Jan. 20, 1953 J. C. SPROUL 2,626,140

MINING MACHINE

Filed Feb. 17, 1950 2 SHEETS—SHEET 1

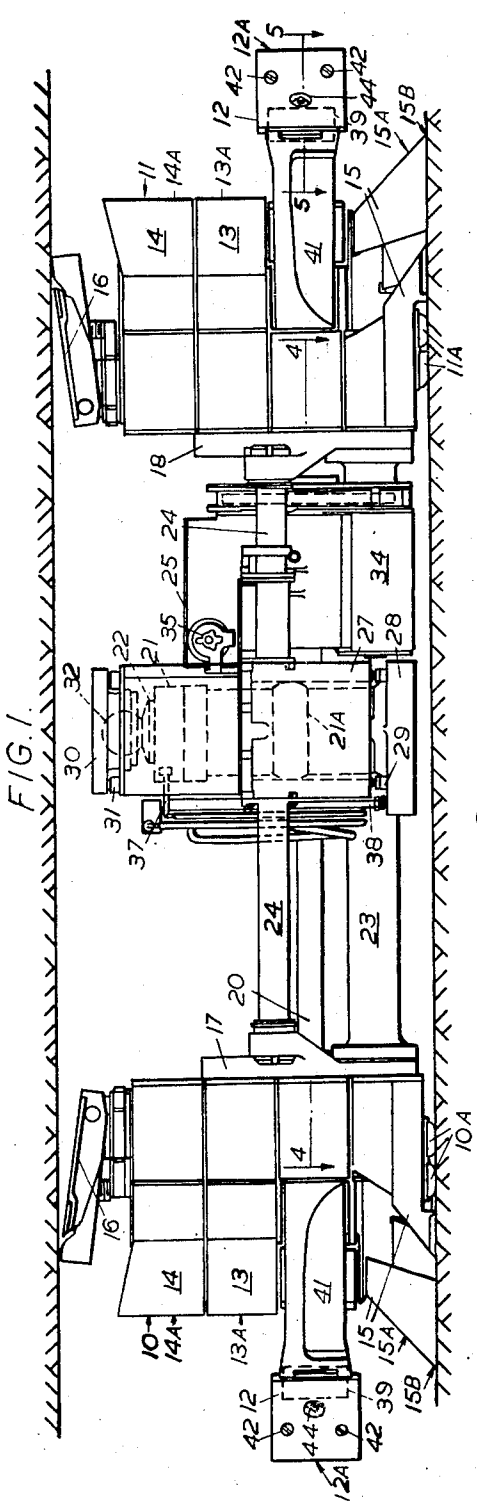


FIG. 1.

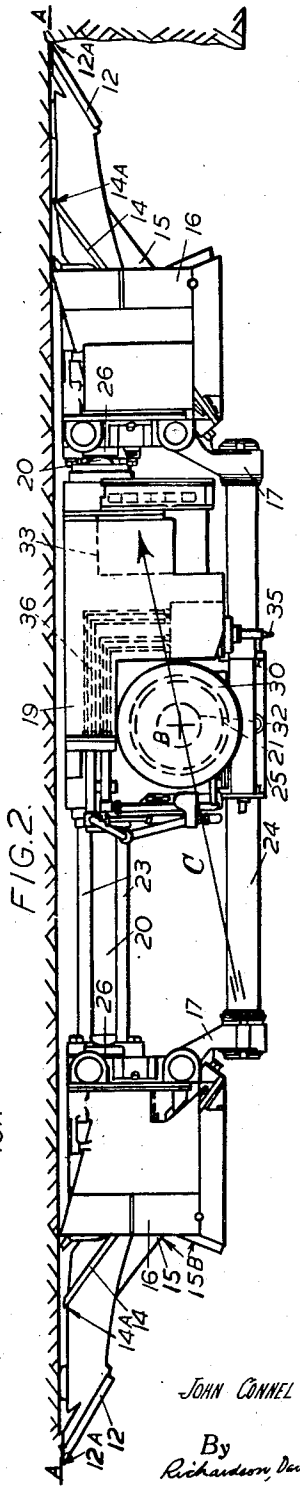


FIG. 2.

Inventor:
JOHN CONNEL SPROUL

By
Richardson, David and Nordon
Attorneys

Jan. 20, 1953 J. C. SPROUL 2,626,140

MINING MACHINE

Filed Feb. 17, 1950 2 SHEETS--SHEET 2

FIG. 3

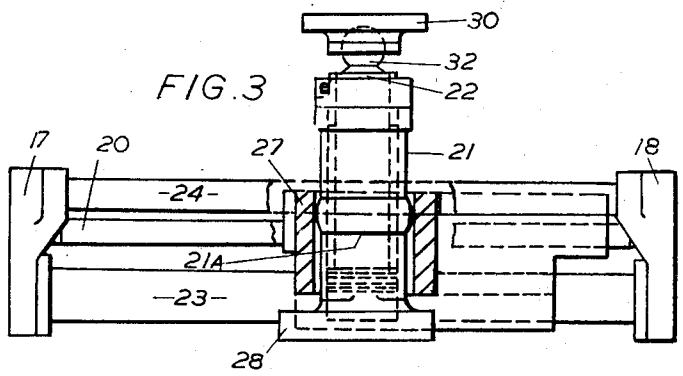


FIG. 4.

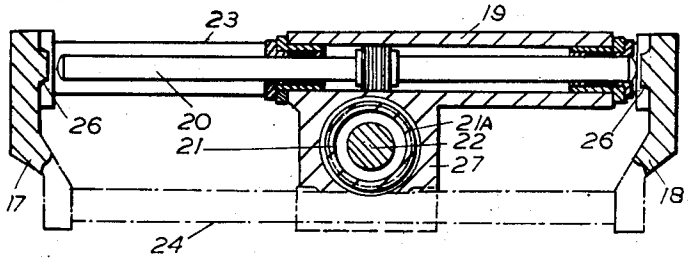
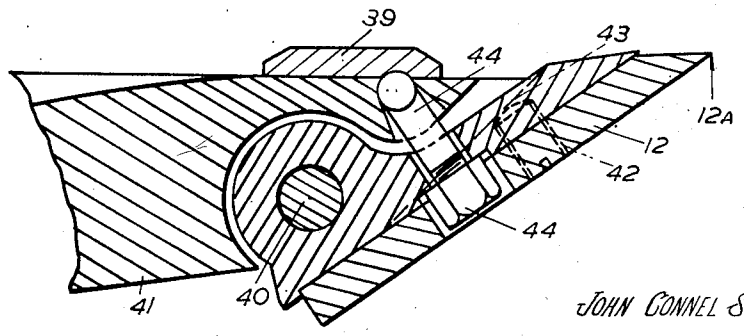


FIG. 5.



Inventor:
JOHN CONNEL SPROUL

By
Richardson, David and Nordon
Attorneys

Patented Jan. 20, 1953 2,626,140

UNITED STATES PATENT OFFICE

2,626,140

MINING MACHINE

John Connel Sproul, Glasgow, Scotland, assignor to Mavor & Coulson, Limited, Glasgow, Scotland

Application February 17, 1950, Serial No. 144,763
In Great Britain November 10, 1947

17 Claims. (Cl. 262—8)

1

This invention relates to machines for mining coal or other mineral and belonging to a previously proposed type having a wedge-like cutter head adapted to strip off the mineral in the advance of the machine by splitting off the mineral in the same manner as by a wedge or chisel along a plane behind the mineral face. Where, as is usually desirable, the machine is double-ended—that is to say, is designed to work in each of its two directions of travel—there are two such cutter heads.

In a previously proposed construction, the machine has jacking means adapted to provide an anchorage or abutment for propulsion apparatus incorporated in the machine. The arrangement is such that first the jacking means is extended to anchor itself between the roof and the floor, next the propulsion apparatus is operated to force the machine forwards so as to make a cutting stroke the reaction of which is taken by the jacking means, next the jacking means is contracted to free itself from its place of anchorage, and finally the propulsion apparatus is operated to pull the jacking means forwards along the floor for location in a new anchorage in readiness for the next cutting stroke.

A disadvantage of previously proposed arrangements is that the jacking means is rigidly attached to the main body of the mining machine, so that when the jacking means is extended to anchor itself and the propulsion apparatus is operated, the tendency of the head to work itself outwardly from the face, as the cutting stroke progresses, imposes heavy bending stresses on the propulsion apparatus.

According to the present invention, a mining machine of the type stated comprises a frame with at least one wedge-like cutter head to split off the mineral from the face of a seam, jacking means to provide an anchorage during each cutting stroke and propulsion apparatus acting longitudinally between the jacking means and the frame to advance them alternately, the jacking means being located on the outer side of the propulsion apparatus in order to bring the centre of the jacking pressure substantially outwards from the plane of the face and in order to apply the cutter head at an effective angle to said plane, and the machine frame being in pivotal relationship with the jacking means in order that as each cutting stroke progresses the frame will adjust itself angularly about the jacking means as axis. By virtue of this arrangement, the cutting force can be applied to the cutter head at an angle which is greater than hitherto, so much so that the cutter head will have no serious

2

tendency to move outwards from the face of the mineral seam.

Preferably, the cutter head (or each cutter head) is associated with a pad arranged immediately behind an active cutter on said head and adapted to slide against the face newly cut by said cutter in the mineral seam. Provision is made for relative lateral adjustment between the cutter and such a pad in order to regulate the cutting action.

The jacking means may be mounted in proximity to the middle of the length of the frame and may be supported by guides on the frame, between which guides and the jacking means relative lengthwise motion occurs during the operation of the cylinder-and-ram apparatus.

An example of a double-ended coal-mining machine according to the invention is shown in the accompanying drawings, in which—

Fig. 1 is an elevation of the machine and Fig. 2 is a plan.

Fig. 3 is a sectional elevation of a hydraulic jack and associated parts as viewed in Fig. 1.

Fig. 4 is a sectional plan of the machine frame and the propulsion means, being a section approximately on the line 4—4 of Fig. 1.

Fig. 5 is a detail view to a larger scale, being a section on the line 5—5 of Fig. 1.

The cutter heads are indicated generally by 10 and 11 respectively. Each of these heads, in the example shown, comprises a leading cutter 12 arranged at an intermediate level, two cutters 13 and 14 above the cutter 12, and a floor cutter assembly 15, all of them having cutting edges working in approximately the same vertical plane A—A, Fig. 2, and they perform the main cutting operation on the coal. The vertical-plane cutting edges are indicated by 12A, 13A, 14A and 15A, respectively. Each floor cutter assembly 15 has also got a horizontal edge 15B, the assembly being in the nature of a deflecting shovel for removing coal from the floor and for lifting and deflecting the coal sidewise to a conveyor (not shown). Each cutter head also includes a horizontal-edged roof cutter assembly 16.

Each head carrying these several cutters is a heavy structure jointed to an end wall 17 or 18 of the frame of the mining machine.

Regarded generally, the mining machine consists of a heavy body, which comprises the aforesaid frame carrying the cutter heads 10, 11 and cylinder-and-ram components 19 and 20 for propelling the frame, in combination with roof-and-floor-engaging jacking means 21, 22 connected with the component 19 of the cylinder-and-ram apparatus to provide a temporarily fixed anchor-

age or abutment against which to apply the propulsion force. The propulsion cylinder 19 and the jacking means constitute an anchorage assembly. The frame includes, in addition to the end walls 17 and 18, two heavy horizontal bars 23 and 24 which rigidly interconnect said end walls. The bar 23 is arranged at a low level and close to the inner side of the machine; that is, the side which comes close to the face of the coal seam, represented in Fig. 2 by the plane A—A. The bar 24 is arranged at an intermediate level and at the outer side of the machine. These bars 23, 24 constitute guides upon which is slidably arranged a blocklike carriage indicated generally by 25. This blocklike carriage incorporates the cylinder component 19 of the cylinder-and-ram propulsion apparatus and carries the cylinder component 21 of the jacking means; that is to say, the carriage 25 carries the whole of the propulsion apparatus and jacking means.

The cutter heads 10 and 11 are equipped with soles 10A and 11A respectively which are slidable upon the mine floor and which assist the floor cutter assemblies 15 to bear the entire weight of the machine.

In the example, the cylinder-and-ram propulsion apparatus is a single hydraulic unit of which the cylinder 19 is double-acting, being arranged in the carriage 25 longitudinally along the inner side of the machine. The ram 20 of the propulsion unit extends from both ends of the cylinder 19. The ram ends register with two buffers or abutments 26 on the end walls 17, 18 of the frame. The ram is very slightly shorter than the distance between the abutments 26, so that there is provision for slight relative longitudinal movement between the ram and the frame. Thus, when the ram is forced longitudinally in either direction relative to its cylinder 19 in the blocklike carriage 25, the ram and frame act like a unit which either advances relative to the temporarily stationary carriage 25 or rests stationary whilst the carriage advances. The fact that the ram 20 is structurally disconnected from the frame gives the important practical advantage that any distortion of the frame due to the very heavy work of the machine is not transmitted to the ram, which is left free of bending and torsional strains to work in its cylinder and to be subjected to purely longitudinal compression due to thrust in both directions on the frame.

With reference to the jacking means 21, 22, in the example this is a hydraulic jack, which is arranged vertically in the carriage 25 at the outer side of the machine. The jack is mounted in a casing or holder 27 incorporated in the structure of the carriage 25. The jack cylinder 21 is vertically slidable in the casing 27 and is formed with a part-spherical enlargement 21A about the centre of which the jack is tiltable in relation to the casing. The cylinder 21 and the piston of the piston-operated component 22 are double-acting. The jack cylinder 21 has a heavy foot or base 28 adapted to engage the mine floor when the jack is extended and which presses upwards against pads 29 on the underside of the casing 27 when the jack is fully contracted. The piston-operated component 22 has a head 30 adapted to engage the mine roof when the jack is fully extended and which rests upon facings 31 on the casing 27 when the jack is contracted. Then the facings 31 bear the weight of the jack. The head 30 is connected to the component 22 by universal joint 32, so that the head is freely tiltable, within limits, in all directions. The arrangement is such that the jack can accommodate itself to undulations in the roof or floor.

The jack cylinder 21 is freely turnable relative to the casing 27 about the jack axis, which is indicated by a cross B in Fig. 2. Thus, when the jack is extended to engage the floor and roof, the machine is laterally pivotable about the axis B.

For the operation of the hydraulic cylinder-and-piston units 19, 20 and 21, 22 constituting the propulsion and jacking means of the machine, any appropriate hydraulic pumping plant is provided, such plant in the example being carried by the carriage 25. The plant comprises an electromotor-driven pump 33, a tank 34 from which the pump draws the hydraulic liquid (namely oil) a manually operated control valve 35 for directing the hydraulic liquid to and from the appropriate ends of the cylinders 19 and 21 and appropriate piping 36 (Fig. 2). As Fig. 1 shows, the piping includes two flexible pipes 37, 38 communicating with opposite ends of the jack cylinder 21. The hydraulic plant, being of any conventional design, is shown more or less diagrammatically.

The leading cutter 12 of each of the cutter heads 10 and 11 is associated with a pad 39, the face of the pad occupying the cutting plane A—A; that is to say, the pad is arranged to slide against the newly cut coal face during each cutting stroke of the head 10 or 11 carrying it. Moreover, each leading cutter itself is angularly adjustable laterally so that its setting relative to the associated pad 39 can be adjusted to regulate the cutting action. As shown in Figs. 1 and 5, the cutter 12 is attached by a vertical pivot pin 40 to an arm 41 projecting forwards from the head 10 (or 11). Two adjustable grub screws 42 extending through the cutter come against a facing 43 on the arm 41 and thus fix the angular setting of the cutter. A swing bolt 44 anchored to the arm 41 passes through the cutter and serves to hold the screws 42 hard against the facing 43.

The operation of the machine is as follows: Assume that the machine as viewed in the drawings is to work towards the right; that is to say, the head 11 has to lead and act on the coal face whereas the head 10 has to trail idly. Assume also that the carriage 25 and jack 21, 22 are positioned as shown and that the hydraulic plant is in operation.

The first action of the machine is to thrust the head 11 forward to perform its cutting stroke. Accordingly, the control valve is manipulated so that the jack 21, 22 is extended. Thus, the jack cylinder 21 is forced downwards until its foot 28 engages the floor, after which the piston-operated component 22 rises until its head 30 engages the roof, so that the jack finally anchors itself and the carriage 25 between roof and floor. Next, the control valve 35 is operated so that the ram 20 of the propulsion unit is forced towards the right; that is, the propulsion unit is operated to push forwards the frame 17, 18, 23, 24. Thus a cutting stroke is performed by the head 11, the frame sliding upon the mine floor past the anchored jack and carriage. Next, the control valve 35 is operated so that the jack is operated to lower its head from the roof and lift its foot clear of the floor. The entire carriage 25 and everything carried by it are now supported by the frame clear above the mine floor. Finally, the control valve 35 is operated so that the propulsion unit acts in the opposite direction so that

its ram 20 thrusts towards the left. This action causes the propulsion cylinder 19 with the carriage 25 and jack 21, 22 to slide forwards, free from obstruction by the floor or roof, along the frame guides 23, 24 in readiness for anchorage again.

When each cutting stroke is performed by the machine, the force of the stroke is directed in a plane from the central axis B of the jack to the approximate place of application to the coal of the main cutter edges 12A, 13A, 14A and 15A of the active head 11. In Fig. 2 the approximate plane of application is indicated by the arrow C, which is directed at an angle to the cutting plane A—A. Throughout the cutting stroke, not only does the frame 17, 18, 23, 24 continue to slide past the anchored jack 21, 22, but as the stroke progresses the angularity of the line of application C with the cutting plane A—A decreases slightly by virtue of the pivotal relationship of the frame to the jack. By virtue of the universal mounting at 21A of the jacking means, the frame is free to follow undulations on the mine floor.

Thus it will be seen that, in the coal-mining machine described, the vertical roof-and-floor jack 21, 22 is outwardly offset from and pivotally related to the longitudinal propulsion cylinder-and-ram unit 19, 20 so that the inwardly inclined thrust from the ram towards the coal face produces an inward cutting influence on the leading cutter head 11, which influence is restricted by the pressure pad 39 on the cutter head.

As Fig. 2 shows, the centre of the total jacking pressure represented by the cross B is substantially offset outwards from the line of action of the propulsion ram 20, so much so that the approximate line of thrust represented by the arrow C is at an angle to the cutting plane A—A reasonably great enough to obviate or substantially reduce any tendency of the cutter head to work itself outwards from the face.

Moreover, the freedom of the frame to pivot about the anchorage at B obviates or minimises bending stresses in the frame; but as already explained, any such bending or other stresses to which the frame may be subject are not communicated to the propulsion apparatus 19, 20.

Patent application No. 144,745 having the same date as the present application describes and shows a mining machine the same as that herein described and shown in the accompanying drawings but claims an invention different from that hereinafter claimed.

I claim:

1. A machine for mining coal or other mineral and of the type stated comprising a frame, a cutter head carried by said frame to split off mineral in a cutting plane from a mine seam, propulsion apparatus supported by said frame for movement along the frame, said cutter head being structurally related to said propulsion apparatus so that said cutting plane is at the inner side of said apparatus, extensible and contractible roof-and-floor engageable jacking means including a vertical axis cylindrical component which is carried by said apparatus and which is offset to the outer side of the propulsion apparatus, said jacking means providing an anchorage against which said apparatus can apply to the frame propulsive and cutting force, and a pivotal connection between the cylindrical component and the propulsion apparatus such that as the cutting stroke progresses the frame can adjust itself angularly by pivoting about the axis of said cylindrical component.

2. A machine according to claim 1 including also a cutter on the cutter head and a pad arranged immediately to the rear of said cutter to slide in the cutting plane against a face newly cut by said cutter.

3. A machine according to claim 2 including also means for effecting relative lateral angular adjustment between said cutter and said pad in order to regulate the cutting action.

4. A machine according to claim 1 in which the said jacking means is an extensible and contractible cylinder-and-piston unit and in which the machine includes a support incorporated in said propulsion apparatus, and wherein said pivotal connection is between said cylindrical component and said support, said unit being vertically slidable in said support.

5. A machine according to claim 4 in which said cylinder-and-piston unit includes one component having a roof-engageable head adapted to rest upon said support, which thus bears the weight of the jacking means when the unit is contracted.

6. A machine according to claim 5 in which the other component of said unit has a floor-engageable foot which comes against said support when the unit is fully contracted.

7. A machine according to claim 4 in which the cylinder-and-piston unit is mounted in said support not only so as to be pivotable and slidable but also so as to be tiltable to the vertical axis of said unit.

8. A machine for mining coal or other mineral and of the type stated comprising a frame, a cutter head carried by said frame to split off mineral in a cutting plane from a mine seam, a carriage which is supported by said frame for movement along the frame, extensible and contractible roof-and-floor engageable jacking means carried by said carriage to provide a temporarily fixed anchorage against which to apply machine propulsion force, said jacking means having an approximately vertical axis, propulsion apparatus also carried by said carriage, said apparatus having an approximately horizontal longitudinal axis and acting longitudinally through said frame while the carriage is anchored to apply a cutting stroke to said cutter head, said cutter head, carriage, jacking means and propulsion apparatus being structurally related so that the propulsion apparatus is located at the inner side of the carriage with its said longitudinal axis close to said cutting plane and the jacking means is located at the outer side of the carriage with its said vertical axis spaced outwards to a substantial extent from said longitudinal axis in order that the cutting stroke will be applied at an effective angle to said plane, and a pivotal connection between the jacking means and the carriage such that as the cutting stroke progresses the frame can adjust itself angularly by pivoting about said vertical axis.

9. A machine for mining coal or other mineral and of the type stated comprising a frame, a cutter head carried by said frame to split off mineral in a cutting plane from a mine seam, a carriage which is supported by said frame for movement along the frame, extensible and contractible roof-and-floor engageable jacking means also carried by said carriage to provide a temporarily fixed anchorage against which to apply machine propulsion force, said jacking means having an approximately vertical axis, a propulsion power cylinder carried by said carriage, a ram movable through said cylinder and

extending therefrom in opposite longitudinal directions to act through the frame while the carriage is anchored to apply a cutting stroke to said cutter head, said jacking means being located on the outer side, with respect to said plane, of the ram in order that the cutting stroke will be applied at an effective angle to said plane, and a pivotal connection between the jacking means and the carriage such that as the cutting stroke progresses the frame can adjust itself angularly by pivoting about the axis of the jacking means.

10. A machine according to claim 9 including also a cutter on the cutter head and a pad arranged immediately to the rear of said cutter to slide in the cutting plane against a face newly cut by said cutter.

11. A machine according to claim 10 including also means for effecting relative lateral angular adjustment between said cutter and said pad in order to regulate the cutting action.

12. A machine according to claim 9 in which the said jacking means is an extensible and contractible cylinder-and-piston unit and in which the machine includes a support incorporated in said carriage, and wherein said pivotal connection is between said cylinder-and-piston unit and said support, said unit being vertically slidable in said support.

13. A machine according to claim 12 in which the cylinder-and-piston unit includes one component having a roof-engageable head adapted to rest upon said support, which thus bears the weight of the jacking means when the unit is contracted.

14. A machine according to claim 13 in which the other component of said unit has a floor-engageable foot which comes against said support when the unit is fully contracted.

15. A machine according to claim 12 in which the cylinder-and-piston unit is mounted in said support not only so as to be pivotal and slidable but also so as to be tiltable to the vertical axis of said unit.

16. A machine for mining coal or other mineral and of the type stated comprising a frame which supports itself at opposite ends on a mine floor, a cutter head incorporated in an end of said frame to split off mineral in a cutting plane from a mine seam, cylinder-and-ram propulsion apparatus having a horizontal longitudinal axis, a carriage which carries said apparatus and which is supported clear of the mine floor by said frame for longitudinal movement along the frame between the ends thereof, extensible and contractible roof-and-floor engageable vertical-axis jacking means also carried by said carriage to provide a temporarily fixed anchorage against which said apparatus can apply a cutting stroke to said cutter head, said cutter head, carriage, jacking means and propulsion apparatus being structurally related so that the propulsion apparatus is located at the inner side of the carriage with its said longitudinal axis close to said cutting plane and the jacking means is located at the outer side of the carriage with its said vertical axis spaced outwards to a substantial extent from said longitudinal axis. in order that the cutting stroke will be applied at an effective angle to said plane, and a pivotal connection between the jacking means and the carriage such that as the cutting stroke progresses the frame can adjust itself angularly by pivoting about the axis of the jacking means.

17. A machine according to claim 16 in which the vertical-axis jacking means is an extensible and contractible cylinder-and-piston unit and in which the machine includes a support incorporated in the carriage, and wherein said pivotal connection is between said cylinder-and-piston unit and said support, said unit being vertically slidable in said support.

JOHN CONNEL SPROUL.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,704,866	Morgan	Mar. 12, 1929
1,761,060	Van Slyke	June 3, 1930
2,420,755	Mavor	May 20, 1947