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ELECTRIC SEWING MACHINE DRIVES

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4 Sheets-Sheet 1

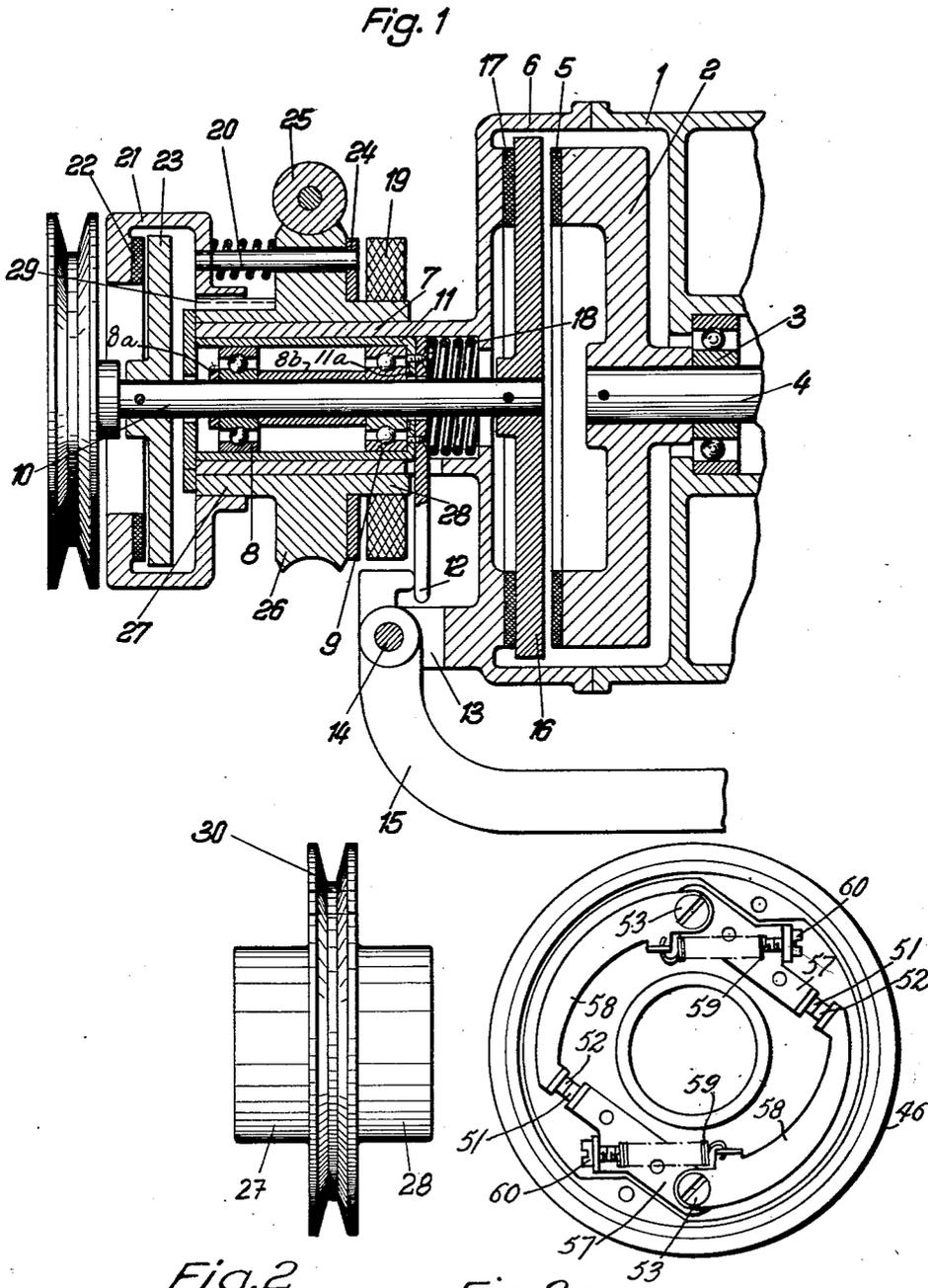


Fig. 2

Fig. 2a

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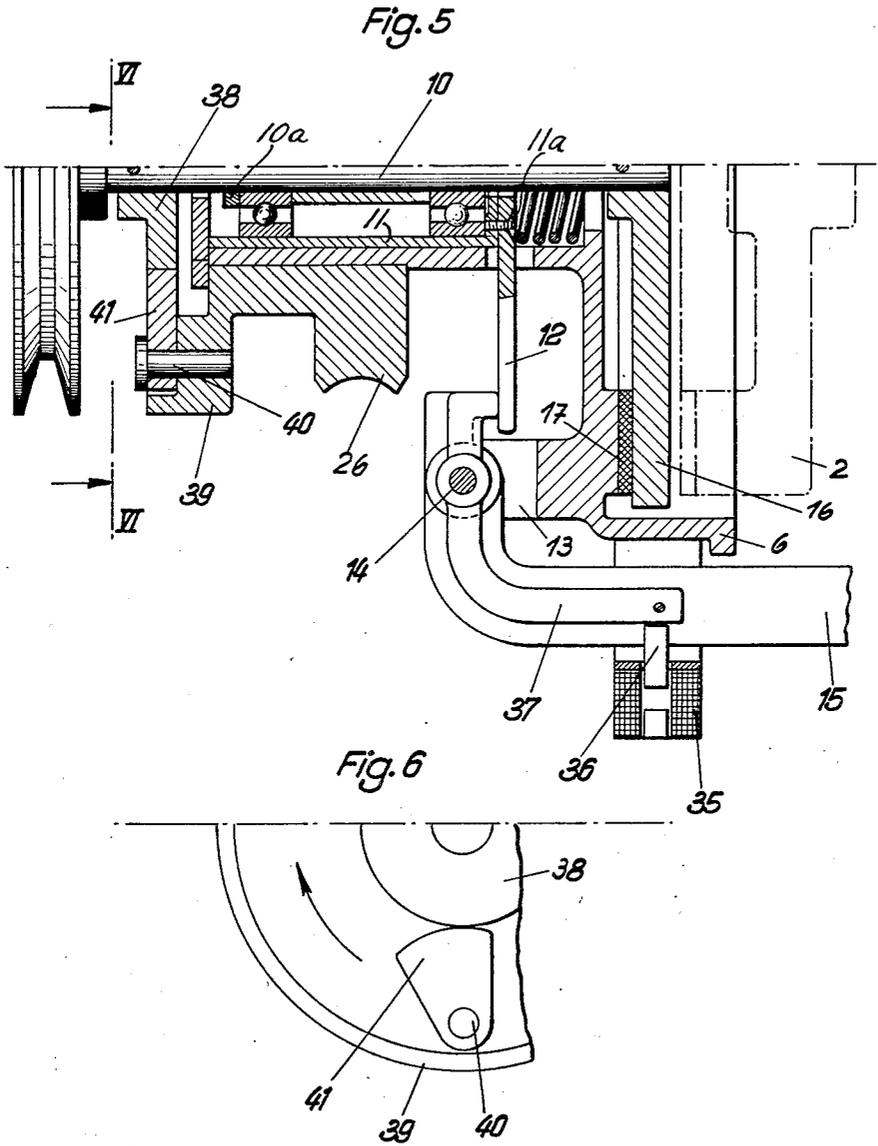
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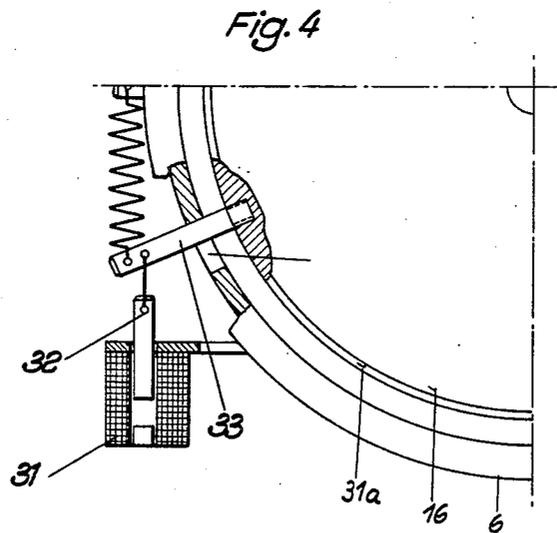
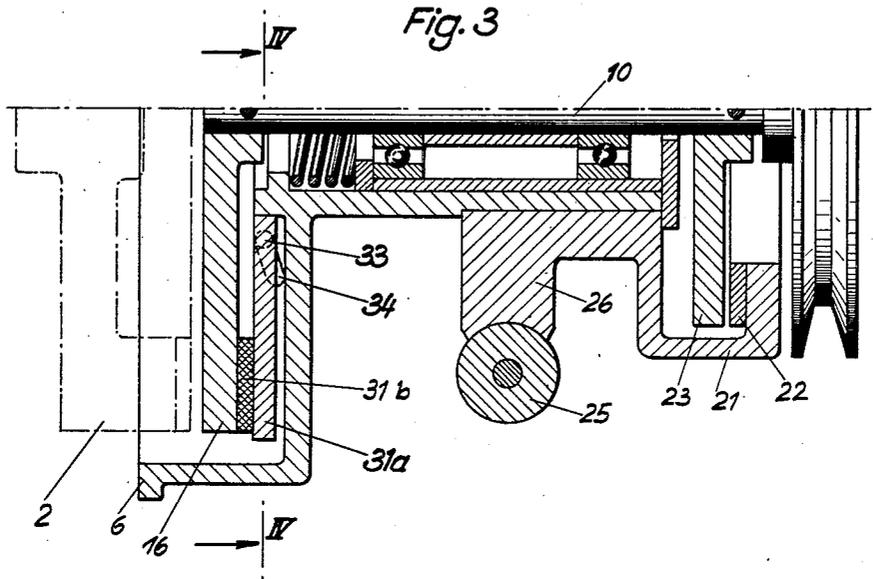
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## ELECTRIC SEWING MACHINE DRIVES

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12 Claims. (Cl. 192—145)

The invention relates to a sewing machine drive comprising an electric motor acting as main driving means, a releasable friction clutch disposed between the said motor and a power take-off shaft connected to the rotating parts of the sewing machine, and an auxiliary drive which can be coupled with the power take-off shaft instead of the main drive. According to the invention, a brake-releasing device is provided by means of which the brake is automatically released after braking the power take-off shaft, in order to release the said shaft for movement by the auxiliary drive. The result is thus obtained that the brake, which is intended in known manner to stop the rotating parts momentarily, releases the power take-off shaft immediately after having overcome the kinetic energy inherent in the rotating sewing machine parts. The said power take-off shaft is thus freed for further movement, so that the sewing machine can be adjusted by further turning into a desired neutral position in which, for example, the needle shank occupies its highest or lowest position. The automatic release of the brake is particularly advantageous if the auxiliary drive of the sewing machine is arranged to effect the said adjusting movement automatically after the main drive has been disengaged.

The brake-releasing device is preferably electromechanically operated and can be controlled by a centrifugal switch which is connected to rotating parts of the sewing machine and responds as soon as these parts have been braked. If the machine is provided with a contact device operating as a circuit-breaker which disconnects the auxiliary drive when the machine is in the desired position, the centrifugal switch may be mounted on the same shaft as the circuit-breaker.

The sewing machine drive according to the invention may furthermore be so designed that the same brake becomes operative both after interruption of the main drive and after interruption of the auxiliary drive. This has the advantage that a relatively strong brake is also available for braking the movement produced by the auxiliary drive. The said movement can then be completed at a higher speed than is possible in the known sewing machine drives, so that the machine is very rapidly set into its neutral position. The saving of time thereby effected is of considerable practical importance, particularly in the case of sewing machines for industrial concerns.

Various embodiments of the invention will now be more particularly described by way of example and with reference to the accompanying drawings, in which:

Figure 1 is a section through a first embodiment of the drive,

Figure 2a is a plan view of a centrifugal switch,

Figure 2, a fragmentary view of a modified part,

Figure 3, a fragmentary section through a second constructional example,

Figure 4, a fragmentary section on the line IV—IV in Figure 3,

Figure 5, a section through a third embodiment,

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Figure 6, a partial view with a fragmentary section on the line VI—VI of Figure 5, and

Figure 7, a diagrammatic illustration of the whole arrangement and of the circuit arrangement of the first example.

In all the embodiments, a driving clutch disc 2 is mounted on a motor shaft 4 running in bearings 3 in a motor housing 1. 5 is a friction lining. A clutch housing 6 has a projecting boss 7 in which the power take-off or coupling shaft 10 is mounted in bearings 8 and 9, the inner races of which are securely fixed to the shaft 10. The bearings 8 and 9 are mounted with their outer races securely fixed to the inner surface of a sleeve 11 longitudinally displaceable in the boss 7. The inner races may be held on the shaft 10 by being forced on with a tight fit, but a locking ring 8a or pin may be provided at one end to prevent sliding in one direction. A spacing sleeve 8b prevents sliding of the bearings toward each other, while sliding between the outer races and sleeve 11 is prevented by a tight fit of the races in the sleeve or any other means known to the man skilled in the art such as slight beading with a punch. Coupling pressure can be exerted in known manner through a flange 12 which is secured to the closed end of the sleeve 11 by means of screws 11a and may be displaced longitudinally by a clutch lever 15 mounted in bearing brackets 13 and pivoting on a pin 14, so as to couple a co-acting clutch disc 16 secured on the take-off or coupling shaft 10 with the friction lining 5. The lever 15 may be arranged for actuation by the operator's leg, or knee, or may be linked with a foot pedal in any suitable manner. The spring 13 acts in opposition to the coupling pressure. If, while the sewing machine is being driven, downward pressure on the horizontal portion of the lever 15 is released, the co-acting clutch disc 16 is first pressed against a brake lining 17. As soon as the rotative inertia or kinetic energy inherent in the rotating sewing machine parts has been reduced by the braking device, in the embodiment shown in Figure 1, an electromagnet 19 controlled by a centrifugal switch (46 in Figure 7) and a relay (50 in Figure 7) becomes operative, and by means of a pin 20 draws a clutch housing 21 having a friction lining 22 against an auxiliary clutch disc 23, so that an operative connection is set up. The travel of the pin 20, which is assembled with a disc 24 co-operating with the magnet 19, is so great that the coupling shaft 10 releases the clutch disc 16 from the braking surface 17.

At the same time, however, the motor H (Fig. 7) of an auxiliary drive is switched on by the relay 50 and rotates a worm 25 (Figures 1 and 7). The worm 25 cooperates with a worm wheel 26, which is mounted on the boss 7 and has flanges or boss extensions 27, 28. The clutch housing 21 is so arranged on the flange 27 as to be longitudinally displaceable, a locating key 29 serving to prevent rotation thereof with respect to the flange 27. The electromagnet 19 is so mounted on the flange 28 as to rotate therewith. The worm wheel 26 can be driven by the worm 25, which is mounted on the shaft of the auxiliary motor, as shown, or it may be driven by the auxiliary motor through a belt. It is possible, instead of employing the worm wheel 26, to provide a pulley (shown in Figure 2) with a belt groove 30, a toothed wheel or the like. If a toothed wheel is used, it can be brought into operative engagement with the auxiliary motor, through an intermediate gear, for example.

The rotation of the shaft of the sewing machine is transmitted without slip to a shaft 45 through a belt 42 and pulleys 43, 44 (Figure 7). Mounted on the said shaft 45 is the aforesaid centrifugal switch 46 and a contact disc 47. The latter has interruptions in the form of insulating inserts or linings 48, 49, which act on the circuit a, b of a relay 50.

This centrifugal switch may be of the construction indicated in Fig. 2a comprising contacts 51, 52 separably mounted on stationary members 57 and movable arms 58, respectively. The arms 58 are pivotally mounted on bolts 53 and are biased in contact closing direction by springs 59 which can be adjusted as required for breaking or closing by means of screws 60.

The said circuit, which passes through the centrifugal switch 46, is connected on the one hand to earth at *g* and thereby to the contact disc 47, and on the other hand to a current collector S. The centrifugal switch 46 does not close this circuit until the kinetic energy of the rotating parts is eliminated. In the position illustrated, the current collector S interrupts the circuit when, for example, the sewing machine needle is in the upper dead-centre position. If the current collector S is moved in the vertical direction through a Bowden cable B, the adjusting device E of which may be secured in the pedal F of the sewing machine, the circuit is broken when the needle is in the lower dead centre position. The Bowden cable B is connected to earth at M. Also connected to earth at M is a conductor *b*, which is connected to the end of the coil of the relay. A conductor *c* is connected directly to the relay coil. As soon as a current interruption occurs, a circuit *df* places out of circuit the auxiliary motor H which has served to turn the needle into the required dead-centre position. If the main motor A is also employed to drive the auxiliary clutch, the pulley 30 driving the worm wheel 26 (Figure 2) can rotate continuously with the main driving device. The operative engagement and the release of the braking are effected by the magnet 19 as already described.

In a further embodiment as illustrated in Figures 3 and 4, after the kinetic energy inherent in the rotating parts has been overcome by a normally stationary, but selectively longitudinally displaceable brake disc 31a having a braking surface 31b, an electromagnet 31 releases the co-acting clutch disc 16 by somewhat rotating the brake disc 31a through a pin 33. The pin 33 engages with a helix 34, and the disc 31a is thus axially moved in accordance with the pitch of the helix 34, and is thereby removed from engagement with the disc 16. The electromagnet 31 corresponds substantially to the electromagnet 19 provided in the embodiment illustrated in Figures 1 and 7 and is connected in a similar manner to the said electromagnet 19. The parts shown in Figures 3 and 4 which are identical with parts of Figure 1 are designated in the same manner as in Figure 1, the less important reference numerals having been omitted.

A further embodiment is shown in Figures 5 and 6. A magnet 35 working by attraction, acts through a core 36 on a lever 37, which may be mounted on the same pin 14 as the clutch lever 15. It is thus possible to release the brake through the flange 12 either by means of the lever 37 or by means of the lever 15. The non-positive engagement of the auxiliary drive with the power take-off shaft is effected by a disc 38, which is rigidly connected thereto. The disc 38 is positively coupled in one direction of rotation with a disc 39, driven by the auxiliary drive, by means of wedging members 41 mounted thereon in the pin 40.

Also in this embodiment the races of the bearings are securely mounted on the shaft 10 and inside the sleeve 11 with a tight fit, while a locking ring 10a may be provided on one side, and the flange 12 is fastened to the inwardly flanged end of sleeve 11 by means of screws 11a.

The electromagnet 35 in the embodiment illustrated in Figures 5 and 6 has substantially the same function as the electromagnets 19 and 31 of Figures 1 and 4 respectively. Its circuit arrangement therefore corresponds to that shown in Figure 7. The most important parts corresponding to the constructional form of Figure 1 are also designated by the same reference numerals in Figures 5 and 6.

#### We claim:

1. In a sewing machine of the type having its functioning parts driven from a common rotating shaft, driving means for said shaft comprising an electric motor having an output shaft adapted to supply a primary source of rotative power; a first clutch element fixed to said output shaft and rotatable therewith; an intermediate shaft extending endwise of said output shaft and rotatably mounted for operation independent of said motor output shaft, said intermediate shaft having a second clutch element fixed adjacent one of its ends and rotatable with the intermediate shaft; means for engaging and means for disengaging said first and second clutch elements whereby said intermediate shaft may selectively rotate with, remain at rest, or be rotated independently of said motor output shaft; a brake associated with said intermediate shaft to retard the rotation thereof, said brake being operable to apply braking effort to the intermediate shaft when the aforesaid first and second clutch elements are disengaged; means operable to release said brake when the rotative inertia of said intermediate shaft has been arrested; an auxiliary drive including a rotatable member engageable with a member fixed to said intermediate shaft and operable to rotate the same when both the aforesaid first and second clutch elements are disengaged and the aforesaid brake is inoperative; means operative upon disengagement of said intermediate shaft by said rotatable auxiliary drive member to restore the braking effect of said brake; and means coupling said intermediate shaft to the common rotating shaft of the sewing machine.

2. Apparatus according to claim 1 in which the means for disengaging the brake comprises a clutch disc defined by said member fixed to said intermediate shaft, which clutch disc is engageable with the auxiliary drive for effecting rotation of the intermediate shaft by said auxiliary drive.

3. Apparatus according to claim 1 in which the operation of the auxiliary drive is controlled by a rotating contactor arranged to be driven in synchronism with the common rotating shaft of the sewing machine, said contactor being arranged to interrupt the auxiliary drive at a predetermined position of the aforesaid sewing machine shaft.

4. In a sewing machine of the type having its functioning parts driven from a common rotating shaft, driving means for said shaft comprising an electric motor having an output shaft adapted to supply a primary source of rotative power; a first clutch element fixed to said output shaft and rotatable therewith; an intermediate shaft extending endwise of said output shaft and rotatably mounted for operation independent of said motor output shaft, said intermediate shaft having a second clutch element fixed adjacent one of its ends and rotatable with the intermediate shaft; means for engaging and means for disengaging said first and second clutch elements whereby said intermediate shaft may selectively rotate with, remain at rest, or be rotated independently of said motor output shaft; a brake associated with said intermediate shaft to retard the rotation thereof, said brake being operable to apply braking effort to the intermediate shaft when the aforesaid first and second clutch elements are disengaged; an electromagnet operable when energized to release said brake; means controlling the flow of electric energy to said electromagnet whereby the latter is energized when the rotative inertia of said intermediate shaft has been arrested; an auxiliary drive including a rotatable member engageable with a member fixed to said intermediate shaft and operable to rotate the same when both the aforesaid first and second clutch elements are disengaged and the aforesaid brake is inoperative; and means coupling said intermediate shaft to the common rotating shaft of the sewing machine.

5. In a sewing machine of the type having its functioning parts driven from a common rotating shaft, driving

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means for said shaft comprising an electric motor having an output shaft adapted to supply a primary source of rotative power; a first clutch element fixed to said output shaft and rotatable therewith; an intermediate shaft extending endwise of said output shaft and rotatably mounted for operation independent of said motor output shaft, said intermediate shaft having a second clutch element fixed adjacent one of its ends and rotatable with the intermediate shaft; means for engaging and means for disengaging said first and second clutch elements whereby said intermediate shaft may selectively rotate with, remain at rest, or be rotated independently of said motor output shaft; a brake associated with said intermediate shaft to retard the rotation thereof, said brake being operable to apply braking effort to the intermediate shaft when the aforesaid first and second clutch elements are disengaged; a centrifugal switch responsive to rotation of said intermediate shaft and operative to energize an electromagnet arranged to release said brake when the rotative inertia of said intermediate shaft has been arrested; an auxiliary drive including a rotatable member engageable with a member fixed to said intermediate shaft and operable to rotate the same when both the aforesaid first and second clutch elements are disengaged and the aforesaid brake is inoperative; and means coupling said intermediate shaft to the common rotating shaft of the sewing machine.

6. In a sewing machine of the type having its functioning parts driven from a common rotating shaft, driving means for said shaft comprising an electric motor having an output shaft adapted to supply a primary source of rotative power; a first clutch element fixed to said output shaft and rotatable therewith; an intermediate shaft extending endwise of said output shaft and rotatably mounted for operation independent of said motor output shaft, said intermediate shaft having a second clutch element fixed adjacent one of its ends and rotatable with the intermediate shaft; means for engaging and means for disengaging said first and second clutch elements whereby said intermediate shaft may selectively rotate with, remain at rest, or be rotated independently of said motor output shaft; a brake associated with said intermediate shaft to retard the rotation thereof, said brake being operable to apply braking effort to the intermediate shaft when the aforesaid first and second clutch elements are disengaged; electrically operable means arranged to release said brake when the rotative inertia of said intermediate shaft has been arrested; an electrically operable auxiliary drive including a rotatable member engageable with a member fixed to said intermediate shaft and arranged to rotate the same when both the aforesaid first and second clutch elements are disengaged and the aforesaid brake is inoperative; an electric switch arranged to simultaneously energize said brake releasing means and said auxiliary drive; and means coupling said intermediate shaft to the common rotating shaft of the sewing machine.

7. Apparatus according to claim 6 in which the electrically operable means for releasing the brake comprises an electromagnet concentric with the intermediate shaft.

8. In a sewing machine of the type having its functioning parts driven from a common rotating shaft, driving means for said shaft comprising an electric motor having an output shaft adapted to supply a primary source of rotative power; a first clutch element fixed to said output shaft and rotatable therewith; a longitudinally displaceable intermediate shaft extending endwise of said output shaft and rotatably mounted for operation inde-

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pendent of said motor output shaft, said intermediate shaft having a second clutch element fixed adjacent one of its ends and rotatable with the intermediate shaft; means for displacing said intermediate shaft longitudinally to engage said first and second clutch elements for driving said intermediate shaft from said primary source of rotative power; a braking element concentrically disposed with respect to said first and second clutch elements and longitudinally spaced therefrom; means for displacing said intermediate shaft longitudinally whereby said second clutch element is removed from engagement with said first clutch element and engages said braking element to arrest the rotative inertia of said intermediate shaft; means responsive to the arresting of rotation of said intermediate shaft to release the engagement of said second clutch element and said braking element whereby said intermediate shaft is free from the influence of both the braking element and the first clutch element; an auxiliary drive including a rotatable member engageable with a member fixed to said intermediate shaft and operable to rotate the same when said shaft is free from the clutch and braking elements as aforesaid; and means coupling said intermediate shaft to the common rotating shaft of the sewing machine.

9. Apparatus according to claim 8 in which the braking element is longitudinally displaceable along the axis of the intermediate shaft and the means which releases the braking element from the second clutch element is operative to effect such release by longitudinally displacing the braking element.

10. Apparatus according to claim 8 in which the second clutch element is released from the braking element by displacing the intermediate shaft longitudinally toward the first clutch element, and an electromagnet is arranged concentrically with the intermediate shaft to provide the energy for such displacement.

11. Apparatus according to claim 8 in which the means for releasing the second clutch element from the braking element comprises a clutch disc defined by said member fixed to said intermediate shaft, which clutch disc is engageable with the auxiliary drive for longitudinally shifting said intermediate shaft, whereby the said shaft is released by the braking element and simultaneously coupled with the auxiliary drive.

12. Apparatus according to claim 8 in which said intermediate shaft is mounted in a sleeve, said shaft and sleeve being displaceable longitudinally as a unit, and the means for displacing said shaft and sleeve from engagement with the first clutch element to engagement with the braking element comprises a spring normally urging said second clutch element to engage said brake element.

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