Aug. 21, 1923. 1,465,593

J. F. BARRETT ET AL.

FEATHERING MECHANISM FOR PADDLE TYPE STREAM MOTORS AND PROPELLERS

Filed Sept. 30, 1921 2 Sheets-Sheet 1

Fig. 1

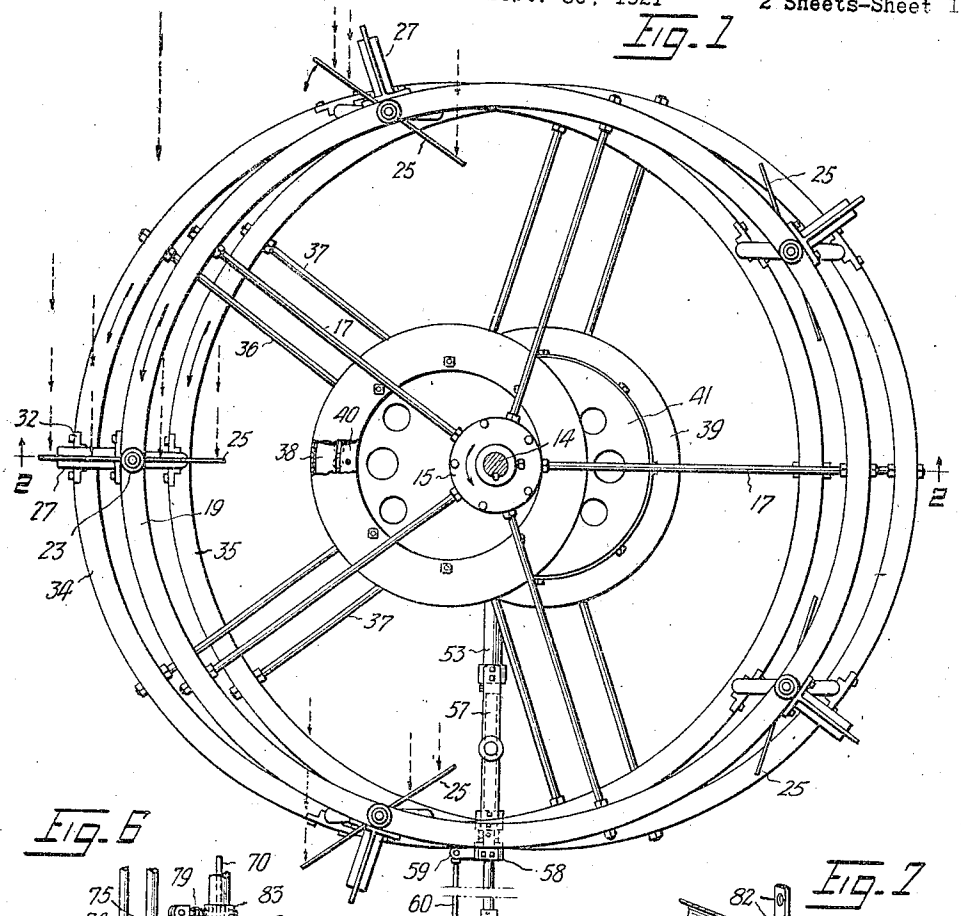


Fig. 6

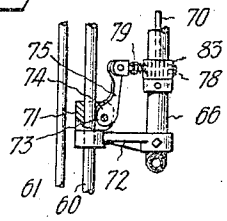


Fig. 5

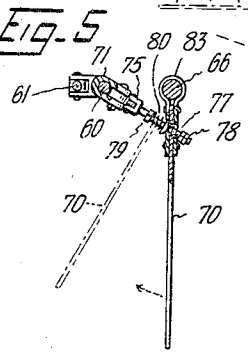
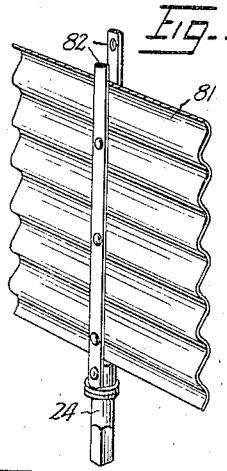


Fig. 7



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FEATHERING MECHANISM FOR PADDLE TYPE STREAM MOTORS AND PROPELLERS

Filed Sept. 30, 1921 2 Sheets-Sheet 2

Fig. 2

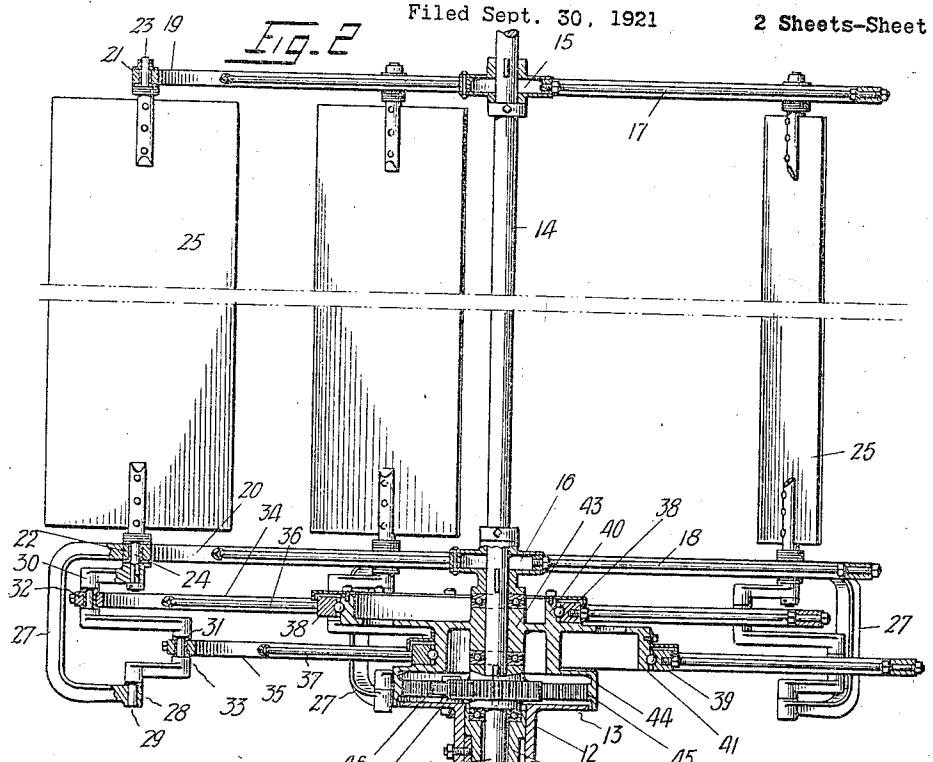


Fig. 3

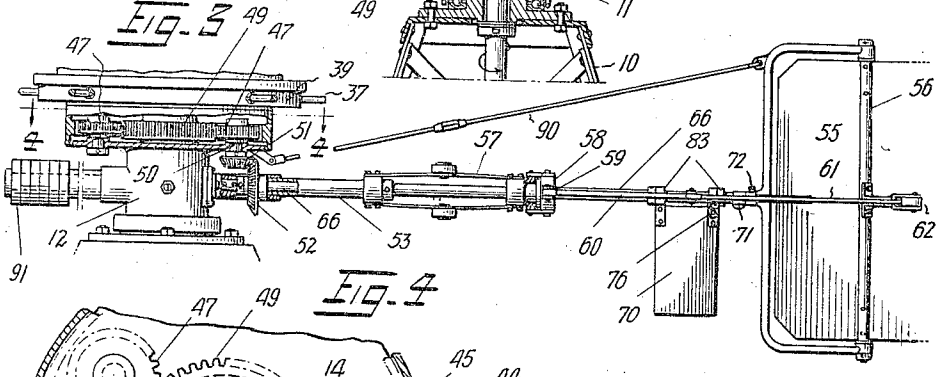
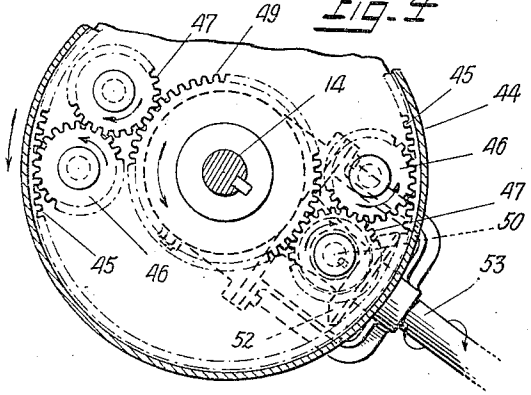


Fig. 4



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UNITED STATES PATENT OFFICE.

JOHN FITZALLAN BARRETT, OF NEWPORT, JOHN ERNEST BARRETT, OF KATOOMBA, AND FRANK ALFRED WYATT, OF NEWPORT, NEW SOUTH WALES, AUSTRALIA.

FEATHERING MECHANISM FOR PADDLE-TYPE STREAM MOTORS AND PROPELLERS.

Application filed September 30, 1921. Serial No. 504,409.

To all whom it may concern:

Be it known that we, JOHN FITZALLAN BARRETT, JOHN ERNEST BARRETT, and FRANK ALFRED WYATT, subjects of the King of Great Britain and Ireland, residing at Newport, Katoomba, and Newport, in the State of New South Wales, Commonwealth of Australia, respectively, have invented certain new and useful Improvements in Feathering Mechanism for Paddle-Type Stream Motors and Propellers, of which the following is a specification.

This invention relates to feathering mechanism for wind motors and other stream motors and propellers having flat or substantially flat vanes pivotally mounted for feathering in the peripheral portion of a lantern cage frame which is fixed on a driven spindle or on a driving shaft. In this type of machine feathering action is effected by applying progressive rotational movement to the vanes by means of cranks on a gang ring which rotates in the same direction and at the same rate as the carrier, around a bearing in excentric relation to the carrier spindle or shaft.

The present invention consists in improvements in the feathering mechanism, and comprises an enclosed gear train of the epicyclic type having the sun wheel thereof driven by the main spindle and geared through planet wheels to an internally toothed ring wheel forming part of a hub which is rotatable about said spindle and carries an excentric disc through which the gang ring is moved relatively to the cage to turn the vane cranks. The planet wheels are rotatably carried on spindles supported on a flanged sleeve which is mounted for rotation around the cage spindle bearing. The angular relation of the vanes in respect of any certain direction of stream movement is varied by more or less rotating this flanged sleeve by means of a manually controlled device in the case of propellers, and in the case of stream motors by means of a rudder or tail with a governor device. The rudder functions during normal speed of rotation to hold the vanes respectively presented to the direction of the stream at such angles as to ensure maximum driving effect and minimum counter pressure on the vane assembly, and during abnormally high speeds of rotation to rotate the flanged sleeve through an angle within 90° thus to procure through the consequent change in the excentric setting a corresponding alteration in the angles of incidence of the stream on the several vanes, so as thereby to procure regulation of the speed of the machine. An arm extending laterally from the flanged sleeve carries a balanced rudder and a centrifugal governor which functions to control the angular set of the rudder, and carries also a stream operated rudder lock which functions to engage the governor linkage at its extreme throw and hold the rudder locked at full offset position until the stream velocity falls to a safe limit, and then to free the rudder for normal control by the centrifugal governor.

The accompanying drawings are explanatory of the application of the invention in a wind motor. It is to be understood that the features in which the invention resides are applicable for water stream motors and for paddle type propellers operating in liquids or gases, the propeller being, however, always of the cage type with an unequal number of lateral blades rotatably mounted in its peripheral portion on axis parallel with the cage axis.

Fig. 1 is a top plan;

Fig. 2 is a vertical sectional elevation;

Fig. 3 is a fragmentary sectional side elevation explanatory of the balanced rudder, the rudder lock, and the rudder governor;

Fig. 4 is an enlarged fragmentary horizontal section on the line 4—4 Fig. 3;

Fig. 5 is a detail sectional elevation of the rudder lock device on the line 5—5 Fig. 1;

Fig. 6 is a sectional plan corresponding with Fig. 5; and

Fig. 7 is a fragmentary perspective view of one of the vanes.

10 is the upper part of a platform or tower framework, upon which is fixed a bearing head 11. Sleeved around this bearing head is the tubular portion 12 of the circular flange 13, which forms the bottom portion of a casing enclosing an epicyclic gear train. The main spindle 14 passes centrally through the bearing head 11. The lower end of this spindle is connected to a pump or other mechanism for applying rotation thereto; upon the upper end of it the lantern cage is fixed. This cage consists of two hub members 15 and 16, supporting ra-

dial arms 17 and 18, which carry the peripheral rings 19 and 20, these rings being concentrically located in respect to the spindle 14. A stiffening bracing, preferably of wire (not shown) may be provided to ensure the rigidity of the cage structure, the bracing wires and frame structure being designed to offer minimum resistance to movement through the medium in which the device is operating. The peripheral rings 19 and 20 are fitted with bearings 21 and 22, symmetrically arranged, to carry the pivots 23 and 24 of the vanes 25, an unequal number of these vanes being disposed around the circle. In practice either three or five vanes are used, their widths being proportioned in relation to the diameter of the cage so that the following blades do not blanket the flow to advance blades in the order of rotation. The lower pivots 24 of the blades 25 carry crank arms. In the preferred arrangement shown in the drawings, a two throw crank is used, and the lower ring 20 carries brackets 27 having bearings 28 formed in their lower ends in alignment with the bearings 22; these bearings carry the bottom end centres 29 of the two-throw cranks 30—31. The two groups of cranks 30—31 work respectively in bearings 32 and 33 in the two gang rings 34 and 35. The gang rings are respectively supported by radial arms 36 and 37 springing from excentric straps 38 and 39; these straps respectively work on discs 40 and 41 on a hub casting 43, said discs being excentrically disposed about the cage axis and diametrically opposite so that the centrifugal effects due to their gyration are balanced. The hub casting 43 is rotatably mounted on the main spindle 14. The lower portion 44 of the hub casting 43 is armed with a ring of internal teeth 45. A pair of pinions 46 diametrically disposed, mesh with the teeth 45, and also mesh with the intermediate pinions 47. As shown in the drawings, a ring of ball bearings is fitted between the excentric straps 38 and 39 and the eccentric discs 40 and 41, but these eccentrics may have surface bearings instead of ball bearings. Similarly, the ball bearings otherwise shown throughout the structure may be eliminated and surface bearings or roller bearings substituted therefor.

The pinions 46 and 47 are rotatably mounted on pivots carried on the circular flange 13. The pinions 46 and 47 are planet pinions in relation to the toothed sun wheel 49; this wheel 49 is keyed on the main spindle 14, and gears with the pinions 47 only. The epicyclic transmission from the main spindle 14 to the hub 43 is from the sun wheel 49 through the pinions 47 and 46 successively to the internal gear 45, the directions of rotation being shown in each case by arrows (Fig. 4). It is essential that the gearing be arranged to cause rotation of the hub 43 in the same direction as the spindle 14. One of the pinions 47 is keyed to its spindle 50, and said spindle is mounted in a bearing and carries a bevel pinion 51 on its bottom end below the flange; this pinion 51 gears with a bevel wheel 52 on the end of the governor spindle 53. The governor spindle is tubular, sleeved on an arm 66 which is fixed on the sleeve 12 and supports at its outer end a yoke 54 in which the rudder 55 is carried on a pintle 56 disposed intermediate the length of the rudder 55 to procure a balance effect to permit the rudder to be readily swung angularly in relation to the supporting arm 66 by means of the governor gear. The governor 57 is of the ordinary fly ball type, mechanically arranged to retract the collar 58 when the balls are forced outward by centrifugal action consequent on rotation of the governor at a speed in excess of the designed normal rate. The inward movement of the collar 58 is applied through the collar bracket 59 the slide rod 60 and the link 61 to the tiller 62 on the rudder pintle 56, so as to swing the rudder 55 off alignment with the arm 66. Under gale conditions the governor will bring the rudder to an extreme offset position (shown in dotted lines in Fig. 1) at an angle of nearly 90° to the arm 66. 90 is a stay wire with strainer, assisting to support the outboard weight of the rudder fitting. 91 is a counterweight to balance the weight of the rudder fitting.

As the vanes are balanced on their pivotal mountings they may be easily adjusted for position in the cage irrespectively of the velocity of the stream. The sleeve 12 may, therefore, be readily swung about the bearing head 11 by a relatively small effort applied to the arm 66 by the rudder or in the case of a propeller by any mechanical control attachment. When the angular set of the rudder is altered by the action of the governor, the arm 66 swings and rotates the hub 43 about the spindle axis through a corresponding angle, and the set of the vanes in the cage is consequently changed, with the result that the stream action on the vanes is diminished and the rate of rotation of the cage and the spindle is therefore regulated within a large range at an approximation to uniformity. When the rudder is swung on its pintle it will set in the direction of the stream and when in the extreme right-angle position shown in dotted lines in Fig. 1, the stream will act with equal effect on the vanes at either side of the cage, and consequently no rotational effort will be applied to the cage. This is the full offset position, in which the motor will remain idle irrespective of the velocity of the stream in which it is immersed, and the adjustment of the governor should be such that the rudder will be brought by it to this full offset position un-

der gale conditions. When the rudder has been brought to the full offset, or to a position near thereto, as will happen only in gale conditions, it is desirable that the rudder be locked in such position until the velocity of the stream moderates, and then that it should be automatically unlocked and restored to the control of the governor; this automatic locking and unlocking is effected by the device now to be described.

70 is a pendent vane loosely hanging by collars 83 on the arm 66. A jaw 71 supported by the bearing bracket 72 in which the rod 60 slides, carries the fulcrum pin 73 of a cam 74. This cam is designed to lock the rod 60 against outward movement by jambing said rod tightly between the cam face and the back of the jaw 71. The lever arm 75 of the cam has pivotally attached to its outer end a push-and-pull rod 76; this rod passes through a hole 77 (ovaled for clearance) in the vane 70 and it carries two stops, one 78 on the end of it and the other 79 adjustable for position intermediate the vane and the lever arm 75. Under gale conditions the vane 70 is tipped upwardly to the position shown in dotted lines Fig. 5, so that it bears against the stop 79, thereby forcing up the lever arm 75 and engaging the cam face 74 against the rod 60. Inward pull of the rod 60 is possible under these conditions if considerable force be applied to it by the governor, but it is locked absolutely against outward movement so long as the vane 70 exercises pressure against the lever 75, to keep the cam locked, through the push-and-pull rod 76. The vane 70 being of metal having considerable weight will drop toward the vertical as soon as the stream pressure against it diminishes, and when it so drops the lever arm 75 will no longer hold, but the cam 74 will remain in locked position holding the rod 60 against outward movement, and thereby maintaining the rudder in the full offset position until the vane strikes the outer stop 78 and thereby through the rod 76 pulls off the lever 75 and releases the cam lock. The rudder will then under the contracting pressure of the governor spring force over the tiller 62 and bring the rudder to a working position in alignment with the arm 66, or, if the stream velocity be still high, to some position intermediate between the alignment position just referred to and the fully offset position shown at the dotted lines at 63. A coil spring 80 may be sleeved on the rod 76 between the stop 79 and the vane 70 to ensure the maintenance of pressure against the cam lever 75 within a certain range of movement of the hanging vane 70 so as thereby to maintain the cam in locked position until the stream velocity has fallen to a point at which it permits the vane 70 to fall to the designed liberating angle.

For simplicity, the vanes 25 have been shown, in Figs. 1 and 2, as flat plates. In practice they are constructed of corrugated sheets of metal 81 fixed between a pair of frame bars 82, which bars, at their ends, are riveted through the stubs of the vane spindles, the lower spindle 24 only being shown in the fragmentary view Fig. 7. The bars 82 must be of sufficient section to assure the necessary longitudinal rigidity in the vanes; lateral stiffness in the vanes is taken care of by the corrugated section.

The operation is as follows:—

The rudder 55 being set out in alignment with the rudder arm 66 and the apparatus set in a stream of water, air, or other fluid, the structure adjusts itself with the rubber 55 in alignment with the direction of the stream, and if the stream velocity be within the normal rate the vanes 25 are then respectively positioned as shown in Figs. 1 and 2. Upon regarding the respective angular positions of the vanes, it will be observed that the stream acts against them with maximum effect to procure the rotation of the cage, the offside vanes on the right hand of Fig. 1 coming up into the stream edge on and offering negligible retardation. As the cage rotates, the vanes are successively brought to the working position at which point of movement the pivotal adjustment is effected through the medium of the epicyclic gearing and the cranks and excentrics. When the stream velocity exceeds the rate at which the motor is adjusted to work, the governor 57 functions to set off the rudder at an angle intermediate the full stroke position shown in full lines in Fig. 1, and the full offset position shown in dotted lines (63) in that figure. In the extreme dotted line position the blade disposition in relation to the direction of the stream will be the disposition of blades seen when viewed from the right hand side of Fig. 1, that is from the direction of the rudder in the dotted position. In this position of adjustment, the pressure acting against the blades on either side of the cage is approximately balanced and little or no rotational effect will be produced on the cage. When the motor is thus brought to a standstill or approximately to a standstill under gale conditions, the governor will slow up and would operate, unless locked, to bring the motor into the wind again. Temporary locking is automatically effected by means of the governor lock device. When the rudder is in the offset or nearly offset position, the hanging vane 70 will be swung upwardly by the stream pressure acting against it, and when it is swung to a sufficiently high angle it acts through the spring 80 and the push rod 76 to engage the lock cam 74 with the rod 60. So long as the bite of the cam 74 is not released, the rod 60 cannot move out-

ward to swing the rudder back to the operating position, but when the steam pressure drops sufficiently to allow the hanging vane 70 to fall to a low position the disengagement of the cam 74 is effected, and thereafter the centrifugal governor reassumes control.

What we claim as our invention and desire to secure by Letters Patent is:—

1. Feathering mechanism for vanes of stream motors comprising a motor spindle, a train of epicyclic gearing keyed to said spindle, a hollow hub surrounding said gearing, an internal ring of teeth on said hub, a lantern cage mounted on said motor spindle, vanes pivotally mounted in said cage, a member carrying the spindles of the epicyclic gearing, and rotatable relatively to said hub, oppositely disposed eccentric discs on said hub, eccentric straps on said discs, and gang rings carried by said straps.

2. Feathering mechanism for vanes of stream motors comprising a motor spindle, a train of epicyclic gearing keyed to said spindle, a hollow hub with internal teeth coacting with members of said gearing train, a lantern cage, vanes mounted on said cage, pivots for each of said vanes, a member carrying the spindles of the epicyclic gearing and rotatable relatively to said hub, two oppositely disposed eccentric discs on said hub, eccentric straps on said discs, two gang rings carried by said straps and double throw cranks connected to said gang rings and said vane pivots.

3. Feathering mechanism for vanes of stream motors comprising a motor spindle, an epicyclic gearing train keyed to said spindle, a hollow hub with internal teeth coacting with said train, a lantern cage, vanes pivotally mounted on said cage, a member carrying the epicyclic gearing spindles and rotatable relatively to said hub, oppositely disposed eccentric discs on said hub, eccentric straps on said discs, gang rings carried by said straps, double throw cranks connected to said gang rings and to the pivots of the vanes, an arm off-set from said spindle carrying member, and a balanced rudder on said arm.

4. Feathering mechanism for vanes of stream motors comprising a motor spindle, an epicyclic gearing train keyed to said spindle, a hollow hub with internal teeth coacting with said train, a lantern cage, vanes pivotally mounted on said cage, a member carrying the epicyclic gearing spindles and rotatable relatively to said hub, oppositely disposed eccentric discs on said hub, eccentric straps on said discs, gang rings carried by said straps, double throw cranks connected to said gang rings and to the pivots of the vanes, an arm off-set from said spindle carrying member, a balanced rudder on said arm, a spindle, a member of the epicyclic gearing keyed to said spindle, a bevel pinion on said spindle, a shaft driven by said bevel pinion, a centrifugal governor rotated by said shaft, and a connection between said governor and said rudder.

5. Feathering mechanism for vanes of stream motors comprising a motor spindle, a train of epicyclic gearing keyed to said spindle, a hollow hub with internal teeth coacting with members of said train, a cage, vanes pivotally mounted on said cage, a spindle carrying-member rotatable relatively to said hub, oppositely disposed eccentric discs on said hub, eccentric straps on said discs, gang rings carried by said straps, double throw cranks attached to said gang rings, an arm off-set from the spindle carrying member, a rudder on said arm, a tiller on said rudder, a rod controlling said tiller, a governor controlled by said epicyclic gearing, a connection between said governor and said rudder, a pendent vane mounted on said off-set arm, and a cam operated by said pendent vane and adapted to lock said tiller controlling arm.

In testimony whereof we affix our signatures.

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FRANK ALFRED WYATT.