense, the arm 58 of switch 34 is shifted into engagement with contact 53 and current flows from terminal 45 through lead 52, make-contact 53, switch arm 58, lead 60, through the field winding 43 and thence through lead 61, switch 35, lead 55, to the commutator brush 40, thence through the armature and out through brush 41, lead 51, to the terminal 46.

Rotation of the switch disk in a counterclockwise sense shifts switch arm 59, instead of switch arm 58. When shifted arm 59 engages contact 54 and causes the current to flow through the field 43 in the opposite direction. It will be understood that movable contact arms 58 and 59 are normally held in engagement with contacts 56 and 57, respectively, by any suitable means such as the tension springs shown diagrammatically at 66 and 67.

Summarizing the reversing operation, actuation of the switch 34 connects lead 52 to terminal 49 while terminal 50 remains connected to lead 61. Actuation of the other switch 35 connects terminal 50 to lead 52 while terminal 49 remains connected to lead 60.

When the disc 32 is released and the flow of power from the power cord 30 is interrupted, the motor continues to coast under its own inertia and the inertia of the card retaining wheel 11. The energy thus created is converted into heat in the shunting resistor 36, the braking action being greater for reduced ohmic values of the resistor 36 and being less for higher ohmic values.

Since the resistor 36 also shunts the armature during the period of the motor is energized to drive the card containing wheel, its effect is to reduce the motor speed.

A reduction of the motor speed due to the shunting action of the resistor 36 is accompanied by a reduction in the tendency of the motor to coast a certain number of revolutions after interruption of the electric power, but I discovered that the braking effect thus produced is considerably in excess, proportionately, of the speed reduction. The relationship of the braking effect to the motor speed is conveniently expressed by comparing the motor revolutions per minute with the number of revolutions the motor continues to coast after the power is shut off. To express this relationship numerically a coasting factor and a braking factor are computed as follows:

A coasting factor

$$C=\frac{n_2}{n_1}$$

compares the number of coasting revolutions n_2 with the motor speed n_1. In order to avoid fractions the quotient

$$\frac{n_2}{n_1}$$

will be multiplied by 100.

A braking factor

$$B=\frac{n_1}{n_2}$$

compares the motor speed n_1 with the coasting revolutions n_2.

Both factors are determined for different motor speeds and it is apparent that if a speed reduction were accompanied by a proportionate reduction in coasting, the two factors would remain substantially unchanged.

As will be shown, however, the coasting factor C is progressively reduced and the braking factor is sharply increased.

The importance of efficient braking is readily appreciated, when it is realized that the operator of the file who watches the cards, as they emerge from the cabinet, must be able to stop the wheel before the desired card disappears agagin into the cabinet. Release of the switch **32** does not bring the wheel **11** to a dead stop, but the wheel tends to coast until it finally comes to rest. Assuming, as a practical example, that the wheel **11** has 16 compartments, the wheel will overshoot its proper position by one compartment if the drive pulley **28** is permitted to make 0.625 of one revolution in a file in which the ratio of the wheel drive is approximately 10 to 1. This ratio is found in a wheel **11** measuring 29½ inches across the partitions driven by a pulley **26** of 3 inches diameter.

In order to establish the relationship between shaft revolutions n_1 of the pulley shaft **27** and the number of coasting revolutions n_2, a series of tests were conducted with a file having a card capacity of 5,500 cards, each card measuring 5 by 8 inches, the unit being powered by a single phase, series wound motor having a rated speed of 5,000 r.p.m. and a rated output of 1/20 horsepower. The motor speed was reduced by a worm-type reduction gear having a gear rate of 72 to 1.

The drive unit was first tested alone after disengaging the drive belt **25** at the drive pulley **26** resulting in test series I. Next, the belt **25** was reengaged and the card filing device was tested with the wheel **11** empty, resulting in test series II. Finally the wheel was loaded with 5,500 file cards to its full capacity, resulting in test series III. For each series the brake factors B and coasting factors C were computed.

TABLE A.—FORWARD OPERATION

Resistance (Ω)		100	90	80	70	60	50
I. DRIVE UNIT ALONE							
Shaft rev. (n_1)	160	78	75	70.5	64	58	51
Percent	100	49	47	44	40	36	32
Coasting rev. (n_2)	2	0.8	0.75	0.7	0.6	0.5	0.4
Percent	100	40	37½	35	30	25	20
II. DRIVE UNIT AND WHEEL (EMPTY)							
Shaft rev. (n_1)	122	86	63	57	54	51	48
Percent	100	70	52	47	44	42	41
Coasting rev. (n_2)	1.25	0.45	0.3	0.25	0.2	0.15	0.15
Percent	100	36	24	20	16	12	12
III. DRIVE UNIT AND WHEEL (100% LOADED)							
Shaft rev. (n_1)	112	62	59	55	51	47	42
Percent X	100	55	53	49	45½	42	37½
Coasting rev. (n_2)	1.2	0.3	0.25	0.2	0.15	0.13	0.1
Percent	100	25	21	17	12.5	10.8	8
I. DRIVE UNIT ALONE							
Coasting Factor C, $n_2/n_1 \times 100$	125	102.5	100	99.5	94	86	78.5
Braking Factor B, n_1/n_2	80	97.5	100	100.5	106.5	116	127
II. DRIVE UNIT AND WHEEL (EMPTY)							
Coasting Factor C, $n_2/n_1 \times 100$	96	52.3	47.5	44	37	34	32
Braking Factor B, n_1/n_2	104	190	210	228	270	294	312
III. DRIVE UNIT AND WHEEL (100% LOADED)							
Coasting Factor C, $n_2/n_1 \times 100$	107	48.4	42.4	36.4	29.4	27.0	28.8
Braking Factor B, n_1/n_2	93.5	207	236	275	340	370	420

The above tests were repeated for rotation in the opposite direction.

TABLE B.—REVERSE ROTATION

Resistance (Ω)		100	90	80	70	60	50
I. DRIVE UNIT ALONE							
Shaft rev. (n_1)	175	86	83	78	71	65	57
Percent	100	49	47	44	40½	37	32½
Coasting rev. (n_2)	3	1.2	1.1	1.0	0.9	0.8	0.7
Percent	100	40	36½	33	30	26N	23½
II. DRIVE UNIT AND WHEEL (EMPTY)							
Shaft rev. (n_1)	132	73	69	64	58	55	52
Percent	100	55	52	48½	44	42	38
Coasting rev. (n_2)	1.3	0.4	0.35	0.3	0.25	0.2	0.15
Percent	100	31	27	23	19	15	11½
III. DRIVE UNIT AND WHEEL (100% LOADED)							
Shaft rev. (n_1)	115	66	63	60	55	50	45
Percent	100	57	55	52	48	43.5	39
Coasting rev. (n_2)	1.2	0.35	0.3	0.25	0.2	0.15	0.1
Percent	100	29	25	21	17	12½	8
I. DRIVE UNIT ALONE							
Coasting Factor C, $n_2/n_1 \times 100$	171	140	133	129	127	123.5	123
Braking Factor B, n_2/n_1	58.3	71.7	75.5	78	79	81	81.5
II. DRIVE UNIT AND WHEEL (EMPTY)							
Coasting Factor C, $n_2/n_1 \times 100$	98.5	55	51	47	43	36	29
Braking Factor B, n_2/n_1	101.5	182	197	214	232	275	345
III. DRIVE UNIT AND WHEEL (100% LOADED)							
Coasting Factor C, $n_2/n_1 \times 100$	104	53	47.6	41.7	36.4	30	22.2
Braking Factor B, n_2/n_1	96	188	210	240	275	334	450

Evaluation of the Tests

A difference in shaft speed is noted for the two directions of rotation. The cause of this unequality is believed to reside in electrical asymmetry of the series wound motor (Boehm M–155), a motor of commercial grade. More particularly, the commutator brushes were not in the optimum position with regard to the field. The motor did not permit rotary adjustment of the brushes.

Table A, Test I

The test indicates that by application of a shunt of 50 ohms it was possible to reduce coasting by 80 percent, whereas the corresponding reduction in shaft speed was only 68 percent. Correspondingly the coasting factor C was reduced from 125 to 78.5 while the braking factor B was increased from 80 to 127, an improvement of over 50 percent.

Table A, Test II

The test results of the driven empty file show a marked improvement over the favorable results of tests conducted with the drive unit alone. A reduction of the drive speed to 41 percent was accompanied by a reduction in coasting to 12 percent. Correspondingly, the coasting factor was reduced from 96 to 32 over the test range while the brake factor rose from 104 to 312, an improvement by 200 percent.

Table A, Test III

The fully loaded file exhibited a further improvement in its characteristics. A reduction of the drive speed to 37½ percent was accompanied by a reduction in coasting to 8 percent. Correspondingly, the coasting factor was reduced from 107 to 23.8 while the brake factor rose from 93.5 to 420, an improvement by over 300 percent.

Table B

Aside from the slightly higher figures for n_1 and n_2 recorded for operation in the reverse direction, the tests corroborate the figures in Table A. The drive unit alone showed an improvement in the brake factor from 58.3 to 81.5, by approximately 40 percent. Test II showed a corresponding improvement from 101.5 to 345, by well over 200 percent, and test III showed an improvement from 96 to 450, by over 350 percent.

The increase in the braking effectiveness may be attributable to the physical characteristics of the card retaining wheel in which a certain amount of the rotational energy is lost and converted into heat by the motion of the cards as they tilt to one side or to the other when the cards move through the highest or lowest points. I do not wish to limit my invention by a possible incorrectness of this explanation, but it is sufficient to note that the braking effectiveness of the driven card retaining wheel surpasses that of its drive unit tested alone.

What is claimed is:

1. A rotary card file comprising a substantially cylindrical file card retaining wheel having a horizontal axis and a peripheral portion forming a seat for file cards disposed substantially radially with respect to the wheel axis with freedom of tilting with respect to the true radial position; a base supporting said wheel for rotation about said horizontal axis; an electric motor mounted on said base, said motor having an armature winding and a field winding, means for electrically connecting one lead of said armature winding to a power line, switching means on said base for controlling said motor, said switching means including an actuator, said actuator being shiftable to a first position corresponding to rotation of the wheel in one direction, to a second position corresponding to rotation of the wheel in the opposite direction, and to an off position, first and second contact pairs, each of said contact pairs comprising a first contact in electrical connection with a second power line and a second contact connected to a second lead of the motor armature, a movable contact member associated with each contact pair, connecting means mechanically interconnecting each of said movable contact members with said actuator, each of said movable contact members being respectively connected to opposite leads of said field, said movable contact members being in engagement with the second contact of each pair when said actuator is in the off position, said connecting means being effective to shift the movable contact of one pair into engagement with the first contact of said pair when the actuator is shifted to its first position, and the movable contact of the other pair into engagement with the first contact of that pair when the actuator is shifted to the second position, and means for returning each of said movable contact members to engagement with the second contact of the associated contact pair when the movable contact member associated with the other contact pair is shifted to a position in engagement with the first contact of that pair, whereby said switching means is effective when the actuator is in said first position to connect the field winding in series with the armature winding and establish a current flow in a first direction through the field winding, and said switching means is further effective when the actuator is in the second position to connect the field winding in series relationship with the armature and establish a current flow through the field winding in the reverse direction, and said switching means is additionally effective when the actuator is in the off position to disconnect said field winding from series connection with said armature, a speed reduction gear mounted on said base, said gear being driven by said motor; drive means between said speed reduction gear and said wheel, and a resistor in parallel with said armature winding for dynamically braking said motor and thereby reducing coasting of the wheel when said actuator is moved into its off position.

2. A rotary card file comprising a substatnially cylindrical file card retaining wheel having a horizontal axis and a peripheral portion forming a seat for file cards disposed substantially radially with respect to the wheel axis with freedom of tilting with respect to the true radial position, a plurality of transverse partitions extending across said peripheral seat forming portion dividing said seat forming portion into a plurality of individual compartments; a base supporting said wheel for rotation about said horizontal axis; an electric motor mounted on said base, said motor having an armature winding and a field winding, means for electrically connecting one lead of said armature winding to a power line, switching means on said base for controlling said motor, said switching means including an actuator, said actuator being shiftable to a first position corresponding to rotation of the wheel in one direction, to a second position corresponding to rotation of the wheel in the opposite direction, and to an off position, first and second contact pairs, each of said contact pairs comprising a first contact in electrical connection with a second power line and a second contact connected to a second lead of the motor armature, a movable contact member associated with each contact pair, connecting means mechanically interconnecting each of said movable contact members with said actuator, each of said movable contact members being respectively connected to opposite leads of said field, said moveable contact members being in engagement with the second contact of each pair when said actuator is in the off position, said connecting means being effective to shift the movable contact of one pair into engagement with the first contact of said pair when the actuator is shifted to its first position, and the movable contact of the other pair into engagement with the first contact of that pair when the actuator is shifted to the second position, and means for returning each of said movable contact members to engagement with the second contact of the associated contact pair when the movable contact member associated with the other contact pair is shifted to a position in engagement with the first contact of that pair, whereby said switching means is effective when the actuator is in said first position to connect the field winding in series with the armature winding and establish a current flow in a first direction through the field winding, and said switching means is further effective when the actuator is in the second position to connect the field winding in series relationship with the armature and establish a current flow through the field winding in the reverse direction, and said switching means is additionally effective when the actuator is in the off position to disconnect said field winding from series connection with said armature, a speed reduction gear mounted on said base, said gear being driven by said motor and having a drive pulley; a drive belt trained around said pulley, said belt having a driving run engaging said partitions within the lower portion of said wheel and retaining cards in said compartments, and a return run; and a resistor in parallel with said armature winding, for dynamically braking said motor thereby reducing coasting of the wheel when said switching means is moved into off position, and whereby the coasting of said wheels is further reduced by motion of cards within said wheel.

3. A rotary card file comprising a substantially cylindrical file card retaining wheel having a horizontal axis and a peripheral portion forming a seat for file cards disposed substantially radially with respect to the wheel axis with freedom of tilting with respect to the true radial position, a plurality of transverse partitions extending across said peripheral seat forming portion dividing said seat forming portion into a plurality of individual compartments; a base supporting said wheel for rotation about said horizontal axis; an electric motor mounted on said base, said motor having an armature winding and a field winding, means for electrically connecting one lead of

said armature winding to a power line, switching means on said base for controlling said motor, said switching means including an actuator, said actuator being shiftable to a first position corresponding to rotation of the wheel in one direction, to a second position corresponding to rotation of the wheel in the opposite direction, and to an off position, first and second contact pairs, each of said contact pairs comprising a first contact in electrical connection with a second power line and a second contact connected to a second lead of the motor armature, a movable contact member associated with each contact pair, connecting means mechanically interconnecting each of said movable contact members with said actuator, each of said movable contact members being respectively connected to opposite leads of said field, said movable contact members being in engagement with the second contact of each pair when said actuator is in the off position, said connecting means being effective to shift the movable contact of one pair into engagement with the first contact of said pair when the actuator is shifted to its first position, and the movable contact of the other pair into engagement with the first contact of that pair when the actuator is shifted to the second position, and means for returning each of said movable contact members to engagement with the second contact of the associated contact pair when the movable contact member associated with the other contact pair is shifted to a position in engagement with the first contact of that pair, whereby said switching means is effective when the actuator is in said first position to connect the field winding in series with the armature winding and establish a current flow in a first direction through the field winding, and said switching means is further effective when the actuator is in the second position to connect the field winding in series relationship with the armature and establish a current flow through the field winding in the reverse direction, and said switching means is additionally effective when the actuator is in the off position to disconnect said field winding from series connection with said armature, a speed reduction gear mounted on said base, said gear being driven by said motor and having a drive pulley; a drive belt trained around said pulley, said belt having a driving run engaging said partitions within the lower portion of said wheel and retaining cards in said compartments, and a return run; and a variable resistor on said base, said resistor being in parallel with said armature winding, said motor is dynamically braked resulting in a reduction of the coasting of the wheel when said switching means is moved into off position, the coasting of said wheel being further reduced by the action of movement of file cards within said compartments.

4. A rotary card file comprising a substantially cylindrical file card retaining wheel having a horizontal axis and a peripheral portion forming a seat for file cards disposed substantially radially with respect to the wheel axis with freedom of tilting with respect to the true radial position; a base supporting said wheel for rotation about said horizontal axis; an electric motor mounted on said base, said motor having an armature winding and a field winding, means for electrically connecting one lead of said armature winding to a power line, switching means on said base for controlling said motor, said switching means including a disk, said disk being mounted for rotation on a horizontal axis and being rotatable in one direction to a first position corresponding to rotation of the wheel in the same direction, said disk being rotatable in the opopsite direction to a second position corresponding to rotation of the wheel in the opposite direction, and to an off position, first and second contact pairs, each of said contact pairs comprising a first contact in electrical connection with a second power line and a second contact connected to a second lead of the motor armature, a movable contact member associated with each contact pair, connecting means mechanically interconnecting each of said movable contact members with said disk, each of said movable contact members being respectively connected to opposite leads of said field, said movable contact members being in engagement with the second contact of each pair when said disk is in the off position, said connecting means being effective to shift the movable contact of one pair into engagement with the first contact of said pair when the disk is shifted to its first position, and the movable contact of the other pair into engagement with the first contact of that pair when the disk is shifted to the second position, and means for returning each of said movable contact members to engagement with the second contact of the associated contact pair when the movable contact member associated with the other contact pair is shifted to a position in engagement with the first contact of that pair, whereby said switching means is effective when the disk is in said first position to connect the field winding in series with the armature winding and establish a current flow in a first direction through the field winding, and said switching means is further effective when the disk is in the second position to connect the field winding in series relationship with the armature and establish a current flow through the field winding in the reverse direction, and said switching means is additionally effective when the disk is in the off position to disconnect said field winding from series connection with said armature, a speed reduction gear mounted on said base, said gear being driven by said motor; drive means between said speed reduction gear and said wheel, and a resistor in parallel with said armature winding, whereby said card retaining wheel is rotated in the same sense as the rotation of the disk when said disk is rotated to its first or second position, said motor being dynamically braked reducing coasting of the wheel when said disk is moved into its off position.

5. A rotary card file comprising a substantially cylindrical file card retaining wheel having a horizontal axis and a peripheral portion adapted to receive file cards disposed substantially radially with respect to the wheel axis, a base supporting said wheel for rotation about said horizontal axis, an electrical motor, drive means interconnecting said motor and said wheel, said motor having an armature winding and a field winding, means for electrically connecting one lead of said armature winding to a power line, a switch actuator shiftable to an off position, a first energized position, and a second energized position, first and second contact pairs associated with said switch actuator, each of said contact pairs comprising a first contact in electrical connection with a second power line and a second contact connected to a second lead of the motor armature, a movable contact member associated with each contact pair, connecting means mechanically interconnecting each of said movable contact members with said actuator, each of said movable contact members being respectively connected to opposite leads of said field, said movable contact members being in engagement with the second contact of each pair when said actuator is in the off position, said connecting means being effective to shift the movable contact of one pair into engagement with the first contact of said pair when the actuator is shifted to its first position, and the movable contact of the other pair into engagement with the first contact of that pair when the actuator is shifted to the second position, and means for returning each of said movable contact members to engagement with the second contact of the associated contact pair when the movable contact member associated with the other contact pair is shifted to a position in engagement with the first contact of that pair, and a resistance permanently connected in shunt with said armature winding, when said switch actuator is in said off position said motor being dynamically braked.

6. A rotary card file comprising a substantially cylindrical file card retaining wheel having a horizontal axis

and a peripheral portion adapted to receive file cards disposed substantially radially with respect to the wheel axis, a base supporting said wheel for rotation about said horizontal axis, said base enclosing said wheel and having an access opening adjacent to the periphery of said wheel, an electrical motor, drive means interconnecting said motor and said wheel, said motor having an armature winding and a field winding, means for electrically interconnecting one lead of said armature winding to a power line, control means for selectively rotating said wheel to bring a predetermined portion thereof into registry with said access opening, said control means comprising first and second double throw switches, each of said double throw switches comprising a first contact in electrical connection with a second power line, a second contact connected to a second lead of the motor armature and a movable contact member, said movable contact member being respectively connected to opposite leads of said field, means for selectively actuating said switches, said means comprising a reciprocating member in mechanical connection with said movable members, a disk, means rotatably mounting said disk on said base, said disk being rotatable in one direction to a first position corresponding to rotation of the wheel in the same direction, said disk being rotatable in the opposite direction to a second position corresponding to rotation of the wheel in the opposite direction and to an off position and means interconnecting said disk and reciprocating member, said movable contact members being in engagement with the second contact of each switch when said disk is in the off position, said reciprocating member being effective to shift the movable contact of one switch into engagement with the first contact of said switch when the disk is shifted to its first position, and the movable contact of the other switch into engagement with the first contact of that switch when the disk is shifted to the second position, and means for returning each of said movable contact members to engagement with the second contact of the associated contact pair when the movable contact member associated with the other contact pair is shifted to a position in engagement with the first contact of that pair, whereby when said first switch is actuated to shift its movable contact member into engagement with said first contact, the field winding is connected in series with said armature for current flow in a first direction through said field windings, when said second switch is actuated to shift its movable contact member into engagement with said first contact, the field is connected in series with said armature so that current flows through the field winding in the opposite direction, said field winding being disconnected from said armature when the movable contact members of both switches are in respective engagement with the second contacts of said switches, and a resistance in shunt connection with said armature, when said field winding being disconnected, the motor is dynamically braked.

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