40 H.P. Motor.

THE
ENGLISH ELECTRIC COMPANY
LIMITED.

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"ENELECTICO, WESTCENT, LONDON."

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SPECIFICATION
FOR
D.K. 29, 30, 31 & 32
VENTILATED TRACTION
MOTORS.

May, 1921.

Publication No. 288.

SPECIFICATION
FOR
VENTILATED TRACTION MOTORS D.K. 29, 30 and 31.

(Box or Split Frame for about 33 in. diameter car wheels.)

(For D.K. 32 Motor see page 4.)

TRACK GAUGE.

The D.K. 29 and D.K. 30 motors may be used on any track gauge from 1 metre (3 feet $3\frac{3}{8}$ inches) upwards.

The D.K. 31 motor may be used on any track gauge from 1,067 m/m (3 feet 6 inches) upwards.

The separate outline drawings for each motor give the dimensions required between car wheel hubs, flanges, etc.

MAGNET FRAME.

The Magnet Frame is of high permeability cast steel and is made either box or split type. In the latter case the two halves are fitted together with a carefully machined joint, clamped with four steel bolts securely locked.

Bored and recessed openings at each end are provided to receive the armature bearing boxes which are secured by steel bolts tapped into the frame and securely locked against turning.

Suitable machined seatings are provided for the four main and four interpoles, and also for the brush holder yoke. A large opening with pressed steel cover is provided over the commutator and brush gear for easy inspection and adjustment. The cover is held in position by means of a spring lock and is easily removable ; a hand hole with a cover is also provided directly underneath the commutator.

Suitable openings fitted with perforated metal or gauze covers are provided for ventilation, the inlets are behind the opening over the commutator and the exhaust openings are at the pinion end of the frame.

Carefully machined and registered joints are provided at an angle of about 60°, to receive the axle bearing boxes.

ARMATURE BEARINGS.

The armature bearings consist of solid bushes made of special anti-friction bronze with machined grooves to distribute the oil over the surface of the journal. The thickness of the bushes is sufficient to allow for a liner of white metal when renewal becomes necessary. The bushes are securely keyed in position to the cast steel bearing boxes.

The lubrication is by means of wool waste and horse hair saturated in oil which is in direct contact with the shaft for practically one-third of its diameter on the low pressure side. The oil reservoir is of sufficient capacity for two or three weeks' running. To prevent the oil creeping along the shaft into the motor, suitable oil throwers are provided.

ARMATURE CORE AND SHAFT.

The armature core is built up of thin steel laminations with a low hysteresis loss, each sheet being thinly coated with insulating lacquer. Slots are stamped in the laminations before assembly to receive the armature coils. Large axial ventilating ducts are left to allow a free passage of air through the core.

The core is carried on and keyed to a cast steel spider and is held in position by a cast steel end plate and steel nut securely locked. As no radial ducts are required spacing supports are eliminated thus enabling the core to be clamped together under very great pressure and ensuring a tight core.

The spider, which is pressed and keyed on the shaft, supports the pinion end armature winding and forms a powerful exhaust fan ; it also extends under the commutator hub, thereby enabling the shaft to be removed or replaced without disturbing the armature windings or commutator.

The shaft is made of best quality hammered steel, ground to gauge. The journal surfaces are rolled to ensure the maximum life of the bearing bushes.

ARMATURE COILS.

These are machine wound, the wire being cotton covered.

The coils are twice dipped in special varnish and baked between dippings ; those portions of the coils which are inserted in the slots are insulated with mica, parchment paper and cambric tape, then vacuum dried and baked for twelve hours under vacuum. The coils are then placed in

the slots, which are lined with leatheroid to prevent mechanical injury, the core being first sprayed with air-drying black varnish. Binding wires of steel, sunk flush with the core and insulated from the coils with hard wood strips, hold the windings in place.

The end windings are supported by the spider and clamping plate, thereby completely shrouding the windings on the under-side. After the binding wires are in place the whole armature is baked for twelve hours and given a final spraying of air-drying black finishing varnish.

COMMUTATOR.

The commutator is built on a separate cast steel spider carried on and keyed to an extension of the armature spider, and held in position with a steel nut securely locked.

The bars of hard drawn copper, finished accurately to gauge, are insulated from each other with best grade mica, and held in position by heavy end flanges, fitting into deep "V" notches turned in the bars. The end flanges are insulated from the bars by micanite end rings and clamped together by a steel nut at the front end, enabling a bar to be taken out without dismantling the commutator. The mica between bars is grooved to a depth of 1·2 m/m ($\frac{3}{64}$ inch) below the surface of the commutator and as the commutator wears the mica should be cut to maintain this depth of groove. An allowance of 16 m/m ($\frac{5}{8}$ inch) is made for radial wear.

POLES.

The main poles are built up of thin steel sheets riveted together between cast steel end plates and shaped to form a shoe to give the proper field distribution, and at the same time serve as a support for the field coils.

The interpoles are made of drop forged steel with shaped pole tips for supporting the field coils. Both main and interpoles are accurately machined and clamped to turned seatings on the magnet frame by steel bolts.

FIELD COILS.

The main coils as well as the interpole coils are made from copper wire of square section, double-cotton and asbestos covered; they are machine wound upon formers, being subsequently impregnated in a vacuum with insulating compound in order to fill all the interstices, then baked, and afterwards insulated with a combined covering of mica and paper taped over with strong braided webbing. The complete coil is then finally treated with a special compound and again baked to render it impervious to moisture.

The coils are clamped between pressed steel springs resting on the machined seats of the magnet frame and brass washers supported by the pole shoes. Any shrinkage of the coil is thus automatically taken up and a rigid construction assured, failures from loose coils being entirely obviated.

BRUSH HOLDERS AND BRUSHES.

The brush-holders are of cast bronze, adjustable radially and bolted to an insulated yoke to which they are clamped by securely locked steel bolts which are accessible by removing the commutator cover.

The brushes are of carbon provided with flexible copper connections, and slide in accurately finished boxes; each brush is independently adjustable.

AXLE BEARINGS.

The axle bearing bushes are split and made of anti-friction bronze with machined grooves for distributing the oil. They can be re-lined in a similar way to the armature bearing bushes.

They are keyed to cast steel boxes which are bolted to machined registered surfaces on the magnet frame; the method of lubrication is the same as for the armature bearings.

They are designed for a maximum axle diameter of 135 m/m ($5\frac{1}{4}$ inches).

SUSPENSION.

Two lugs are cast on the upper half of the magnet frame on one side for attachment to the cross suspension bar; the motor frame is supported on the opposite side by the axle bearings.

GEARING.

The power is transmitted to the axle through single reduction spur gearing. The pinion is of hammered steel cut from the solid, keyed to a taper on the armature shaft and held in position by a steel nut securely locked. The gear wheel is of high grade steel, and can be supplied either solid or split. In the latter case the two halves are clamped together by eight steel bolts securely locked.

The teeth are accurately cut to No. 3 diametrical pitch with a face of 115 m/m ($4\frac{1}{2}$ inches). The standard gear ratio is 14 teeth in pinion and 70 teeth in gear wheel, although where required a different ratio may be provided.

GEAR CASE.

The gearing is enclosed in a pressed steel case in halves, each of which is pressed from a solid sheet 4·7 m/m ($\frac{3}{16}$ inch) thick. The two halves are clamped together with steel bolts securely locked. The case is supported at each end directly under the flanged lugs, and no riveted brackets are, therefore, required. The cast steel arms forming the supports are designed to withstand heavy vibration and the case is clamped to these by steel bolts.

RATING.

On a shop test at the rated voltage, at the end of one hour's continuous run with full load through gearing, the temperature rise will not exceed 75°C. (135°F.) as measured by thermometer, above a surrounding air temperature not exceeding 25°C. (77°F.). In this connection it is important to note that due to the positive ventilation the continuous capacity on a shop test with the same temperature rise is about 70 per cent. of the one hour rated capacity, 40 per cent. being a comparable figure for the unventilated type of motor. The above ratings for the ventilated motor are with perforated covers over all the ventilating openings.

The motors will run in either direction from no load to 100 per cent. overload current with fixed brush position and practically without sparking.

INSULATION TEST.

The insulation between field coils and magnet frame and between armature windings and armature core is tested at 2,500 volts alternating current for one minute.

INTERCHANGEABILITY.

All parts of the motor are machined and finished to gauge and all drilling is done in special jigs, ensuring absolute interchangeability of all similar parts.

VENTILATION.

A special feature of this type of Motor is the system of positive ventilation. Large axial ventilating ducts are provided in the armature core extending through the commutator hub at one end and leading to a powerful exhaust fan at the pinion end of the armature. The fan itself is formed out of part of the spider. The air enters through screened inlets at the commutator end; one current of air is drawn through ducts in the armature core and another current passes over the armature and round the field coils, both paths meeting at the fan, which discharges through four screened outlets at the pinion end.

The volume of air and its velocity are such that any dust entering the casing is carried right through and expelled, this operation being facilitated by the smooth and direct air passages and by the unidirectional character of the air currents in the casing.

If for special reasons, such as the fear of water entering the motor due to flooded track, etc., it is considered desirable to close the bottom ventilating openings by solid metal plates instead of perforated covers, the continuous output of the motor on a shop test for the temperature rise specified above under "Rating" will be reduced to approximately 65% of the one hour rating.

In the event of all the ventilating openings being closed by solid covers, the continuous output under similar conditions will be still further reduced to about 50% of the one hour rating. It is not usually found necessary to fit solid covers to the lower ventilating openings, but it has been done in a few cases; the necessity of fitting solid covers to all the ventilating openings never arises unless some very severe and peculiar conditions of service have to be met.

SPECIFICATION
FOR
D.K. 32 VENTILATED TRACTION MOTOR.

The foregoing specification also applies to the D.K. 32 Motor, with the following exceptions:—

1. The frame is made in the Box Type only.
2. The maximum diameter of the motor suspension bearings for the car axle may be 146 m/m ($5\frac{3}{4}$ inches).
3. The width of the gearing is 140 m/m ($5\frac{1}{2}$ inches).
4. The standard gear ratio is 16 to 70.

TRACK GAUGE.

The motor will occupy a minimum distance of 1,219 m/m (48 inches) between the wheel hubs.

GENERAL.

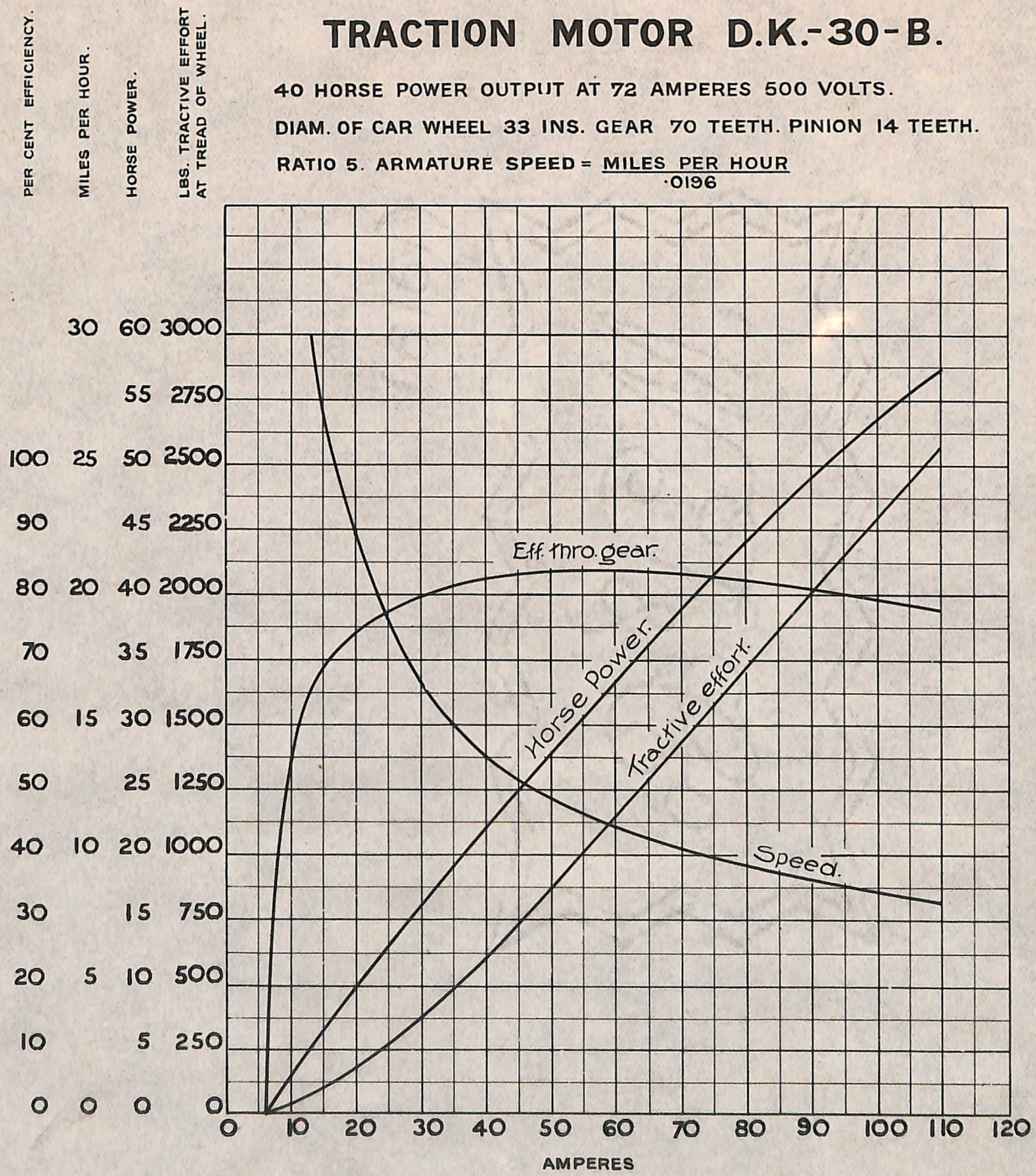
For small wheel diameters of 24 inches or 27 inches, we make the D.K. 34 ventilated motor, which is described in a separate specification (Publication No. 263).

TRACTION MOTOR D.K.-30-B.

40 HORSE POWER OUTPUT AT 72 AMPERES 500 VOLTS.

DIAM. OF CAR WHEEL 33 INS. GEAR 70 TEETH. PINION 14 TEETH.

RATIO 5. ARMATURE SPEED = $\frac{\text{MILES PER HOUR}}{\cdot 0196}$



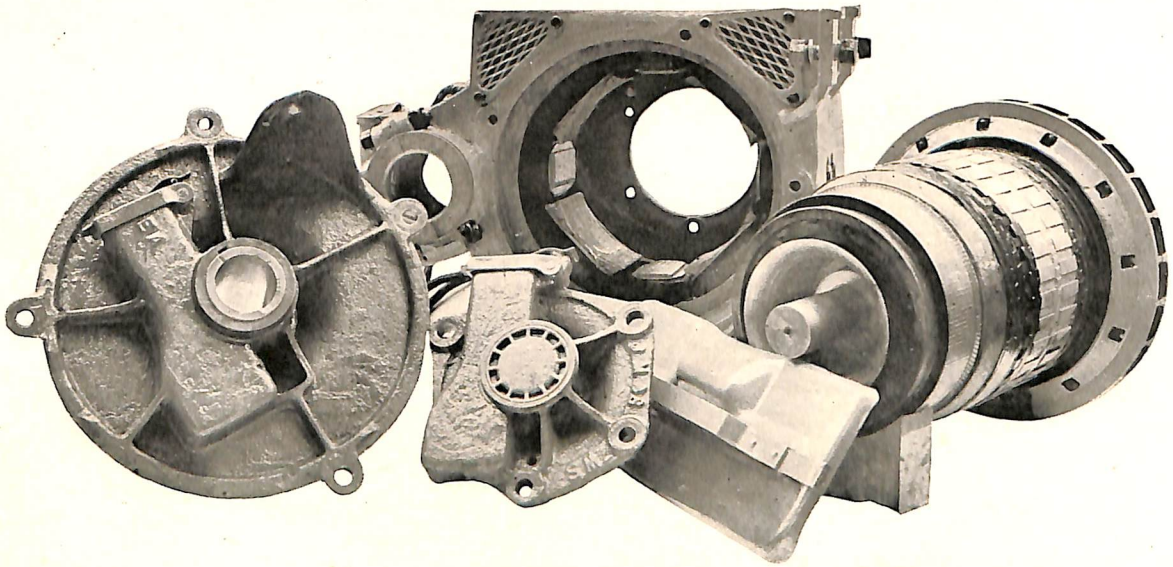
App. [signature] Date Jan. 22-1920 Traction Eng Dep't.

CURVE No. 4-30 B.

THE
ENGLISH ELECTRIC COMPANY, LIMITED.
LONDON.

CURVE LITHO No. 1059.

VENTILATED TRACTION MOTOR.

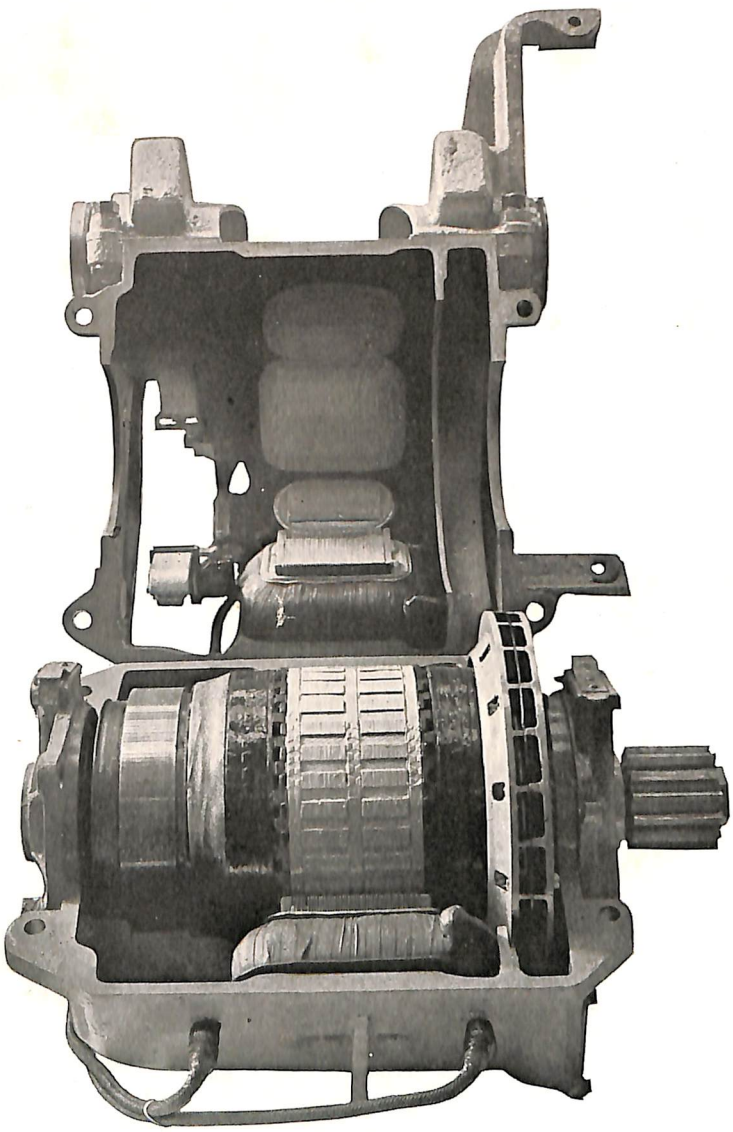


BOX FRAME, Shown Opened Up.

THE
ENGLISH ELECTRIC COMPANY,
LIMITED.
QUEEN'S HOUSE, KINGSWAY,
LONDON, W.C. 2.

PUBLICATION No. 223.

VENTILATED TRACTION MOTOR.



SPLIT FRAME, Shown Opened.

THE
ENGLISH ELECTRIC COMPANY,
LIMITED.
QUEEN'S HOUSE, KINGSWAY,
LONDON, W.C. 2.

PUBLICATION No. 224.