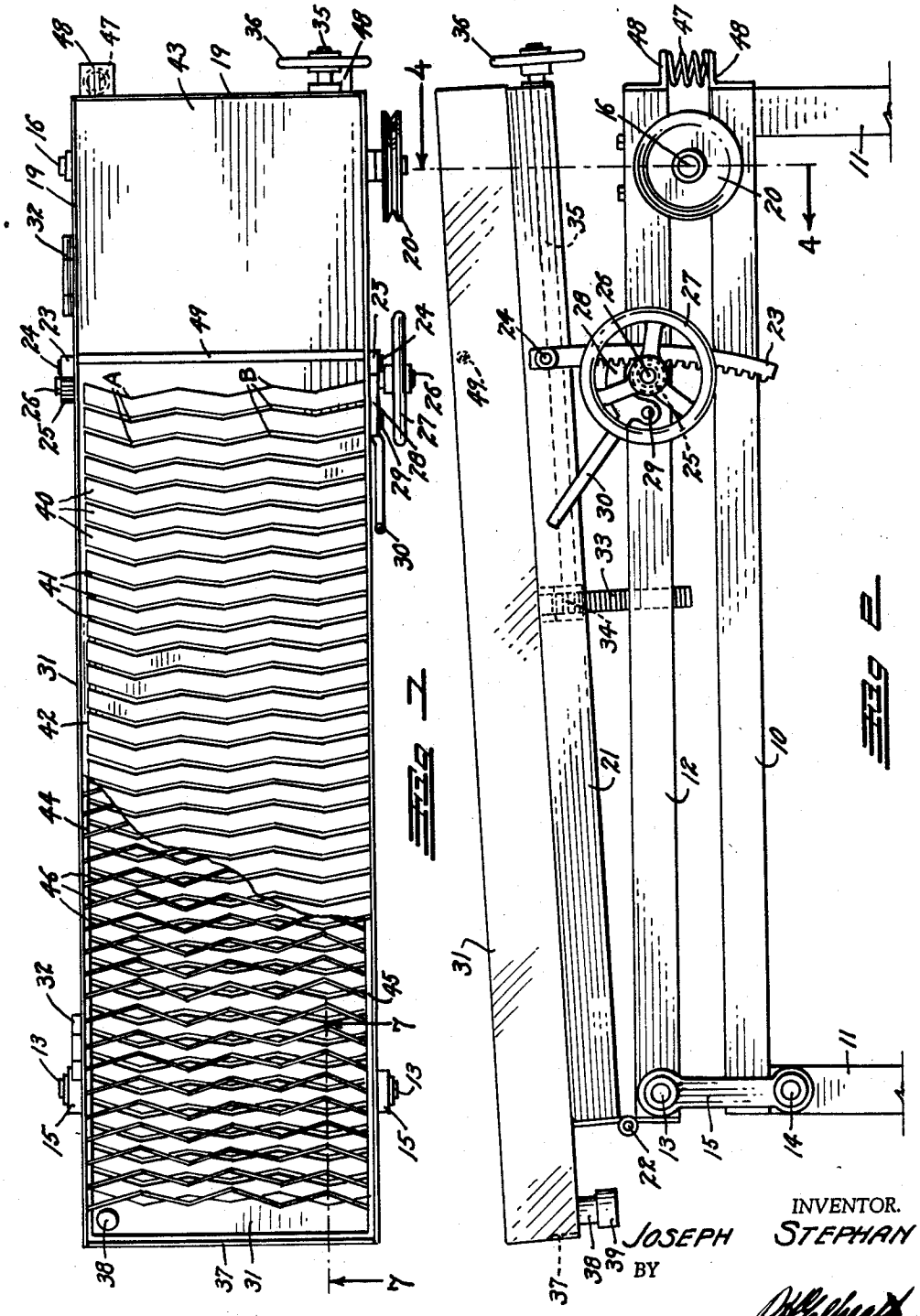
July 12, 1960 J. STEPHAN 2,944,668

PLACER TYPE UNITS FOR THE RECOVERY OF MINERAL VALUES

Filed April 6, 1959 2 Sheets-Sheet 1



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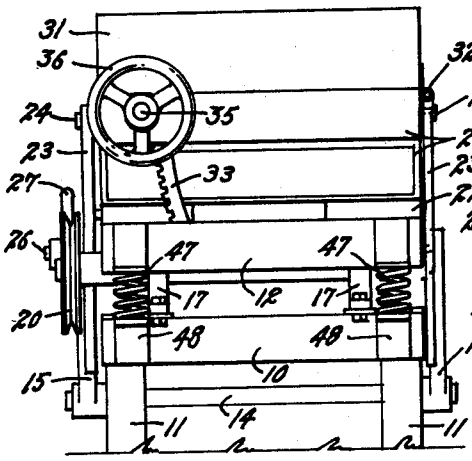


Fig 3

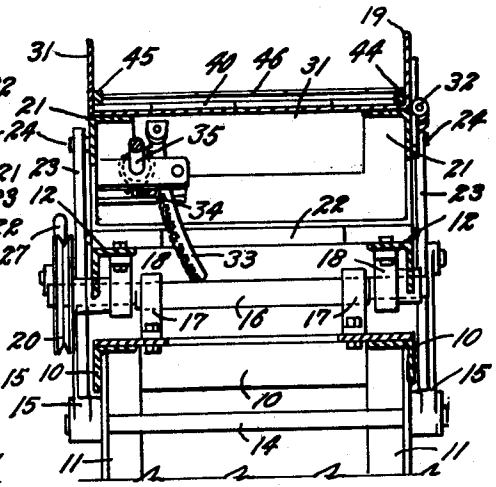


Fig 4

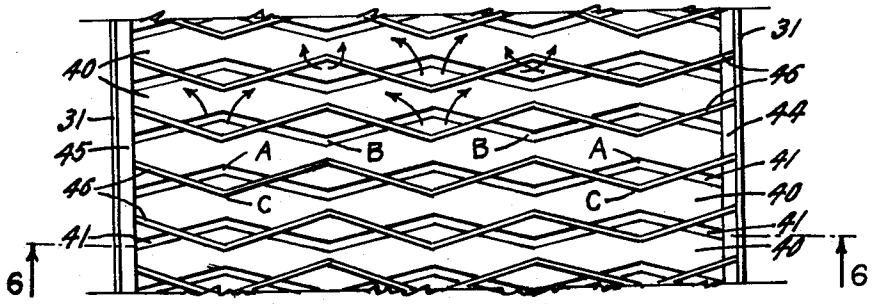


Fig 5

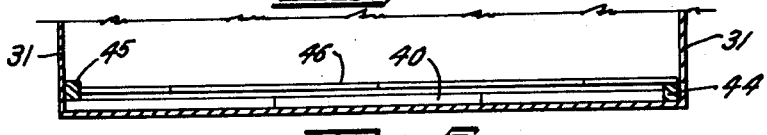


Fig 6

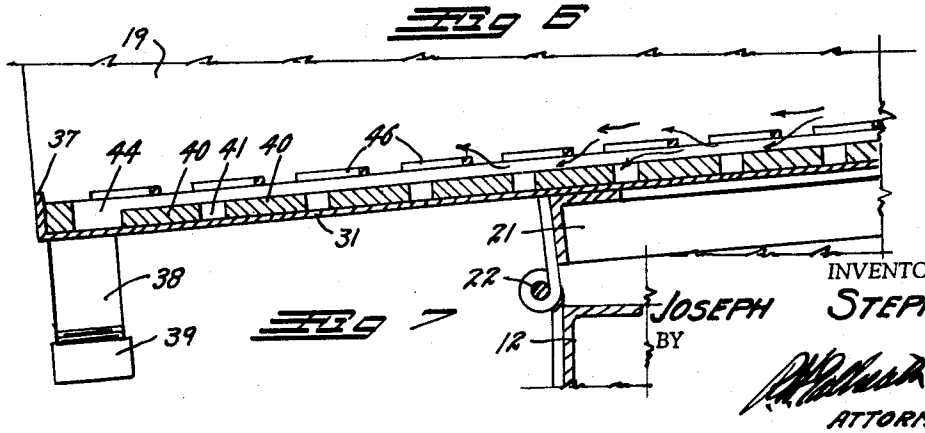


Fig 7

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United States Patent Office 2,944,668 Patented July 12, 1960

2,944,668

PLACER TYPE UNITS FOR THE RECOVERY OF MINERAL VALUES

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Filed Apr. 6, 1959, Ser. No. 804,531

8 Claims. (Cl. 209—443)

This invention relates to a placed type recovery unit for the recovery of mineral values from hydraulic solutions of mineralized ore or sand.

The principal object of the invention is to provide a recovery unit which will simulate the action of a hand-operated gold pan and which will greatly increase both the efficiency of recovery and the capacity per unit of width over present devices of this type, such as sluice boxes, concentrating tables, and the like.

Another object of the invention is to provide a riffle construction for hydraulic mineral recovery devices which will provide accumulation pockets throughout the length of each riffle to increase the retention capacity of the riffle and to provide means for creating swirls and eddies in the water flowing over the riffle so as to obtain a maximum deposit of the mineral values combined with a rapid elimination of rock, gangue, and other valueless suspensions.

A further object of the invention is to provide a hydraulic mineral recovery unit which can be rapidly and easily cleaned at frequent intervals to prevent over filling of the riffles with a minimum "clean up" time loss.

Other objects and advantages reside in the detail construction of the invention, which is designed for simplicity, economy, and efficiency. These will become more apparent from the following description.

In the following detailed description of the invention, reference is had to the accompanying drawing which forms a part hereof. Like numerals refer to like parts in all views of the drawing and throughout the description.

In the drawing:

Fig. 1 is a plan view of the improved mineral recovery unit showing a swirl grill, with which the unit is provided, partially broken away to reveal the riffle construction of the unit;

Fig. 2 is a side view of the upper or operating portion of the improved unit;

Fig. 3 is an end view of the operating portion looking toward the feed extremity of the unit.

Fig. 4 is a vertical cross section, taken on the line 4—4, Fig. 2;

Fig. 5 is a fragmentary enlarged plan view of a portion of a riffle pan employed in the device with the swirl grill in place thereon;

Fig. 6 is a cross section through the riffle pan, taken on the line 5—5, Fig. 5; and

Fig. 7 is a still further enlarged fragmentary, longitudinal section through the bottom of the discharge extremity of the riffle pan taken on the line 7—7, Fig. 1.

The unit is supported upon a suitable horizontal, rectangular supporting frame **10** which in turn may be supported in any desired manner such as by suitable supporting legs **11**. An oscillating frame **12**, corresponding substantially in shape and size to the supporting frame **10**, is positioned over the latter. An upper rocker shaft **13** is extended transversally through the oscillating frame

12 adjacent its discharge extremity and a lower rocker shaft **14** is similarly extended through the supporting frame **10**. The rocker shafts **13** and **14** are connected together at their extremities by means of vertically positioned rocking links **15** which movably support the discharge extremity of the oscillating frame **12** above and in spaced relation to the supporting frame **10**.

The feed extremity of the oscillating frame **12** is supported from an eccentric shaft **16** which is rotatably mounted in stationary bearings **17** supported from the supporting frame **10**. The terminal portions of the eccentric shaft **16** are eccentric of the medial portion thereof. The medial portion is mounted in the stationary bearings **17** and the feed extremity of the oscillating frame **12** is supported from the eccentric terminal portions by means of suitable, oscillating bearings **18**. A suitable drive pulley **20** is secured on the eccentric shaft **16** whereby it may be rotated from any suitable source of power.

It can be seen that, if the shaft **16** be rotated, the oscillating frame **12** will simultaneously vibrate both longitudinally and vertically. The vertical vibration will be more pronounced adjacent the feed extremity, due to the proximity of the eccentric shaft **16**, than adjacent the swinging links **15**. A pair of springs **47** are compressed between spring brackets **48** on the supporting frame **10** and the oscillating frame **12** to constantly urge the latter apart and to act as counterbalances to absorb a portion of the weight of the superstructure so as to increase the ease and speed of lift of the eccentric shaft.

A rectangular pan frame **21** substantially corresponding in contour to the oscillating frame **12** is mounted above the latter upon a suitable transverse hinge **22** mounted between the discharge extremities of the two frames. The feed extremity of the pan frame **21** is adjustably supported upon two rack bars **23** pivotally mounted, as shown at **24**, at their upper extremities upon opposite sides of the pan frame **21**. The rack bars **23** extend downwardly upon opposite sides of the oscillating frame **12** and intermesh with the teeth of pinions **25** mounted on the extremities of a pinion shaft **26** rotatably mounted in and extending transversally of the oscillating frame **12**. A hand wheel **27** is mounted on the pinion shaft by means of which it can be rotated to cause the rack bars **23** to move upwardly or downwardly to position the pan frame **21** at any desired incline longitudinally. The pan frame can be locked at any desired incline by means of a suitable ratchet dog **28** mounted on a dog shaft **29** extending transversally of the oscillating frame **12** and provided with a suitable release handle **30**.

The pan frame **21** supports an elongated, rectangular riffle pan **31** relatively-high, having substantially vertical side walls **19** extending along its two sides and across its feed extremity. The discharge extremity of the riffle pan overhangs the pan frame **21**. The riffle pan **31** is hinged to one side of the pan frame **21** upon suitable longitudinally-extending hinges **32** so that the near side of the pan may be raised about the axis of the hinges **32** to tilt the material in the pan to the far side thereof. The pan may be tilted in any desired manner. As illustrated, it is tilted by means of a second rack bar **33** suspended from the bottom of the riffle pan and engaging a pinion **34** on a pinion shaft **35** mounted in and extending longitudinally of the pan frame **21**. The pinion shaft can be rotated to tilt the riffle pan by means of a hand wheel **36** mounted thereon.

A relatively low overflow flange or tail board **37** extends across the discharge extremity of the riffle pan over which the valueless sand and gangue overflows. A clean out nipple **38** extends downwardly from the

overhanging extremity of the pan adjacent the hinged side thereof. The clean out nipple 38 is normally closed by means of a suitable removable cap 39.

A plurality of upstanding strips or riffles 40 extend transversally of the riffle pan in spaced-apart relation to provide a plurality of collection channels 41 intermediate the riffles throughout the length of the pan. It is desired to call attention to the specific shape of the riffles 40. They have what will be herein termed a "zig-zag" shape, that is, each riffle inclines first toward the discharge end of the riffle pan, thence toward the feed, etc., throughout their lengths. Since all of the riffles are similar in size and shape, this provides a "zig-zag" contour to the collection channels 41 so as to provide a plurality of V-shaped pockets directed toward the discharge end, as indicated at "A," and a plurality of inverted V-shaped channel points, as indicated at "B," directed toward the feed end of the pan.

The riffles 40 terminate in spaced relation to the feed end of the pan to provide a non-riffled feed receiving area or box 43, at the feed extremity of the pan, the two sides of which are braced from each other by means of a suitable cross brace tube 49. The riffles 40 may be formed from individual, separated, "zig-zag" members secured to the bottom of the riffle pan in any desired manner or they may be indented upwardly in the bottom of the pan. The riffles extend in contact with the near side wall 19 of the pan and terminate in spaced relation to the far side wall of the pan adjacent the hinges 32 to leave a longitudinally-extending channel 42 along the latter wall communicating with all of the collection channels 41.

It can be seen that if a hydraulic suspension of solids, such as gold bearing sands, crushed ore, or the like, be fed into the feed box 43, it will flow downwardly over all of the riffles 40 and discharge over the tail board 37. The heavier, value-bearing portions of the solids will settle by gravity into the collection channels 41 between the riffles 40. Due to the "zig-zag" shape of the riffles 40, a double flow is provided in each channel 41. First, there is the swirling flow caused by the longitudinal movement of the water transversally across the channel and second, there is a flow lengthwise of the channel from the apex points "B" to the V-shaped pockets "A" which effect an efficient accumulation of values in the pockets "A." A complete "planning" effect is produced in the channels by the combined differential, longitudinal and tilting vibration of the pan which causes the gangue and waste material to rapidly overflow the riffles while the metal bearing particles are entrapped and slowly gravitated and collected in the V-shaped pockets "A." The uplift of the pan is increased by the action of the springs 47 so as to increase the settling effect of the values.

A maximum recovery of mineralized particles from a hydraulic suspension is at times difficult due to the fact that occasionally the metallic particles are so fine and flake-like that they are carried along more readily than some of the larger valueless particles. Also particles having small areas of adhering metal will have but slight difference in specific gravity from a particle having no metallic adherence so as to make gravitational separation difficult. With this invention, however, an oscillating vibration of very slight magnitude and great rapidity is provided at the feed extremity of the pan which causes a rapid settling of the heavier particles. The vertical impulse of the oscillating vibration gradually diminishes as the discharge extremity is approached so that particles of slight gravity differences will eventually reach a point where the heavier particles will be entrapped and collected. The latter collection can be controlled for a very accurate control of the longitudinal incline of the riffle pan and the resulting speed of flow can be had by adjusting the hand wheel 27 to adjust the incline of the pan to the particular type of sand or ore being treated. For instance, if it is found that values are going over the tail board 37, the incline can be lessened until maximum values are retained without unduly interfering with the capacity of the device.

As above described, the device is exceedingly valuable in recovering free gold and other metallic values from hydraulically flowing sand and ore and has also been found valuable in the recovery of the radio-active values from monozite ores. However, it has been found that the efficiency and the capacity can be still further increased more especially on difficult flaked and entrapped values by placing a grill of specific design over and in spaced-relation to the riffles. The grill, as illustrated, comprises a first side frame bar 44 which fits into and fills the longitudinal channel 42 along the far wall of the riffle pan and a second side frame bar 45 which overlies the riffles adjacent the near side wall of the riffle pan. A plurality of "zig-zag" grill bars 46 are welded to the top of the first frame bar and to the side of the second frame bar 45 in spaced-apart relation. The contour or "zig-zags" of the grill bars are exactly opposite to the "zig-zags" of the riffles 40 so as to create eddy currents in the overflowing suspension as indicated by the arrows in Fig. 5. The "points" on the "zig-zags" of the grill bars, indicated at "C" are positioned forwardly of the channel pockets "A" so as to interfere with and divert the intensity of the flow away from the pockets to prevent washing of values therefrom and to create a longitudinal flow in the channels 40 to increase the efficiency of recovery.

In a highly successful operating unit, the riffles 40 are 1¼" wide, have an elevation of ¼" above the bottom of the riffle pan, the angle of the "zig-zags" from a straight transverse line is 6°, and the eccentric shaft has an eccentricity or "throw" of 1/16". The grill bars 46 are 3/16" square and are positioned 1/8" above the top of the riffles 40. In any event, the dimensions and proportions and the incline of the pan should be such as to obtain a sufficient current lengthwise of the riffle channels to agitate and eliminate the major portion of the valueless black sands having a specific gravity of from 4 to 4.5 while retaining the black sand particles having attached metallic values and having a specific gravity in excess of 6 S.G.

It would have been troublesome to use "zig-zag" riffles in prior machines since it would be difficult and time consuming to remove the accumulated values from the V-shaped pockets "A." With the present invention, however, the "clean up" presents no problem. At clean up time, the grill is simply lifted from place; the hand wheel 36 is rotated to tilt the riffle pan toward the hinged side; and the values are washed by means of a water hose from the riffle channels 41 into the longitudinal channel 42 and from thence into the nipple 38 for quick recovery.

It has been noted that the grill bars provide a preliminary separation of the pure waste material. The latter flows completely and entirely above the grill bars so as not to interfere with the finer classifications of the heavier particles in the undercurrents below the grill bars. The tail board 37 holds back the water at the discharge extremity to form a semi-quiescent pool for the final settling.

While a specific form of the improvement has been described and illustrated herein, it is to be understood that the same may be varied within the scope of the appended claims, without departing from the spirit of the invention.

Having thus described the invention what is claimed and desired secured by Letters Patent is:

1. A placer type mineral recovery unit comprising: an elongated longitudinally-inclined pan arranged to allow a hydraulic suspension to be fed into its higher feed extremity to overflow its lower discharge extremity: a plurality of riffles extending in a common plane transversally of and on the bottom of said pan, and being spaced apart to form transversally extending collection channels

between adjacent riffles, each of said riffles being longitudinally "zig-zag" in shape so that said collection channels will have longitudinally-aligned pointed portions directed toward the higher extremity of said pan and alternating pocket portions directed toward the lower extremity of said pan, said riffles being in contact with said bottom throughout their lengths to prevent transverse flow beneath said riffles throughout their lengths; grill bars extending transversally of said pan; and means supporting said grill bars in a plane parallel to the common plane of said riffles and in vertically-spaced relation thereto to allow hydraulic currents to flow between the plane of said bars and the plane of said riffles, said grill bars having a "zig-zag" contour throughout their lengths so that portions of said grill bars directed toward said feed extremity will alternate with portions directed toward said discharge extremity all of said portions lying in a common plane.

2. A placer type mineral recovery unit as described in claim 1 in which the portions of the "zig-zag" grill bars directed toward the feed extremity of the pan are positioned in longitudinal alignment with the pocket portions of the collection channels.

3. A placer type mineral recovery unit comprising: an elongated longitudinally-inclined pan arranged to allow a hydraulic suspension to be fed into its higher feed extremity to overflow its lower discharge extremity; a plurality of riffles extending to overflow its lower discharge extremity; a plurality of riffles extending transversally of and on the bottom of said pan, and being spaced apart to form transversally extending collection channels between adjacent riffles, each of said riffles being longitudinally "zig-zag" in shape so that said collection channels will have longitudinally-aligned pointed portions directed toward the higher extremity of said pan and alternating pocket portions directed toward the lower extremity of said pan; an inclined pan frame supporting said pan; an oscillating frame positioned below said pan frame; hinge means connecting the lower extremity of said pan frame to said oscillating frame; vertically adjustable means supporting the higher extremity of said pan frame from said oscillating frame; means for oscillating said oscillating frame; and hinge means securing one side of said pan to one side of said pan frame so that said pan can be tilted sidewardly for clean up purposes.

4. A placer type mineral recovery unit as described in claim 3 having a longitudinally-extending channel connecting said collection channels adjacent the hinged side

of said pan to allow material to flow from said collection channels to the lower extremity of said pan, therebeing a discharge for said materials at said lower extremity.

5. A placer type mineral recovery unit comprising: an elongated, horizontal, substantially rectangular fixed frame having a discharge and a feed extremity; swinging links mounted on and extending upwardly from the discharge extremity of said fixed frame; an eccentric shaft rotatably mounted on said fixed frame adjacent its feed extremity; an oscillating frame substantially similar to said fixed frame supported at its discharge extremity by said swinging links and at its feed extremity by said eccentric shaft so that rotation of the latter will impart an oscillating movement to said oscillating frame; a pan frame substantially similar to said oscillating frame positioned above the latter; hinge means connecting the discharge extremity of said pan frame to the discharge extremity of said oscillating frame; vertically adjustable supporting means supporting the other extremity of said pan frame from said oscillating frame; and a riffled pan supported by said pan frame; hinge means connecting one side of said pan with one side of said pan frame so that said pan is tiltable side ways for clean up purposes.

6. A placer type mineral recovery unit as described in claim 5 in which the riffles extend across the pan in spaced relation on similar "zig-zag" paths to define "zig-zag" channels therebetween, therebeing a longitudinally-extending channel connecting all of said channels adjacent the hinged side of said pan.

7. A placer type mineral recovery unit as described in claim 6 having a side grill strip extending along and within each side of said pan and grill bars extending between said strips in vertical-spaced relation to said riffles.

8. A placer type mineral recovery unit as described in claim 7 in which the grill bars have a "zig-zag" conformation in opposite relation to the "zig-zag" conformation of said riffles.

References Cited in the file of this patent

UNITED STATES PATENTS

207,153	Bagley	Aug. 20, 1878
233,661	Currier	Oct. 26, 1880
910,992	Curtis	Jan. 26, 1919
1,704,265	Stephan	Mar. 5, 1929
2,148,067	Fuller et al.	Feb. 21, 1939
2,373,931	Upham	Apr. 17, 1945
2,496,025	Stephan	Jan. 31, 1950