No. 770,923. PATENTED SEPT. 27, 1904.

E. S. PILLSBURY.

ELECTRIC MOTOR.

APPLICATION FILED JULY 27, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

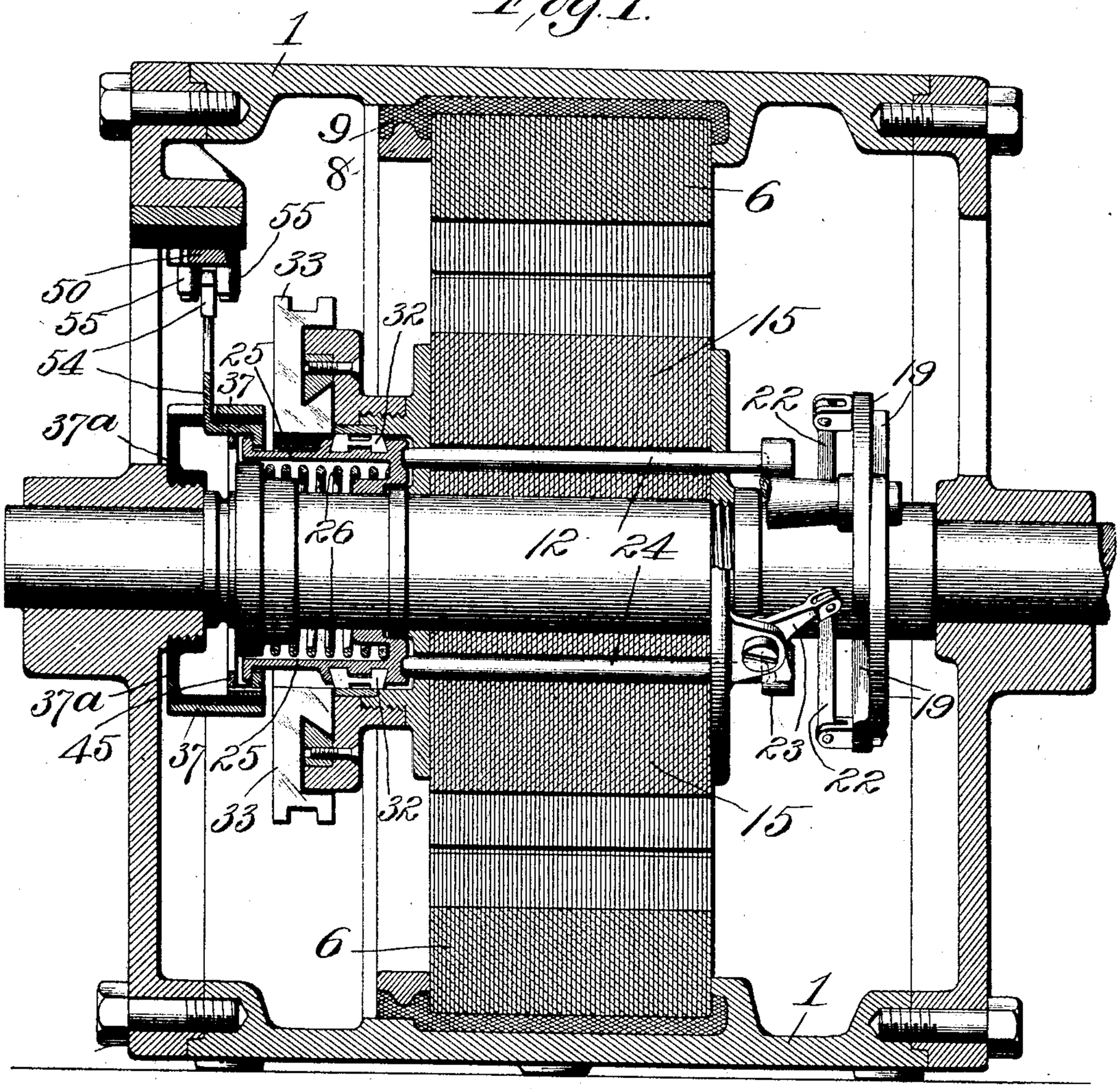
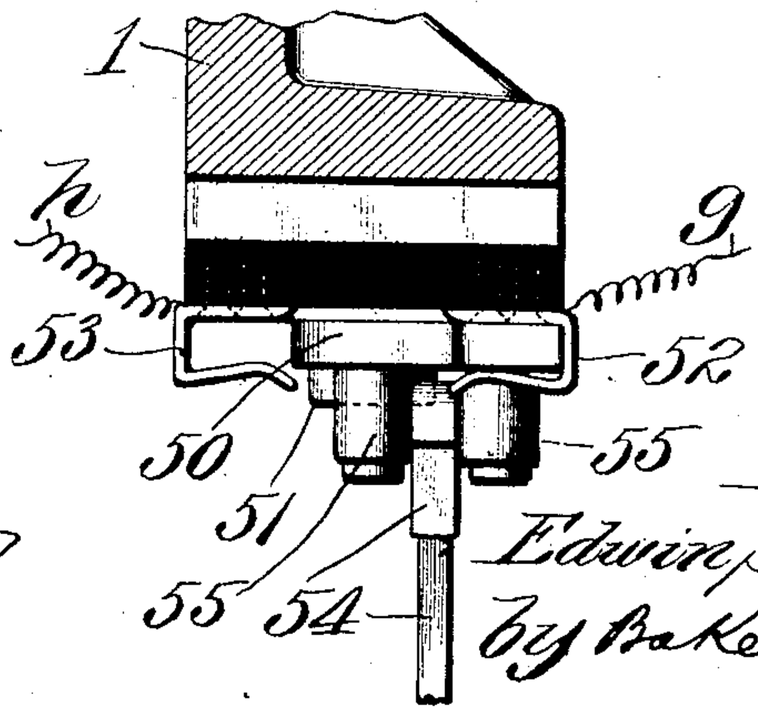


Fig. 4.



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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2.

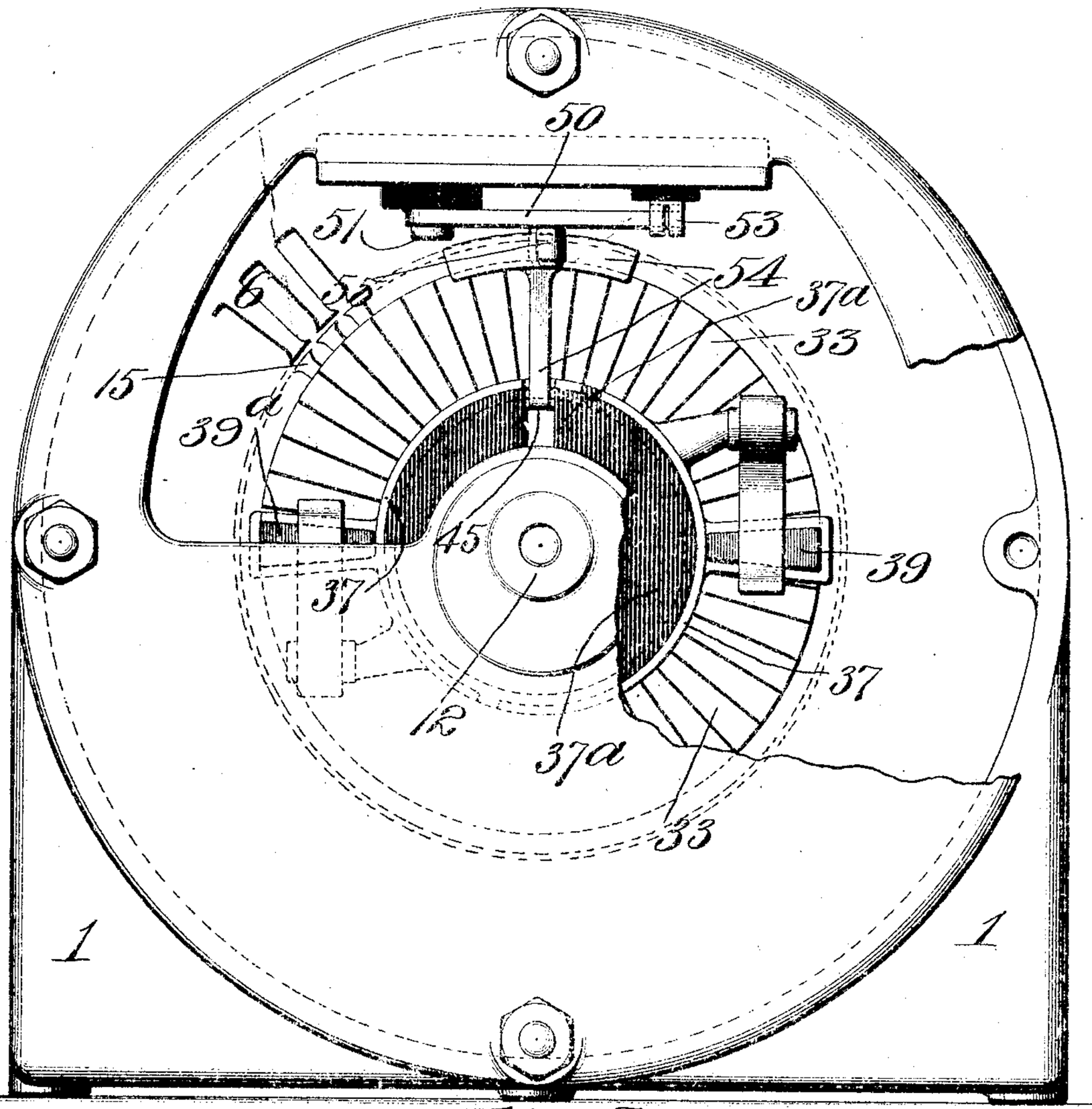
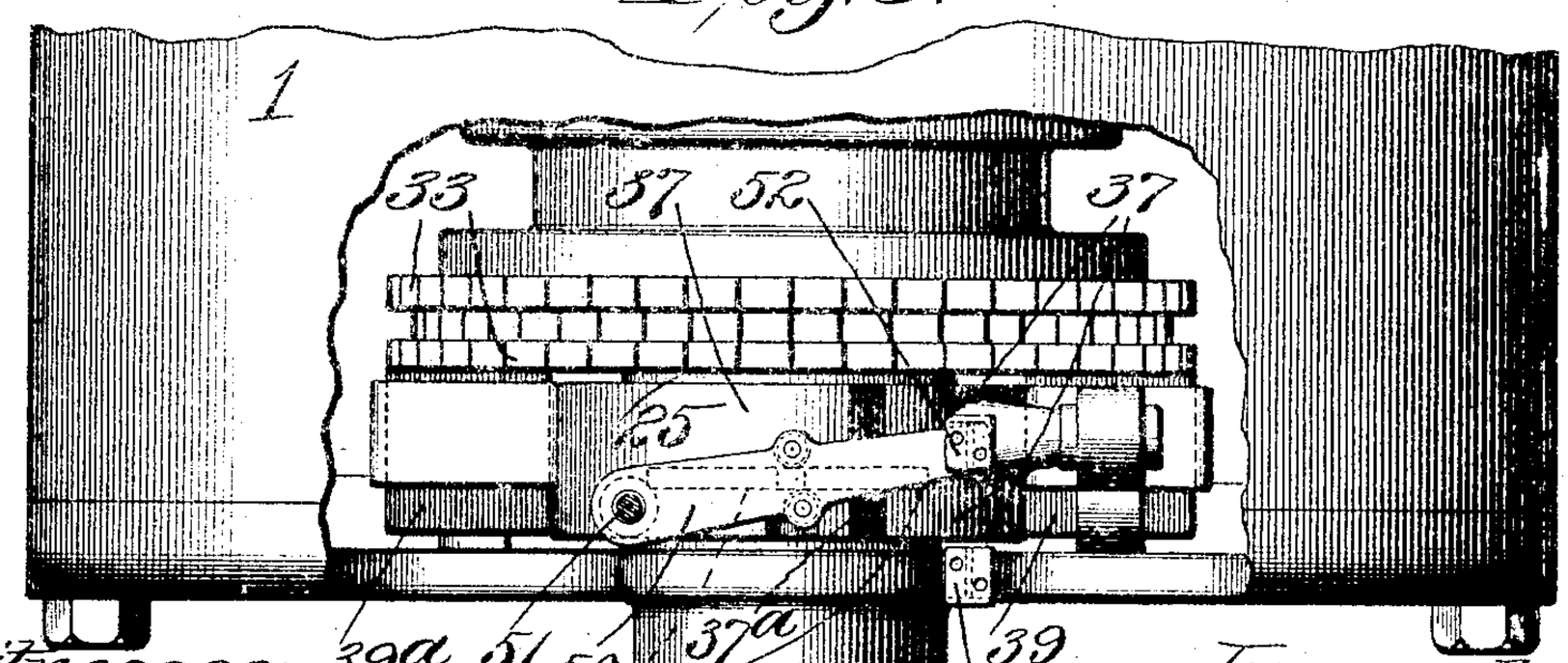


Fig. 3.



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NO MODEL. 3 SHEETS—SHEET 3.

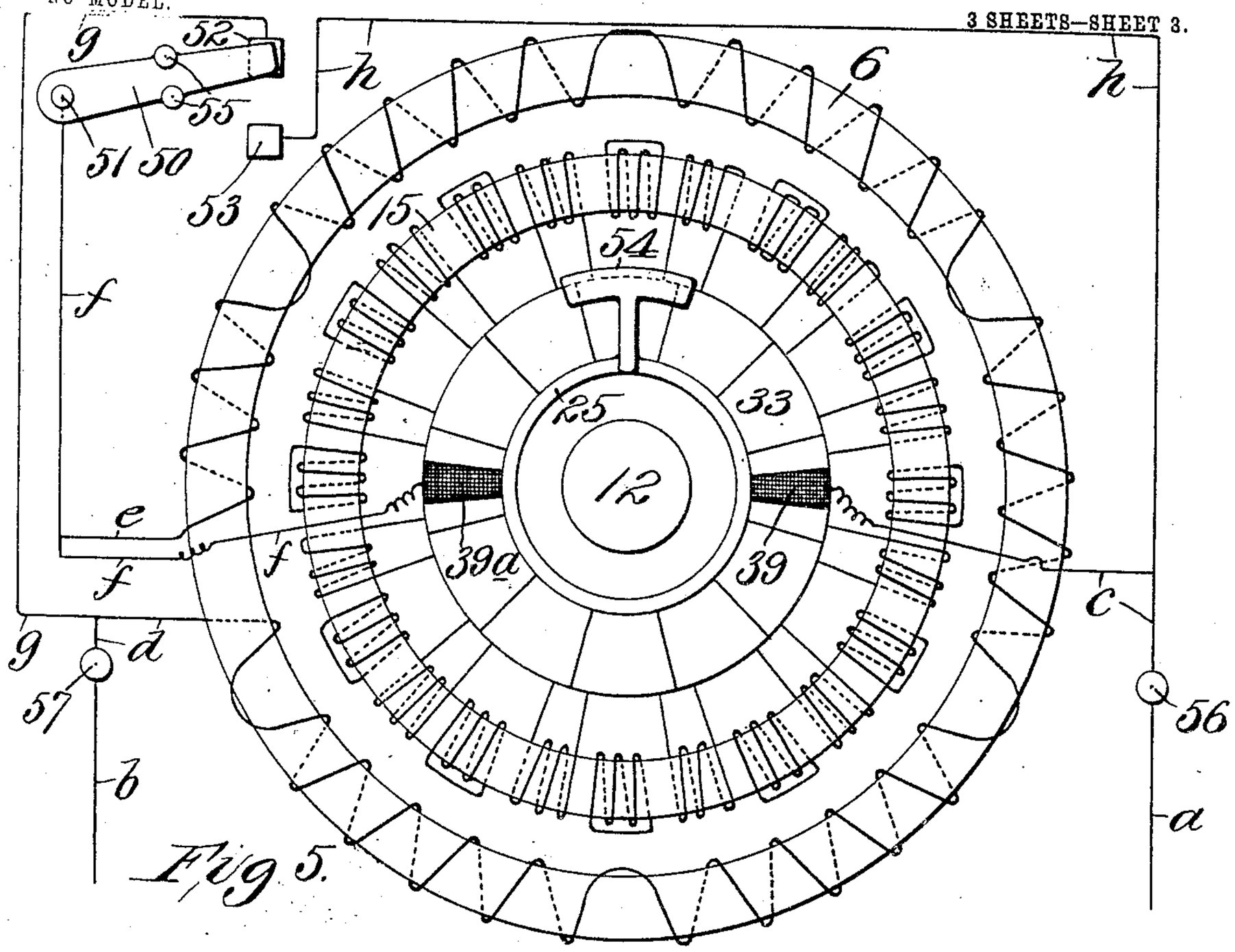


Fig 5.

Fig. 6.

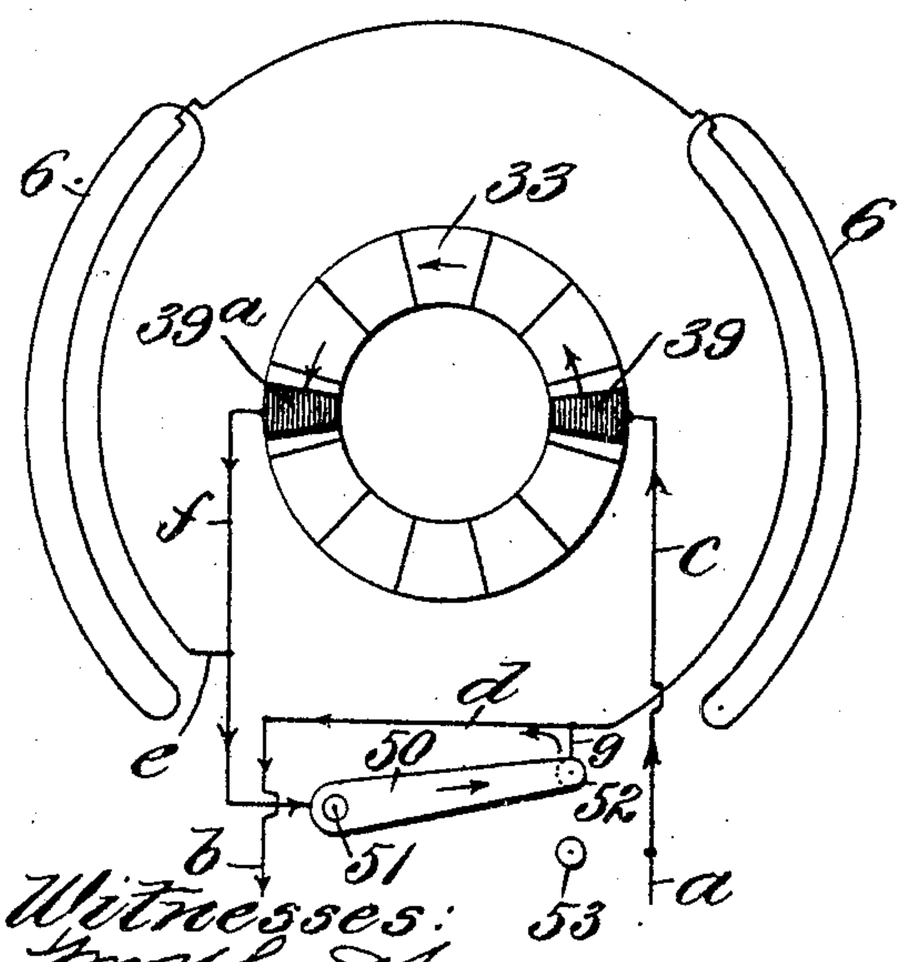
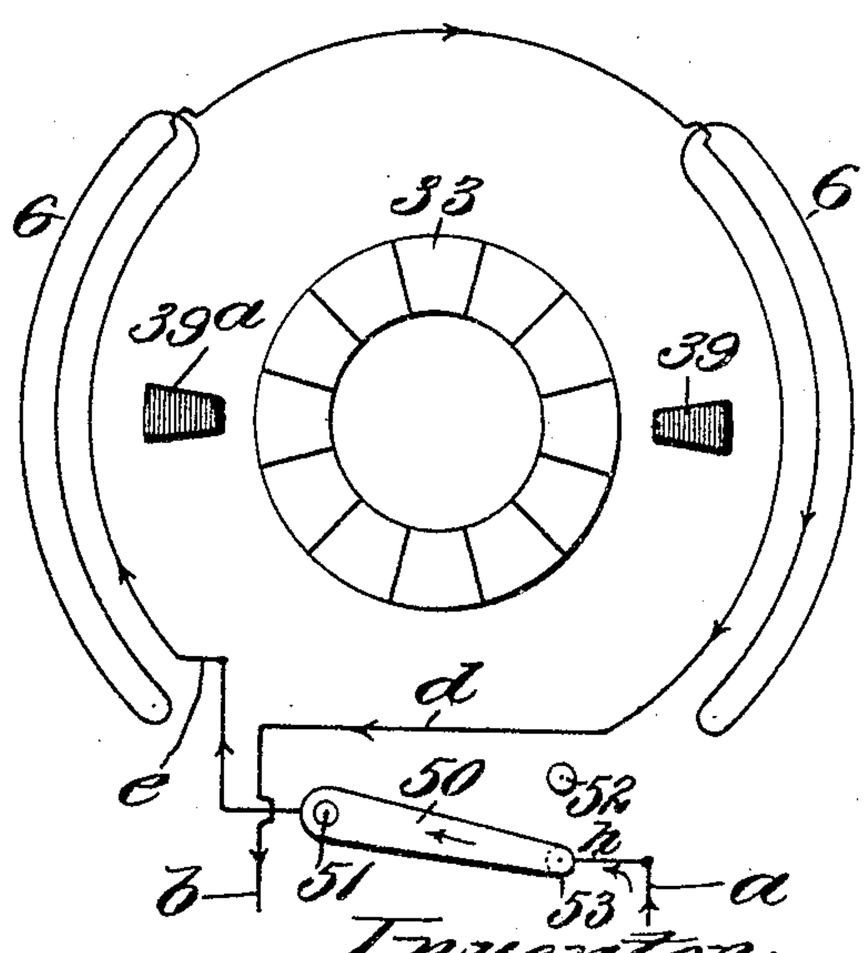


Fig. 7.



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No. 770,923. Patented September 27, 1904.

UNITED STATES PATENT OFFICE.

EDWIN S. PILLSBURY, OF ST. LOUIS, MISSOURI.

ELECTRIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 770,923, dated September 27, 1904.

Application filed July 27, 1903. Serial No. 167,190. (No model.)

To all whom it may concern:

Be it known that I, EDWIN S. PILLSBURY, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Electric Motors, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a longitudinal sectional elevation. Fig. 2 is a front elevation, a portion of the casing being broken away. Fig. 3 is a fragmentary top plan view, a portion of the casing being broken away. Fig. 4 is a detail view. Fig. 5 is a diagrammatic view illustrating the complete wiring. Fig. 6 is a diagram of the starting position, and Fig. 7 is a diagram of the running position.

This invention relates to electric motors.

The primary object is to provide such a structure that when the motor is started the strong line-current is supplied directly to the armature or rotor and after the motor has attained the desired speed the armature is cut out of the line-current and this line-current is supplied to the field or stator, whereby when the motor is running at desired speed a current can be induced in the armature and the commutator-segments can be short-circuited, as in the manner disclosed by my Patent No. 718,518, of January 13, 1903.

By reason of the structure forming the subject-matter of the present invention the brushes which coöperate directly with the commutator of the armature are in series with the primary while starting, so that the strong primary line-current is supplied directly to the armature, and this strong primary current is opposed to any resistance which may be offered by reason of roughness of the commutator, &c., such a structure as the present differing from the prior constructions primarily, because heretofore the strong primary current has been supplied to the field and a secondary current has been induced in the armature.

To the ends above indicated and also to improve generally upon apparatus of the character indicated the invention consists in the various matters hereinafter described and claimed.

The structure of motor herein shown for the purpose of illustrating the present invention is substantially similar to the motor fully shown and described in my before-mentioned patent, to which patent reference is made for details of construction not herein disclosed. Said motor includes the casing 1, field-magnets 6, the armature 15, mounted upon the rotatable armature-shaft 12, the commutator, mounted upon said armature and including the segments 33, the brush-support 37, the ring 25, carrying short-circuiting plates 32, which coöperate with the armature-segments, the spring 26, coiled about said shaft and serving to normally hold said ring in such position that the short-circuiting plates are out of contact with the armature-segments, the centrifugally-operable plates or weights 19, pivotally connected to the rotatable armature-shaft, the connections including the rods 24, the bell-crank levers 23, and links 22, whereby as the armature-shaft attains speed the ring 25 is moved in a direction which may be termed "outwardly" in order to bring the short-circuiting plates into contact with the commutator-segments and the slidable ring 45, which is, generally speaking, a portion of the short-circuiting device and moves with said ring 25 in order to relieve the brushes of tension, as fully described in my prior patent. The field-core is shown held in position by means of suitable binding material 9 and a ring 8, as more fully disclosed in my said prior patent. In the present structure the brushes 39 and 39^a are insulated from each other, but engage the commutator-segments in the usual manner, said brushes being mounted upon the brush-support 37, which is here shown as composed of two semicylindrical members insulated from each other and in turn mounted upon an insulating-support 37^a. A suitably-supported switch-arm 50 is pivoted upon the stud 51, and its free end is adapted to contact with the terminal 52 in one position and with the terminal 53 in another position, said terminals 52 and 53 being suitably insulated from each other and from

the pivotal stud 51. Carried by the beforementioned ring 45 is a projecting arm 54, which is received between suitable projections, such as the rollers 55, upon the said switch-arm 50, so that when the ring 25 is in innermost position the switch-arm is in contact with the terminal 52, while when the said ring is in outer position (the position which it occupies when the motor has attained speed) the switch-arm is in contact with the terminal 53.

The line-wire *a* is shown as connected to the binding-post 56, while the line-wire *b* is connected to the binding-post 57. From said binding-post 56 the wire *c* leads to the brush 39. From the binding-post 57 the wire *d* leads to the field-windings, the opposite end of the field-windings being connected by the wire *e* with the wire *f*, which leads from the brush 39ª to the stud 51, upon which the switch-arm 50 is mounted and with which it is in electrical connection. The terminal 52 is connected to the wire *d* by the wire *g*, and the terminal 53 is connected to the wire *c* by the wire *h*. Considering now the operation of the present motor, it will be assumed that the same is at rest, in which event the short-circuiting plates 32 will be out of contact with the commutator-segments, the ring 25 will be in innermost position, and the switch-arm 50 will be in contact with the terminal 52. Current being supplied to the line enters through the wire *a* into the wire *c* and passes through the brush 39 to the armature-winding, thence through the brush 39ª to the wire *f*, thence to the switch-arm 50, thence to the terminal 52, thence through the wire *g* to the wire *d*, and thence back to the line-wire *b*. When the parts are in the position last indicated, the field-windings are short-circuited, the wire *g* leading from the terminal 52 to one end of the field-windings and the wires *e* and *f* connecting the other end of said field-windings with the switch-arm 50, which is itself in contact with the terminal 52, from which the said wire *g* extends. Thus the strong primary current is supplied directly to the armature and the motor starts. When the motor attains the desired speed, the plates 19 serve to force the ring 25 outwardly, and the switch-arm 50 is thus thrown out of contact with the terminal 52 and into contact with the terminal 53. This causes the current from the line-wire *a* to pass through a portion of the wire *c* and through the wire *h* to the terminal 53, thence along the switch-arm 50, thence through a portion of the wire *f* and through the wire *e* to one end of the field-windings, thence through the field-windings, thence from the other end of the field-windings to the wire *d*, the current passing through said wire *d* back to the line-wire *b*. The outward movement of the ring 25 serves to move the short-circuiting plates 32 into contact with the commutator-segments, just as in the structure disclosed in my said prior patent. Therefore in starting the motor the armature is in the line-circuit and the field is short-circuited, the short-circuiting segments being out of contact with the commutator-segments, so that the strong primary current is supplied directly to the armature or rotor and a current is induced in the field. When, however, the motor has attained the desired speed, the line-current is thrown into the field and the armature is short-circuited, the operation of the motor being then similar to that of the motor described in my said prior patent.

I am aware that minor changes in the construction, arrangement, and combination of the several parts of my device can be made and substituted for those herein shown and described without in the least departing from the nature and principle of my invention.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is—

1. In a motor, the combination with a field, an armature, and a source of energy, of means for first supplying the energy from said source to said armature and short-circuiting said field, and means for then cutting off the supply of said energy to said armature and supplying said field with said energy from said source of supply; substantially as described.

2. In a motor, the combination with a field, an armature, and a source of energy, of means whereby energy from said source can be supplied to either said field or said armature, and means for short-circuiting said armature; substantially as described.

3. In a motor, the combination with a field, an armature, and a source of energy, of means whereby energy from said source is first supplied to said armature and said field is short-circuited, and means whereby said energy from said source of supply can be cut off from said armature and fed to said field and said armature can be short-circuited; substantially as described.

4. In a motor, the combination with a field, an armature, and a source of energy, of means controlled by said motor whereby energy from said source can be supplied to either said field or said armature; substantially as described.

5. In a motor, the combination with a field, an armature, and a source of energy, of means controlled by said motor whereby when said motor is at rest said armature is in connection with said source of energy, and, when said motor has started and attained desired speed, said armature is disconnected from said source of energy and said field is connected thereto; substantially as described.

6. In a motor, the combination with a field, an armature, and a source of energy, of a switch adapted, when in one position, to direct energy from said source to said armature, and, when in another position, to direct

energy from said source to said field, and means whereby said switch is thrown by the operation of the motor; substantially as described.

7. In a motor, the combination with a field, an armature, and a source of energy, of a switch adapted, when in one position, to direct energy from said source to said armature, and, when in another position, to direct energy from said source to said field, a centrifugally-operable mechanism in operative connection with the motor, and operative connection between said centrifugally-operable mechanism and said switch; substantially as described.

8. In a motor, the combination with a field, an armature, a commutator for said armature, and a source of energy, of a switch adapted, when in one position, to direct energy from said source to said armature, and when in another position, to direct energy from said source to said field, a short-circuiting device coöperating with said commutator, and means whereby operation of the motor serves to move both said short-circuiting device and said switch; substantially as described.

9. In a motor, the combination with a field, an armature, a commutator, and a source of energy, of a switch adapted, in one position, to direct energy from said source to said armature, and, in another position, to direct energy from said source to said field, a short-circuiting device coöperating with said commutator, connection between said short-circuiting device and said switch, an operative mechanism in operative connection with the motor and adapted to move said short-circuiting device, and operative connection between said short-circuiting device and said operative mechanism; substantially as described.

10. In a motor, the combination with a field, an armature, a commutator, and a source of energy, of a switch adapted, when in one position, to direct energy from said source to said armature, and, when in another position, to direct energy from said source to said field, a short-circuiting device coöperating with said commutator, an arm upon said short-circuiting device and engaging said switch, an operative mechanism in operative connection with the motor and adapted to move said short-circuiting device, and operative connection between said short-circuiting device and said operative mechanism; substantially as described.

11. In a motor, the combination with a field, an armature, brushes coöperating therewith and insulated from each other, and a source of energy, of terminals insulated from each other, a switch-arm adapted to contact with either of said terminals, electrical connection between one pole of said source of energy and one of said brushes, electrical connection between the other of said brushes and said switch-arm, electrical connection between one of said terminals and the other pole of said source of energy, electrical connection between said last-mentioned terminal and one end of the field-winding, electrical connection between said switch-arm and the other end of said field-winding, and electrical connection between the other said terminal and the first-mentioned pole of said source of energy; substantially as described.

12. In a motor, the combination with a field, an armature, and a source of energy, of brushes coöperating with said armature and insulated from each other, separated terminals insulated from each other, a switch-arm adapted to contact with either of said terminals, a conductor leading from one pole of said source of energy to one of said brushes, a conductor leading from one of said terminals to said first-mentioned conductor, a conductor leading from the other pole of said source of energy to one end of the field-winding, a conductor connecting said last-mentioned conductor with the other said terminal, a conductor between the other of said brushes and said switch-arm, and electrical connection between said last-mentioned conductor and the other end of said field-winding; substantially as described.

13. In a motor, the combination with a field, an armature, and a source of energy, of means for first supplying the current from said source of energy to said armature, means for then cutting off the supply of said current to said armature and supplying said current to said field, and means for short-circuiting said armature; substantially as described.

14. In a motor, the combination with a field, an armature, and a source of energy, of means for first short-circuiting the field and supplying the current from said source of energy to said armature, and means for then breaking the short circuit through said field, cutting off the said supply to said armature and supplying said current to said field; substantially as described.

15. In a motor, the combination with a field, an armature, and a source of energy, of means for first short-circuiting said field and supplying the current from said source of energy to said armature, means for then breaking the short circuit through said field, means for cutting off the supply of said current to said armature, means for then supplying said current to said field, and means for short-circuiting said armature; substantially as described.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 20th day of July, 1903.

EDWIN S. PILLSBURY.

Witnesses:
GALES P. MOORE,
GEORGE BAKEWELL.