United States Patent [19]

Hale

[11] **3,862,444**

[45] **Jan. 21, 1975**

[54] **SUPER SPEED CLUTCH MOTOR**

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[73] Assignee: **Union Special Company,** Chicago, Ill.

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[21] Appl. No.: **331,699**

[52] **U.S. Cl.** ..... **310/74,** 192/18 R, 310/76, 310/115

[51] **Int. Cl.** **H02k 7/10,** H02k 7/112

[58] **Field of Search** 310/112, 113, 114, 115, 310/116, 117, 118, 74, 76; 192/18

[56] **References Cited**

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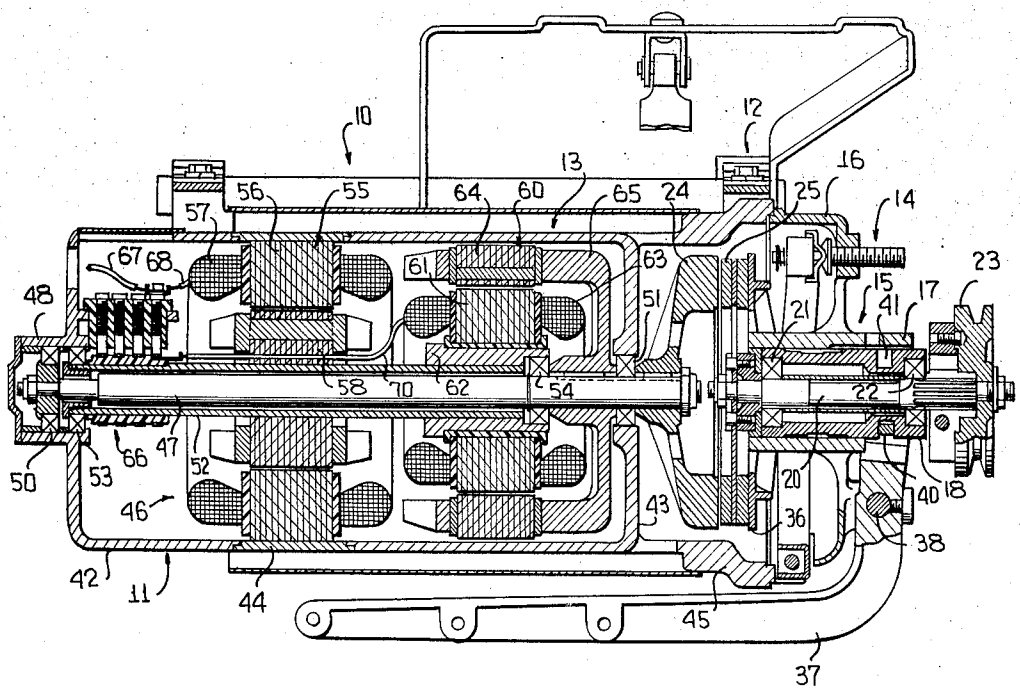
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Primary Examiner—J. D. Miller
Assistant Examiner—Robert J. Hickey
Attorney, Agent, or Firm—Diller, Brown, Ramik & Wight

[57] **ABSTRACT**

This disclosure relates to an electric transmitter for sewing machines and like machines which provides a greater revolution rate than that normally possible solely with an alternating current transmitter in the absence of gearing and like speed multipliers. The electric transmitter utilizes a plurality of motors serially connected with the motors being mounted in a single housing whereby the electric transmitter may be mounted in the normal manner and the clutch-brake thereof may remain of the conventional construction and be mechanically operative.

5 Claims, 2 Drawing Figures



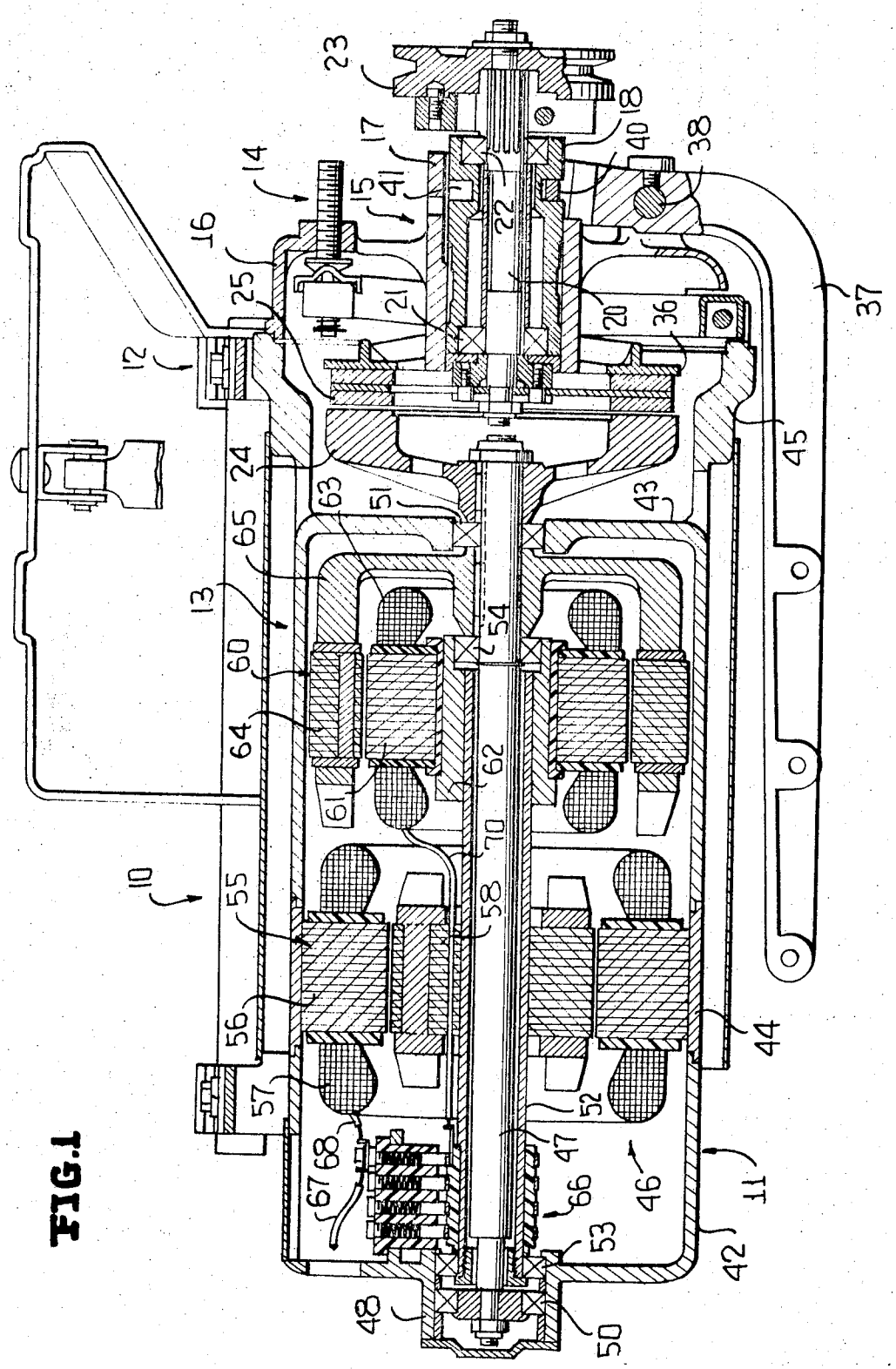

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FIG.1

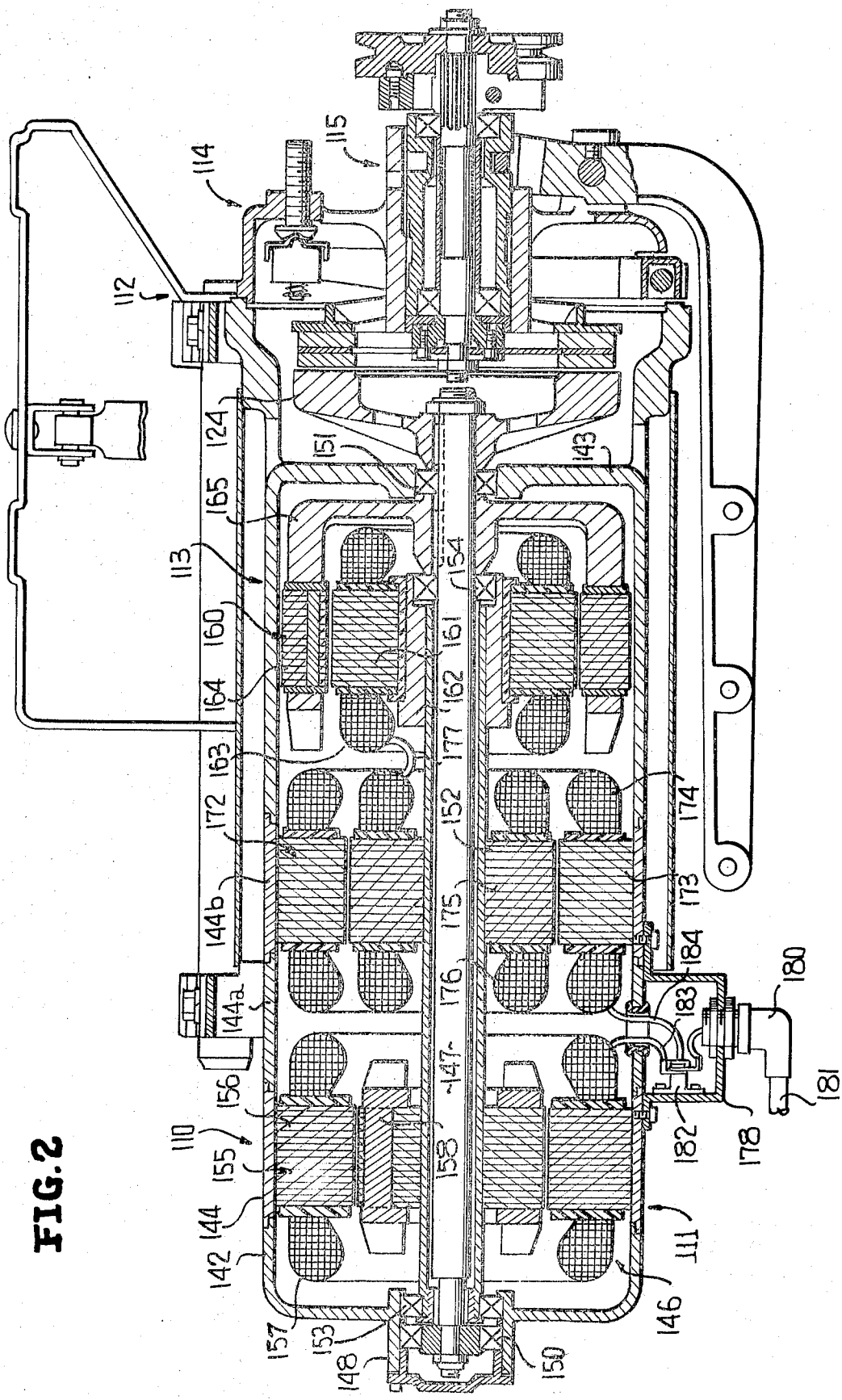

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FIG. 2

SUPER SPEED CLUTCH MOTOR

This invention relates in general to new and useful improvements in electric transmitters for sewing machines and like machines, and more particularly to a super speed electric transmitter which, without utilizing gearing and like speed multiplying mechanism, has a revolution rate which is greater than that heretofore possible with alternating current motors utilizing energy of a given frequency.

BACKGROUND OF THE INVENTION

It is conventional to drive a sewing machine utilizing an electric transmitter of the type including a constant revolution rate motor which is operatively connected to an output shaft by means of a clutch-brake device. The motor is free running and the output shaft is fixed against rotation in the non-driving condition of the transmitter. A mechanical actuator is utilized to disengage the brake portion and engage the clutch portion of the clutch-brake.

For efficient and uniform operation of a sewing machine it is desirable to provide a power source which is capable of quick acceleration and deceleration of the machine and which will operate the machine at a substantially uniform speed throughout a stitch forming operation, regardless of variations in the load in the course of forming a seam. To achieve the latter result, it has been considered desirable to employ an induction motor, and in order to attain a maximum speed this is usually of the two pole type. Such motors operating on 60 cycle alternating current have a maximum theoretical speed of 3,600 R.P.M. but a maximum rated speed of about 3,450 R.P.M.

The importance of quick acceleration and deceleration will be appreciated when it is considered that a sewing machine is subject to very frequent starting and stopping. Only a few seconds are required to form a seam of average length. Therefore, little benefit would be derived from a machine capable of maximum operation at, say, 5,000 R.P.M., if a large portion of the time is consumed in getting up to speed. With the present trend toward higher and higher speeds the importance of rapid acceleration to the normal high speed is accentuated. For good efficiency in the operation of a sewing machine it is desirable to bring the machine to substantially its maximum operating speed within about 1/10 of a second. Even more rapid acceleration is desirable. In general, it has been found that a machine may be gotten up to around 90 percent of its maximum speed within 5 to 30 hundredths of a second, depending upon the machine and its driving means. From this point the machine more gradually increases in speed to its maximum. Factors which enter into the problem of acceleration are the characteristics of the machine itself contributing to inertia, the inertia of the clutch plate and driving pulley of the power unit, the type of belt employed to connect the power unit with the machine, the belt tension, and the like.

To attain machine speeds above 5,000 R.P.M. with present power units, so-called electric transmitters, it has become necessary to increase the size of the motor pulley in relation to the machine pulley. However, this has led to belt slippage, due to the smaller arc of contact with the machine pulley, and has thus increased the length of time required to bring the machine substantially to its maximum speed. This condition becomes quite objectionable when the pulley diameters are such that the machine is operated at more than about one and a half times the speed of the motor.

One solution to the foregoing problem in the past has been by providing suitable gearing between the motor and the flywheel overdriving the flywheel at a rate of about 1.5 to 1. Such arrangement is disclosed in my prior granted U.S. Pat. No. 2,745,525, granted May 15, 1956, and entitled Electric Transmitter for Sewing machines.

This arrangement, however, has the drawback of the added costs involved, the power loss resulting therefrom and the problem of wearing of the components of the gearing and repair thereof.

Another alternative to the problem is the provision of a frequency changer which will increase the frequency of the current supplied to the electric transmitter. It is impractical to provide an individual machine, such as a sewing machine, with a frequency changer.

It is also known to provide a tandem motor arrangement wherein components of two electric motors are coupled together so as to obtain an output speed equal to a combination of the speed of the two motors. Such motor arrangements have been known for a very long time but in no way utilized with clutch-brake devices for exceeding fast start and stop operations.

SUMMARY OF THE INVENTION

In accordance with this invention, a super speed electric transmitter has been invented wherein the customary motor thereof has been replaced by a two-motor unit coupled in series in a mechanically feasible arrangement whereby the speed of the power shaft of the motor of the transmitter is in excess of the normal speed obtainable with the avaiable current frequency.

The principal feature of the invention is the utilization of the tandem motor arrangement in combination with existing transmitter components in a manner wherein the new electric transmitter may be readily mounted to drive a sewing machine in the customary manner and the clutch-brake thereof may remain of the same construction and be mechanically actuated in the normal manner.

Another feature of the invention is the formation of a tandem motor arrangement in an electric transmitter wherein long life of the various components may be realized.

Another feature of the invention is the formation of an electric transmitter which eliminates the necessity of slip-rings or commutator rings for transmitting electrical energy to a rotating component.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by a reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings:

IN THE DRAWINGS:

FIG. **1** is a longitudinal sectional view taken through a first form of electric transmitter constructed in accordance with this invention.

FIG. **2** is a longitudinal sectional view similar to FIG. **1** taken through another form of electric transmitter.

Referring now to the drawings in detail, it will be seen that there is illustrated in FIG. **1** a super speed electric transmitter which is generally identified by the numeral **10.** The electric transmitter **10** includes a housing which is generally identified by the numeral **11,** which housing is provided with support means, generally iden-

tified by the numeral **12,** for effecting a convenient mounting thereof relative to a sewing machine or other machinery.

The housing **11** may be considered as including a motor section, generally identified by the numeral **13,** and a clutch-brake section, generally identified by the numeral **14.** Further, the housing **11** is formed of a plurality of individual components which are secured together in any desired manner.

The clutch-brake portion **14** has mounted therein a conventional type of clutch-brake, generally identified by the numeral **15.** Such a clutch-brake is disclosed in U.S. Pat. No. 2,739,251 to Ross D. Ingalls, granted Mar. 20, 1956.

The housing **11** includes an end cap **16** which supports the clutch-brake unit **15,** the end cap **16** being provided with a central tubular support **17** which slidably carries a control sleeve **18.**

A stub shaft or output shaft **20** is rotatably journaled within the control sleeve **18** by means of suitable bearings **21, 22.** The output shaft **20** projects beyond the control sleeve **18** and has mounted thereon a pulley assembly **23** which will be coupled to the sewing machine or other machine by way of a drive belt.

The clutch-brake unit **15** is associated with a flywheel **24** of the motor unit to be described hereinafter, and includes a double face clutch disc **25** mounted on the inner end of the output shaft **20.** opposing the flywheel **24** is a stationary brake member **36** which is suitably carried by the end cap **16.**

The clutch disc **25** is normally engaged with the brake member **36** and serves to hold the output shaft **20** and the pulley assembly **23** against rotation. In order that the clutch disc **25** may be engaged with the flywheel **24** to drive the output shaft **20,** there is provided a clutch-brake actuating lever **37** which is pivotally mounted on a pin **38** and which lever **37** has a pin **40** which is seated in a circumferential groove **41** formed in the control sleeve **18.** It is to be understood that the lever **37** will be spring-loaded in a manner not shown to rotate in a clockwise direction and to constantly urge the control sleeve **18** to the right to hold the clutch disc **25** against the brake member **36.** Suitable operator actuated linkage (not shown) will be connected to the lever **37** to effect the rotation thereof in a counterclockwise direction, releasing the brake and engaging the clutch disc **25** with the flywheel **24.**

Reference is now made to the motor portion **13** of the housing **11,** which motor portion **13** includes a pair of opposed end caps **42** and **43** separated by an intermediate housing member **44.** At this time it is to be noted that the end cap **43** has a tubular extension **45** to which the end cap **16** is secured and that the flywheel **24,** the clutch disc **25** and the brake member **36** are disposed within the tubular extension **45.**

The housing portion **13** has mounted therein a tandem alternating current electric motor assembly generally identified by the numeral **46.** The motor assembly **46** includes a solid power shaft **47** which is supported in a tubular sleeve portion **48** of the end cap **42** by means of a bearing **50.** The opposite end of the power shaft **47** is supported by a bearing **51** carried by the end cap **43.** The power shaft **47** has directly mounted thereon for rotation therewith the flywheel **24.**

A tubular shaft **52** is telescoped over the power shaft **47** for a major portion of the length thereof with the left end of the tubular shaft **52** being supported for rotation by a bearing **53** carried by the sleeve portion **48.** The right end of the tubular shaft **52** is supported by the power shaft **47** by means of a bearing **54** in a manner to be described hereinafter.

The tandem motor assembly **46** includes a first stage motor, which is preferably of the squirrel-cage induction type and is generally identified by the numeral **55.** The motor **55** includes a stator **56** which is carried by the housing portion **44** and is stationarily mounted within the housing **11.** The stator **56** includes suitable windings **57** and may be described as a wound element or field.

A rotor or armature **58** in the form of a shorted-bar element is mounted on the tubular shaft **52** for rotation therewith in radial alignment with the stator **56.** It is to be understood that when the windings **57** are energized, the rotor **58** will be driven and the tubular shaft **52** will rotate.

The motor assembly **46** also includes a second stage motor, which is preferably of the squirrel-cage induction type and is generally identified by the numeral **60.** The second stage motor **60** includes a rotatable stator **61** which is mounted on a sleeve **62** carried by the tubular shaft **52.** It is to be noted that the sleeve **62** is rigidly connected to the tubular shaft **52** and carries the bearing **54** so that the right end of the tubular shaft **52** is supported from the shaft **47** through the sleeve **62.**

The stator **61** is also provided with suitable windings **63** which are connected to a power source in a manner to be described hereinafter and thus may be identified as a wound element or field. The stator **61** has radially aligned therewith an outer armature or rotor **64** in the form of a shorted-bar element which is secured in a cantilever manner to the power shaft **47** through a cup-shaped support **65.**

The tubular shaft **52** and the end cap **42** have mounted thereon a cooperating slip-ring and spring-loaded brush assembly generally identified by the numeral **66.** In the illustrated embodiment of the invention, the slip-ring assembly **66** includes four separate slip-rings. This is due to the fact that the tandem motor assembly **46** utilizes three-phase current and in addition to the three energized leads of a three-phase current power supply, the neutral conductor is also brought out of the housing **11.** Suitable leads **67** are connected to the brush contacts of the slip-ring assembly **66** and leads **68** of the windings **57** are also connected to the same contacts. Further leads **70** from the windings **63** extend along the tubular shaft **52** and are connected to respective ones of the slip-rings of the slip-ring assembly **66** for energizing the windings **63.**

In the preferred embodiment of the invention, the first stage motor **55** is of a four-pole construction and will run at a speed of about 1,725 rpm when supplied with 60-cycle current. When utilized for use with a sewing machine, it is preferably of a one quarter horsepower capacity and normally will operate on 3 phase 220 volts.

The second stage motor **60** will, of course, be supplied with electrical energy of the same voltage and the same rate frequency as is supplied to the first stage motor **55.** In the preferred embodiment of the invention, the second stage motor is equivalent to a one-half horsepower, two-pole motor and, therefore, has a speed of about 3,450 rpm. However, since the stator **61** thereof is not fixed relative to the housing **11,** but is fixed to the tubular shaft **52** for rotation therewith, it

will be seen that the relative rotation of the stator **64** with respect to the tubular shaft **52** will be about 3,450 rpm and that the total speed of the power shaft **47** will be the sum of the two speeds, namely, about 5,175 rpm.

Although the first stage motor **55** has been indicated as being a four-pole motor and the second stage motor **60** has been indicated as being a two-pole motor giving a combined speed of about 5,175 rpm for the power shaft **47,** other combinations of poles could be designed. For example, based upon 60-cycle current supply, if both the first stage motor and the second stage motor were two-pole motors, then the output speed of the power shaft **47** and the flywheel **24** would be about 6,900 rpm. It is also to be understood that where the frequency of the current is less than 60-cycle, there would be a corresponding reduction in the output speed of the electric transmitter.

It will be apparent that the slip-ring assembly **66** has certain disadvantages such as arcing, wearing, producing dust and dirt, etc. and in certain instances it is advantageous to eliminate such electrical current transferred devices. Accordingly, there has been developed a modification of the electric transmitter **10,** the modification being shown in FIG. **2** and the electric transmitter thereof being identified generally by the numeral **110.** The electric transmitter **110** includes a housing **111** which has connected thereto a conventional type of support **112** for mounting the transmitter. The housing **111** includes a motor portion **113** and a clutch-brake portion **114.** A clutch-brake unit **115,** identical to the clutch-brake unit **15** is carried by the housing portion **114** and will not be described in further detail except to state that it cooperates with a flywheel **124** which is carried by a tandem motor assembly **146** carried by the motor portion **113** of the housing **111.**

The tandem motor assembly **146** includes a rigid power shaft **147** which has the left end thereof journaled in a bearing **150** carried by a tubular portion **148** of one end cap **142** of the housing **111.** The right hand end of the shaft **147** is rotatably journaled in a bearing **151** carried by a second end cap **143** of the housing **111.** At this time it is pointed out that the housing **111** also includes separate intermediate portions **144, 144*a*** and **144*b*** disposed between the end caps **142** and **143.**

A tubular shaft **152** is telescoped over the power shaft **147** for the major portion of its length with the left end of the tubular shaft **152** being rotatably supported by a bearing **153** carried by the end cap **142.** The right end of the tubular shaft **152** is rotatably supported through a bearing **154** carried by the power shaft **147** in a manner to be described hereinafter.

The tandem motor **146** also includes a first stage motor **155** which is preferably of the squirrel-cage induction type and has an outer stator **156** fixedly carried by the housing portion **144.** The stator **156** includes windings **157** and may be described as a wound element or field.

The first stage motor **155** also includes an armature or rotor **158** which is radially aligned with the stator **156** and which is rigidly secured to the tubular shaft **152** for rotation therewith, the rotor being in the form of a shorted-bar element. It is to be understood that the first stage motor **155** will drive the tubular shaft **152.**

A second stage motor, generally identified by the numeral **160,** of the tandem motor assembly **146,** is mounted generally within the end cap **143.** The second stage motor **160** is also of the squirrel-cage induction type and includes a stator **161** which is fixedly mounted on a mounting sleeve **162** which, in turn, is fixedly mounted on the tubular shaft **152** for rotation therewith. The bearing **154** supporting the right end of the tubular shaft **152** is carried by the sleeve **162** with the result that the sleeve **162** supports the right end of the tubular shaft **152.**

It is to be understood that the stator **161** includes windings **163** and thus may be identified as a wound element or field. It is also to be understood that the second stage motor **160** includes a rotor **164** which is radially aligned with the stator **161** and which is carried by a cup-shaped support **165.** The cup-shaped support **165,** in turn, is fixedly secured to the power shaft **147** for driving the same. The flywheel **124** is also mounted on the power shaft **147** to be driven thereby.

As stated above, the electric transmitter **111** is constructed so that the tandem motor assembly thereof may have the necessary electrical power delivered to the rotating components thereof without the use of a slip-ring assembly or other rotating electrical energy transmitter which requires brushes and collector rings. To this end, the second stage motor **160** is spaced longitudinally from the first stage motor **155** sufficiently to accommodate a transformer generally identified by the numeral **172.** The transformer **172** includes a stationary field magnet **173** which is carried by the housing portion **144**b and which is provided with suitable windings **174.** Carried by the tubular shaft **152** for rotation therewith and radially aligned with the stationary field magnet is an armature **175** having suitable windings **176.** It is to be understood that the stationary field magnet **173** and its associated winding **174** form the primary member of the transformer **172** and that the armature **175** and its associated winding **176** form the secondary member of the transformer **172.** The primary and secondary members of the transformer form, purely electrically, nothing more than the transformer of the known type. The current inducted into the windings **176** is supplied by suitable conductors **177** to the windings **163** of the stator **161.**

It is to be noted that the intermediate housing portion **144**a has aligned therewith a junction box **178** which is provided with a fitting **180** through which a power supply **181** enters into the junction box **178.** A suitable junction block **182** will be mounted in the junction box **178** and leads **183** and **184** coupled to the supply line **181** at the junction block **182** are coupled to the windings **157** and **174,** respectively, to energize them.

It is to be understood that the first stage motor **155** and the second stage motor **160** may be of the same construction as that set forth with respect to the motors **55, 60** including the various alternatives as outlined above. Accordingly, no further description of the tandem motor assembly **46** is required. In a like manner, the clutch-brake **115** will perform in the same manner as that described with respect to the clutch-brake **15.**

Although only two preferred embodiments of the electric transmitter have been specifically illustrated and described herein, it is to be understood that minor variations may be made in the electric transmitter construction without departing from the spirit and scope of the invention, as defined by the appended claims.

I claim:

1. A high speed clutch-brake drive for intermittently driving a serving machine head, said drive comprising a fixed housing having means for mounting the same in

fixed relation to a sewing machine head, at least two constantly rotating induction motors mounted within said housing, said motors having rotating components including a power shaft rotatably journalled relative to said housing, coupling means coupling rotating components of said motors for continuously driving said power shaft at a speed corresponding to the total of the speeds of said two motors and in excess of synchronous speed, a flywheel secured to said power shaft for continuous rotation therewith, an output shaft rotatably supported by said housing in axial alignment with said power shaft, a drive pulley carried by said output shaft for driving a sewing machine head, and a clutch-brake device carried by said housing for selectively coupling said output shaft to said flywheel for rotation therewith and for preventing rotation of said output shaft, said clutch-brake device including a fixed friction face spaced from and opposing said flywheel, a clutch disc coupled to said output shaft and having two friction engaging faces, said clutch disc being positioned between said flywheel and said fixed friction face and means mounting said clutch disc for selective engagement with said flywheel for rotation therewith and said fixed friction face for braking said clutch disc.

2. The drive of claim **1** wherein each of said motors includes a field and a rotor, and said coupling means including means coupling a field of one motor to a rotor of the other motor for rotation in unison.

3. The drive of claim **1** wherein each of said motors includes a field and a rotor, and said coupling means including means coupling a field of one motor to a rotor of the other motor for rotation in unison, the field of the other motor being fixedly secured to said housing and the rotor of said one motor being coupled to said power shaft.

4. The drive of claim **1** wherein said induction motors are squirrel-cage motors, and said rotors are shorted-bar rotors.

5. The drive of claim **1** wherein each of said motors includes a field and a rotor, and said coupling means including a tubular shaft disposed coaxially with said power shaft and coupling a field of one motor to a rotor of the other motor for rotation in unison.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,862,444 Dated January 21, 1975

Inventor(s) Arthur N. Hale

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the Abstract Page, under Assignee, read "Union Special Company" as -- Union Special Corporation --;

Signed and sealed this 15th day of July 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks

UNITED STATES PATENT OFFICE

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