Sept. 16, 1947. G. E. SHAWCROSS 2,427,423

RECIPROCATING MECHANISM FOR INCLINED MINERAL SEPARATING PNEUMATIC TABLES

Filed Nov. 5, 1945

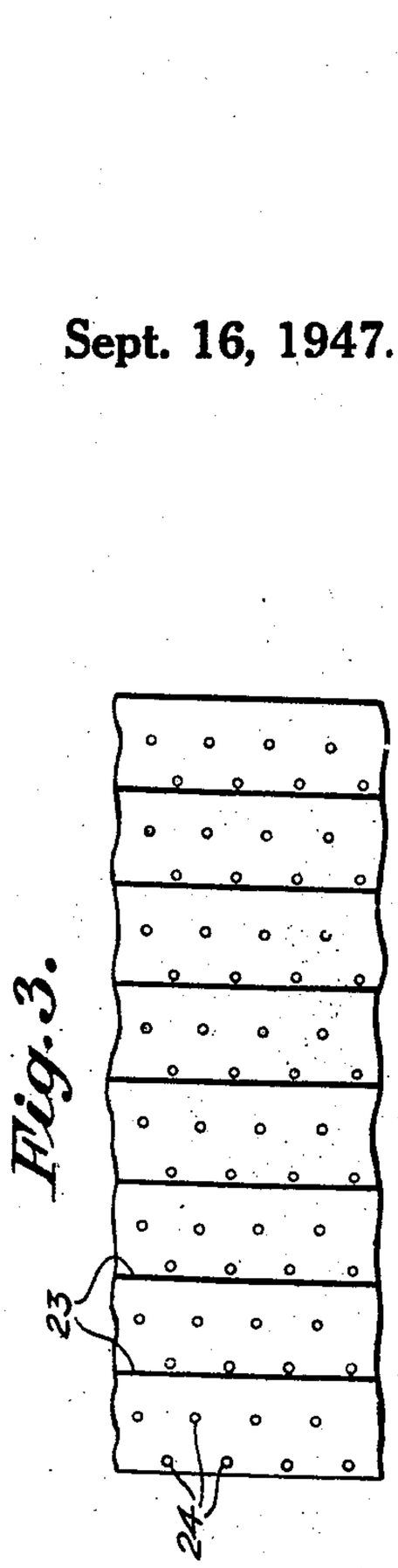


Fig. 3.

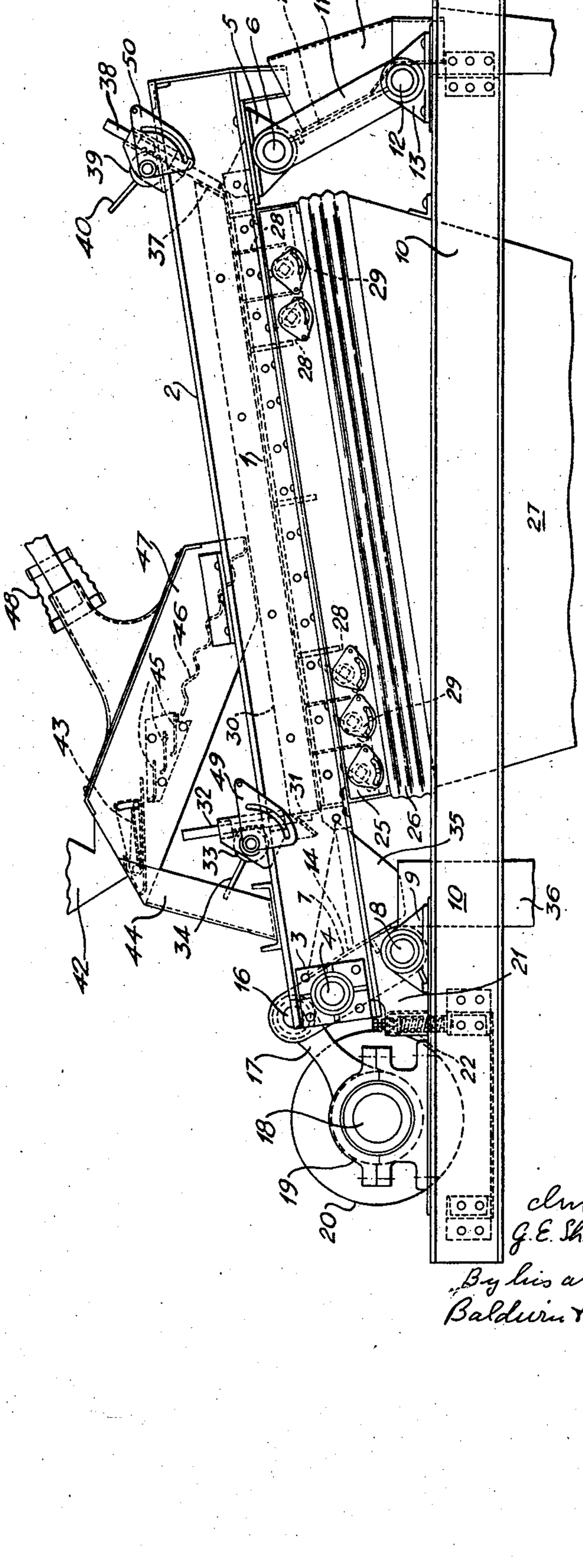


Fig. 1.

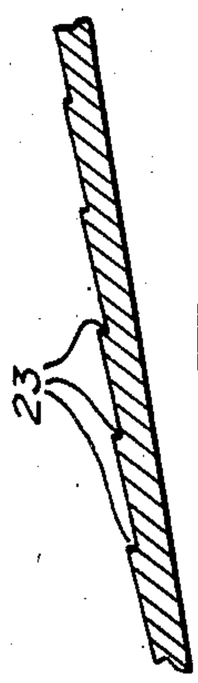


Fig. 2.

Inventor:
G. E. Shawcross,
By his attorneys:
Baldwin & Wight

Patented Sept. 16, 1947 2,427,423

# UNITED STATES PATENT OFFICE

2,427,423

## RECIPROCATING MECHANISM FOR INCLINED MINERAL SEPARATING PNEUMATIC TABLES

George E. Shawcross, Fenton, Stoke-on-Trent, England, assignor of one-half to Saxon Engineering Company, Limited, Staffordshire, England; Lloyds Bank Limited, London, England, executor of said George E. Shawcross, deceased

Application November 5, 1945, Serial No. 626,807
In Great Britain November 16, 1944

1 Claim. (Cl. 209—504)

1

The invention relates mainly to the dry cleaning of coal, particularly of the smaller sizes, but may also be used for the dry separation of other minerals such as tin ore from gangue. While wet processes will produce a satisfactory separation of coal and shale or dirt, the subsequent elimination of the water or other liquid involves heavy additional expense when small coal is in question. Proposals have been made for the dry cleaning of small coal, but no such proposal has been entirely successful in practice in that it provided an output of shale completely free of coal and of coal without appreciable admixture of shale.

The usual form of apparatus for the dry cleaning of coal comprises a perforated table set on a slope and oscillated in an oblique direction making also an oblique angle with the table. The table is perforated for the passage of air to keep the bed of raw coal in a floating state during treatment, so that the shale may sink to the bottom of the layer and be conveyed to the top end of the table, while the cleaned coal slides down over the shale to be discharged at the lower end. The present invention relates to apparatus in accordance with this general description. It is, of course, understood that with other minerals the heavier constituent is usually the wanted product, but this makes no difference to the apparatus in question, which always discharges the heavier constituent at the upper end of the table.

According to the invention the apparatus has three features in combination, firstly the direction of oscillation is not the same at both ends, having a larger vertical component at the lower end, secondly means such as discharge weirs are fitted at both ends of the active surface of the table to maintain the depth of material under treatment at a suitable value, and thirdly the table surface is made rough or uneven in such a manner as to ensure transmission of the conveying effect to the material in contact with it.

Other features are desirable for improving the results still further, and these will first be enumerated. The perforations in the table should preferably be small and closely spaced. They may for instance be $\frac{3}{32}''$ diameter at ½'' spacing, giving a perforation area less than 3% of the table area. The preferred form of the table surface is of serrated longitudinal section with

2

low steep fronts facing towards the upper end and with the reverse slopes quite gentle. It is then convenient to place a row of holes near the bottom of each dip and a second row part way up the slope; the next row of holes would then be in the next dip.

Where a very fine fraction of coal or other material is to be treated, such as from $\frac{3}{32}''$ to $\frac{1}{32}''$, this construction would not be suitable. A fine wire mesh may be used for material of the smaller particle sizes. The natural roughness of the wire mesh due to the crossings of warp and weft is sufficient for ensuring that the heavier fraction in contact with the table has the conveying effect transmitted to it. In fact, its greater conveying power will usually necessitate a greater slope of the table.

Adjustable dampers may run transversely of the table on its under side to modify the distribution of air so as to secure the best results. These may be flaps adjustable through a right angle on fixed bars attached to the table. Usually it is desirable to shut off the air completely or nearly so for a short distance at the top end and to reduce the air discharge a little for perhaps a quarter or a fifth of the table length at the lower end, but other adjustments may be better for certain varieties of coal.

The discharge weir at the upper end is preferably made sloping to provide a gentle ramp over which the shale will glide easily. Such a feature is of less value at the lower end because of the smaller friction of coal.

Other features of the invention may be regarded as having the more immediate purpose of providing convenience in adjusting the table to the best operating conditions for whatever material is to be treated.

Either or both of the discharge weirs may be made adjustable in slope or height or both. It is preferable to set the coal discharge weir higher than the shale discharge weir to equalise the resistance to the passage of air through the bed, since the heavier shale imposes a greater resistance than an equally thick layer of coal. For the smaller sizes the bed may be 1½'' thick at the shale end and 2½'' thick at the coal end, but with larger sizes the depth should be made commensurate with the size of the pieces of material.

Two other adjustments are desirable. One is

that of the slope of the table itself and the other is that of the directions of oscillation.

The invention is illustrated by a table for the dry cleaning of small coal shown in the accompanying drawing, in which

Figure 1 is a side elevation of the whole table, and

Figures 2 and 3 fragmental views in section and plan respectively of a portion of the bed on an enlarged scale.

Referring to the drawing, a table 1 of suitable width for the quantity of material to be treated is supported on two longitudinal girders 2, one at each side. The girders are set at a suitable slope, the left hand end as viewed in Figure 1 being the lower one. At the left hand end one girder has a bearing housing 3 in which is rotatably mounted one end of a shaft 4, the other end being similarly mounted in a bearing housing on the other girder 2.

At the right hand end each girder has another bearing housing 5, in which is rotatably mounted one end of a shaft 6. All the bearings are of the solid rubber type.

Just inside each bearing 3 a link 7 is keyed to the shaft 4 and is keyed at its lower end to a shaft 8, which is mounted at each end by a solid rubber bearing in a housing 9 fixed to the stationary framework 10 of the apparatus. Similarly a link 11 is keyed to the shaft 6 just inside each bearing 5 and is keyed at its lower end to a shaft 12, which is mounted at each end by a solid rubber bearing in a housing 13 fixed to the framework 10.

The links 7 and 11 slope as shown, but the links 11 are more nearly upright than the links 7, so that the vertical component of the table movement is less at the right hand or higher end than at the left. The two links 7 are united by a plate 14 and the two links 11 by a plate 15 to ensure that there shall be no lateral oscillation of the table 1.

To provide for the reciprocation of the table, the links 7 are extended upwards beyond the bearings 3, each carrying a short length of shaft 16 to which an eccentric strap 17 is linked by a solid rubber bearing. The two eccentrics are mounted on a shaft 18 journalled in bearings 19 on the framework 10. A pulley 20 on the shaft 18 is driven from any suitable source of power. The links 7 have extensions 21 to press on springs 22 supported by their lower ends on the framework 10 to economise in driving power.

The bearings 19 can be adjusted in a left and right direction to adjust the slope of the table by a small amount. The slope is varied by this adjustment because the links 7 are shorter than the links 11 between shaft centres.

The surface of the table is of a serrated section with steep fronts 23 facing to the right as shown in Figure 2. Perforations 24 as shown in Figure 3 are provided in the table surface. The perforations are arranged in transverse rows at equal spacings, each alternate row being at the bottom of a serration. The lower side of the table is enclosed by a casing 25 connected by flexible material 26 such as canvas to a fixed casing 27, which is supplied with clean air at low pressure from a fan (not shown).

It has been found advisable to regulate the current of air passing through the bed of material near the ends, and for this purpose baffles 28, 28 project downwards from the table surface to form air chambers. Each of the five air chambers shown has a butterfly valve 29 to regulate the air flow. No such regulation is required at the central portion of the table.



The table has side walls 30 to prevent the material from falling off the sides. A weir 31 is provided at the left hand end of the table to maintain a suitable depth of material. The height of the weir can be adjusted by means of a rack 32 and pinion 33 at each end, a hand lever 34 being provided for rotating the pinion shaft. The weir 31 is locked in its adjusted position by means of a quadrant 49. The clean coal is discharged by a chute 35 into another chute 36.

At the upper end the table is unperforated from the highest baffle 28 to the end, and here there is a sloping weir 37 set to give an easy glide angle for the shale. The weir 37 is adjustable in height by means of a rack 38 and pinion 39 at each end, the pinions 39 being mounted on a common shaft, which can be rotated by a hand lever 40 and locked in adjusted position by means of a quadrant 50. The shale falling over the top of the weir 37 is discharged into a chute 41.

The raw coal is fed into a stationary hopper 42 of which the discharge end is in close proximity to a plate 43 hinged at its left hand end. The plate 43 is supported on a structure 44 attached to the girders 2 so as to participate in the vibration imparted to the latter. As a result the coal feed is only in operation while the apparatus is working, and no separate device is required to stop the feed when shutting down. The plate 43 is hinged to adjust the rate of feed.

From the plate 43 the coal falls in succession on to a series of plates 45, 45 and then on to a corrugated plate 46, by which it is distributed over the whole width of the table. The plates 43, 45 and 46 are enclosed in a casing 47 from which air for dedusting is drawn through a flexible connection 48 by a fan (not shown). If dedusting is not required, the casing 47 is omitted and the corrugated plate 46 is extended up to the plate 43, the plates 45 being omitted, since their sole function is to provide a coal cascade through which dedusting air can be drawn.

The upper side of the table is left open, as practically no dust is produced in the process of cleaning. The operator can see at any time how the apparatus is working and can at once make any adjustments which he may deem advisable. The air pressure does not need to be high, in fact it should only be sufficient in conjunction with the table vibration to maintain fluidity of the bed of coal.

In operation the raw coal is first screened into suitable ranges of particle size, and each fraction is treated on a separate table. A suitable grading may be into six sizes, 1¼'' to ¾'', ¾'' to ⅜'', ⅜'' to $\frac{3}{16}$'', $\frac{3}{16}$'' to $\frac{3}{32}$'', $\frac{3}{32}$'' to $\frac{1}{32}$'' and $\frac{1}{32}$'' to 0, but it is advisable to de-dust the smallest size.

The more thorough separation achieved by means of the invention makes it possible to reduce the active length of the table to about six feet, which further conduces to economy in first cost and in operating power. As already mentioned above, a very low air pressure is sufficient, and this again represents a saving in power over existing apparatus for the same purpose.

What I claim is:

Apparatus for the dry separation of minerals comprising a sloping perforated table, air supply means on the underside of the table, a fixed supporting structure for the table, links pivoted on the supporting structure and on the

table near the lower end thereof and sloping upwards towards the lower end of the table, links pivoted on the supporting structure and on the table near the upper end thereof and sloping upwards towards the lower end of the table but with less deviation from the vertical than the first-mentioned links, the said links constituting the sole support of the table from the supporting structure, said second mentioned links being longer than said first-mentioned links between pivot centres, an eccentric having its strap linked to the table and its sheave driven by a source of power, and means for adjusting the position of the eccentric sheave to vary the slope of the table.

G. E. SHAWCROSS.



## REFERENCES CITED

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

UNITED STATES PATENTS

| Number | Name | Date |
|---|---|---|
| 1,786,739 | Davis | Dec. 30, 1930 |
| 2,063,533 | Vissac | Dec. 8, 1936 |
| 2,348,344 | Holmes | May 9, 1944 |
| 1,579,993 | Andre | Apr. 6, 1926 |
| 2,204,379 | Overstrom | June 11, 1940 |

FOREIGN PATENTS

| Number | Country | Date |
|---|---|---|
| 332,291 | Great Britain | July 24, 1930 |
| 439,972 | Great Britain | Dec. 18, 1935 |