Sept. 9, 1958 C. V. ORE 2,851,160

PNEUMATIC SEPARATOR HAVING RESILIENTLY MOUNTED DECKS

Filed Jan. 13, 1954 2 Sheets-Sheet 1

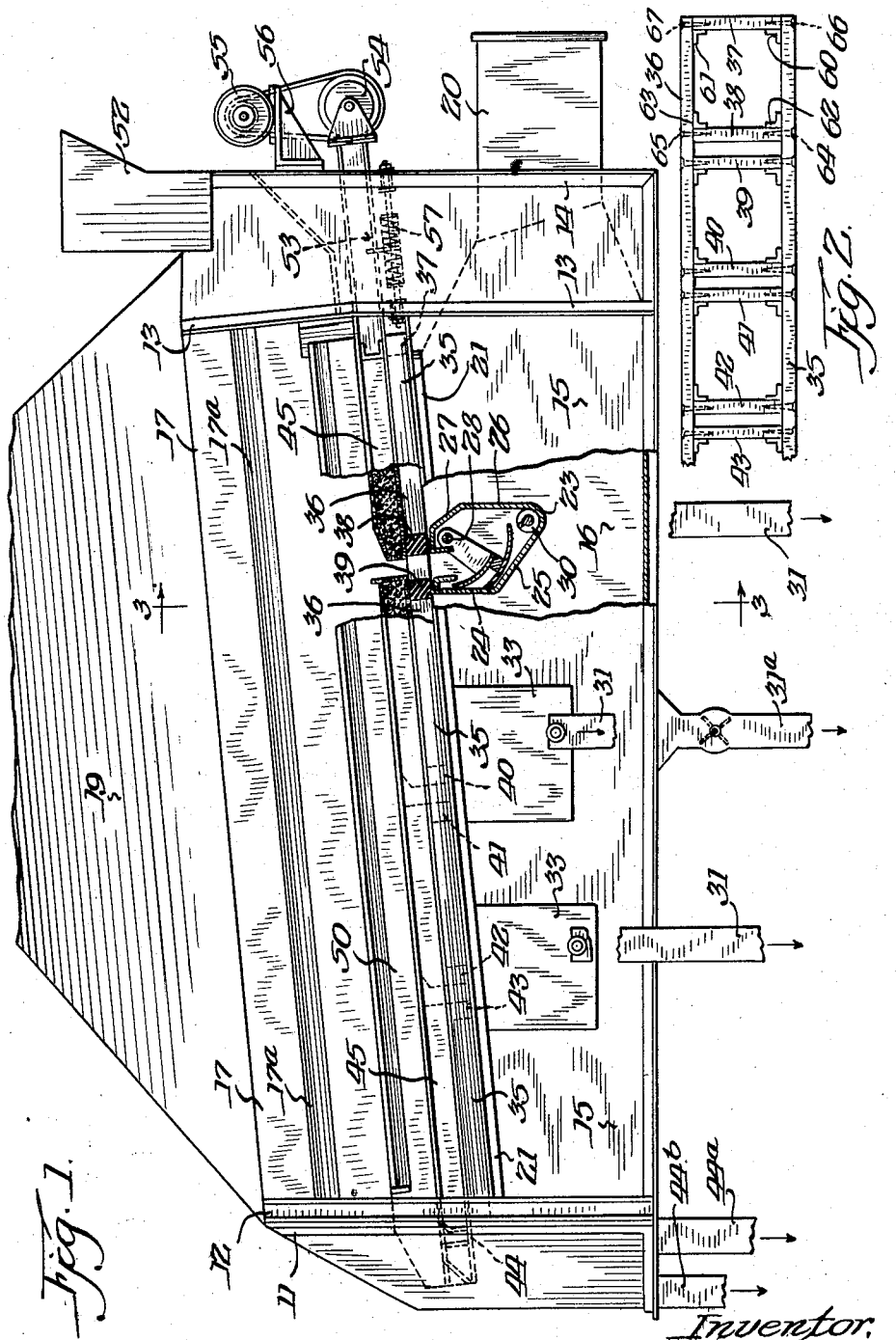


Fig. 1.

Fig. 2.

Inventor.
Carl V. Ore.
By [signature] Atty.

Sept. 9, 1958 C. V. ORE 2,851,160

PNEUMATIC SEPARATOR HAVING RESILIENTLY MOUNTED DECKS

Filed Jan. 13, 1954 2 Sheets-Sheet 2

Fig. 3.

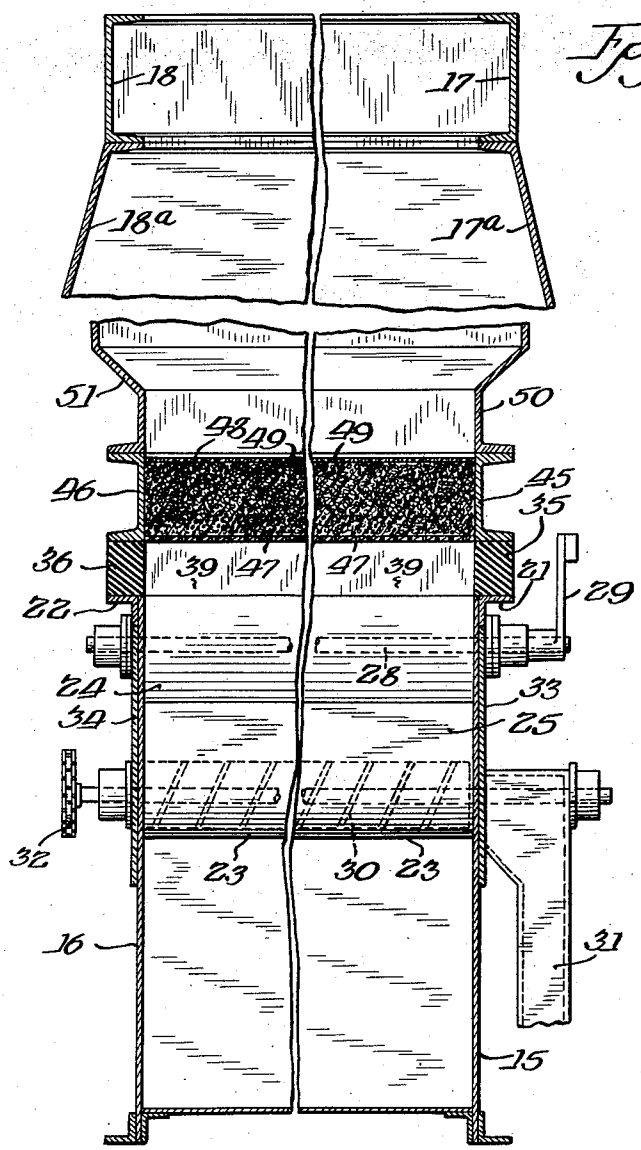


Fig. 4.

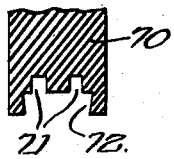


Fig. 5.

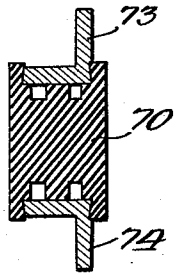


Fig. 6.

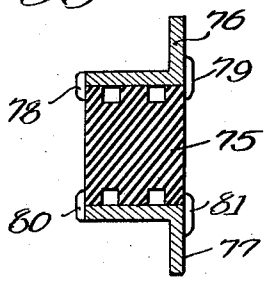
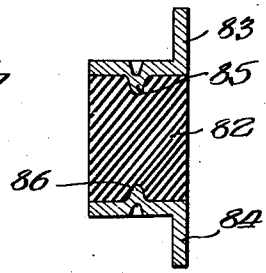


Fig. 7.



Inventor:
Carl V. Ore.

By

Atty.

United States Patent Office

2,851,160

Patented Sept. 9, 1958

2,851,160

PNEUMATIC SEPARATOR HAVING RESILIENTLY MOUNTED DECKS

Carl V. Ore, Harvey, Ill., assignor to Roberts and Schaefer Company, Chicago, Ill., a corporation of Illinois

Application January 13, 1954, Serial No. 403,722

15 Claims. (Cl. 209—466)

This invention is concerned with a pneumatic separator having material receiving decks which are resiliently mounted for vibration on a stationary casing forming an air chamber, e. g., by rubber strips extending longitudinally and also transversally of the decks, underneath thereof, to define transversally extending intermediate discharge openings and discharge chutes connecting with corresponding stationary discharge casings disposed in the air chamber.

The separator may be a coal cleaner of the type disclosed in Patent No. 2,513,960. The decks shown in the structure described in this patent are suspended from hangers secured to a top frame. The vibrator is an unbalanced weight vibrator mounted on a beam extending rearwardly from the rearmost deck. The direction of vibration of the decks is thus determined by the angle of angular displacement of the hangers, i. e., by the arcuate displacement of the lower ends of the hangers to which are secured the decks.

The new resilient mounting, as disclosed herein, permits vibration of the decks in every direction. It is possible, therefore, to mount the vibrator at any desired point, in suitable connection with the decks, so as to obtain vibration thereof in any desired principal angular direction.

In the structure described in the above noted patent, there are provided shields which extend downwardly from the longitudinally spaced ends of adjacent decks to form discharge chutes projecting into associated intermediate discharge casings. Air impulses are injected into the air chamber underneath the decks for injection thereinto through packs containing air-diffusing bodies such as marbles. These air impulses escape upwardly from the decks into the bed of coal thereon, while the decks are vibrated so as to obtain a separation of the particles in accordance with the specific gravities thereof. In order to confine the pulsating air flow to and through the decks, the structure described in the previously mentioned patent provides bellowslike canvas sheets connecting the longitudinal sides of the vibrating decks with the walls of the stationary air chamber and similar canvas sheets extending transversally of the decks in parallel with the respective discharge chutes to provide air seals between such chutes and the discharge casings respectively associated therewith.

These canvas sheets are subject to wear and therefore constitute sources of trouble. Defects in any of the canvas sheets disposed on the outside longitudinally of the decks are usually recognized soon after they occur. Trouble has been experienced particularly with the interiorly transversally extending portions of the canvas sheets which connect the intermediate discharge chutes with the discharge casings. If such a canvas sheet bebecomes defective, air will escape in unwanted direction, e. g., into a discharge casing, and insufficient air will be available for the separation of the material particles on the decks. Such trouble may be difficult to discover immediately after it arises and separation suffers. Replacement of defective canvas sheets entails loss of time for productive operation and labor costs in addition to expenses for new sheets.

The invention provides, in this respect, a considerable improvement. The rubber strips on which the decks rest in resilient connection with the stationary top frame of the housing forming the air chamber eliminate the hangers of the prior structure and provide a durable and very reliable air seal which may last for the lifetime of the separator or at least for the greater part thereof. The transversally extending portions of the rubber strips form the air seal for the intermediate discharges, and at the same time function as means forming the corresponding intermediate discharge chutes. In other words, the shields forming the discharge chutes of the prior structure are eliminated.

The use of the new resilient mounting also provides a differential vibratory motion for the decks. Assuming that the unbalanced weight vibrator is mounted at the rear end of the rearmost deck, as in the prior structure, there will occur a slight bouncing vibratory motion at the forward end where the clean coal is discharged. This bouncing motion is due to the action of the new resilient mounting and is a rotary or angular motion producing accelerating and retarding components, respectively. It is believed that such motion at the forward end of the decks may benefit separation because the more pronounced vibration at such end will compensate for the air supply which diminishes slightly from the rear to the front, thus assisting in keeping the front deck plates from blinding or clogging.

The invention thus provides structural improvements by eliminating previously necessary parts, thereby simplifying fabrication and improving the appearance of the product. The operation is improved by the elimination of trouble sources and is thereby rendered more reliable. The differential vibration provides a further improvement which benefits the separation.

Details of the invention will now be explained with reference to the accompanying drawings. In these drawings

Fig. 1 illustrates a more or less diagrammatic elevational in part sectional side view of an air flow separator or cleaner showing the parts thereof which are essential for the understanding of the invention;

Fig. 2 is a top view of the resilient mounting on a very much reduced scale;

Fig. 3 is a section through the structure of Fig. 1, on an enlarged scale, and taken approximately along line 3—3 thereof; and

Figs. 4–7 show how the rubber strips forming the resilient mounting may be formed and secured in place.

Like parts are indicated by like reference numerals throughout the drawings.

Referring now to Figs. 1–3, numerals **11**, **12**, **13** and **14** indicate suitably positioned structural upright members disposed on either side of the machine substantially at opposite ends thereof. The uprights **12** and **13** on either side are joined by suitable sheet members forming the side walls **15** and **16** which extend throughout the lower portion of the machine. Vertically extending sheets join the uprights **13** and **14** on either side in the rear and similar sheets extend forwardly from the uprights **11** to the left as seen in Fig. 1. The left forward end of the machine may be closed by a suitable plate or the like. Secured to the top of the uprights **12** and **13** on either side and extending therebetween in longitudinal direction are the generally U-shaped girders **17** and **18**, respectively (see also Fig. 3). From these girders extend the downwardly and outwardly flaring shields **17*a*** and **18*a***, respectively. Numeral **19** indicates a dust hood

which extends upwardly and terminates in a suitable exhaust duct for drawing off air carrying dustlike fines for cleaning and recirculation back to the intake **20** (Fig. 1) through which the air is fed to the air chamber formed by the walls **15** and **16** and associated transverse walls at the front and rear of the structure. Valve means, e. g., a rotary valve (not shown) may be provided in the intake **20** so as to feed the air into the chamber in the form of impulses.

On top of the walls forming the air chamber, including the walls **15** and **16**, are provided angle bars as indicated at **21** and **22**. Similar angle bars extend at the opposite ends in transverse direction on top of the respective front and rear walls of the structure.

Within the air chamber, extending transversally between the side walls **15** and **16**, are provided intermediate discharge casings such as the casing shown in Fig. 1 in section and indicated by numeral **23** having the walls **24/25** and **26/27**. Within each discharge casing is provided an oscillatable scraper operable by a shaft **28** which is actuated by an arm **29** (see Fig. 3) through the medium of a suitable mechanism omitted from the drawings because it does not form part of the invention. At the bottom of each intermediate discharge casing is provided a discharge screw **30** for feeding material into an associated discharge duct **31**. Each screw is operated by a chain and sprocket drive indicated in Fig. 3 at **32**. The top of each discharge casing is open for feeding thereinto material separated from the material bed on the decks at a corresponding intermediate area thereof. The drive means for the oscillatable scraper and for the discharge screw in each intermediate discharge casing is mounted on associated plates **33/34** respectively secured to the side walls **15** and **16**. A discharge duct **31***a* is provided for removing fines from the bottom of the air chamber by means of a star wheel.

On the frame comprising the angle bars such as **21** and **22** on top of the side and end walls of the air chamber is disposed the new mounting for resiliently supporting the decks for vibration. This mounting comprises longitudinally extending pure gum rubber strips **35** and **36** (see also Fig. 2) and transversally extending similar strips as indicated at **37/38**, **39/40**, **41/42** and **43**, etc. The rearmost transverse strip rests on the rearmost transverse angle member on top of the rear end wall of the air chamber; the transverse strips **38/39** rest on the transversally extending portions of the intermediate discharge casing **23**; the strips **40/41** and **42/43** rest in similar manner on the transversally extending portions of the associated successive discharge casings; and the transverse strips at the left forward end of the structure rest likewise on transverse stationary members associated with the correspondingly located discharge **44** for the removal of the final intermediate product through the chute **44***a*. The clean coal is discharged by way of the chute **44***b*. The respective pairs of strips **38/39**, **40/41**, **42/43** and the corresponding pair of strips underneath the coal discharge have a dual function. They form in conjunction with the longitudinally extending strips **35/36** the resilient mounting for the decks and in addition thereto the discharge chutes. Various grades of separated refuse, middlings, and the like are discharged through the forwardly successive chutes formed by the strips **38/39**, **40/41**, **42/43**. Certain features concerning the strips and the resilient mounting formed thereby will be presently discussed after completing the description of other parts of the machine.

The deck structure resting on the resilient mounting comprises longitudinally extending cross-sectionally U-shaped members **45** and **46**. Between these members are disposed the deck sections or individual decks, each being formed by perforated bottom and top plates such as **47** and **48** (see also Fig. 3), forming an enclosure containing air diffusion means such as a pack of marbles **49**. Each individual deck or deck section is separated from the successive deck or section by a space forming a transversally extending discharge opening or slot. The U-shaped members **45** and **46** rest respectively upon the longitudinally extending arms **35** and **36** of the resilient mounting; the opposite ends of the rearmost individual deck or deck section also rest on the transversally extending arms **37** and **38** of the mounting; and the opposite ends of the remaining deck or deck sections also rest on the correspondingly positioned transversally extending arms **39/40**, **41/42**, etc., of the resilient mounting.

A shield **50** extends upwardly from the U-shaped deck member **45** and a similar shield **51** extends from the deck member **46**, forming with the perforated top deck plates **48** a longitudinally extending troughlike structure which is in the described manner resiliently supported on the mounting comprising the pure gum rubber strips. Numeral **52** in Fig. 1 indicates a hopper for feeding raw coal to the troughlike deck structure for separation thereon.

The means for vibrating the deck comprises a beam **53** extending rearwardly from the rearmost deck section and carrying an unbalanced weight vibrator **54** which is driven by a motor **55** disposed on a shelf **56**. Numeral **57** indicates a device comprising springs for adjusting the normal position of the deck structure.

The weight of the deck structure with the material load thereon may be relatively great depending on the size of the machine which determines the ton/hour capacity thereof. Extensive research and experimentation as well as testing under actual operating conditions in the field were required to determine the type of rubber that should be used for the mounting and also the structural shape of the strips as well as the manner of joining them to form the mounting. It was found as a result of this work that pure gum rubber is most suitable to absorb the 3/16 inch vibratory motion to which the deck is subjected. The rubber strips used should be from 1 to 2 inches wide and about 3½ inches high. Rubber strips 1 inch wide and 3½ inches high were found to give satisfactory results under all operating conditions. Laminated rubber is not recommended because it may come apart under the severe work to which it has to be subjected. Sponge rubber was tried and found satisfactory only to a limited degree because strips made therefrom would necessitate among other features a greater cross-sectional area to serve as desired and necessary.

Other problems that had to be solved related to the manner of forming the mounting and of securing it in place.

While it is possible to form the mounting integrally by suitable molding, it may also be made by cutting strips of desired and required length and securing them together as indicated in Fig. 2. Each of the transverse strips such as **37** to **43** is put in place relative to the longitudinal strips **35** and **36** and secured thereto first, by a suitable adhesive, second, by corner pieces of rubber which are secured to the respective longitudinal and transverse strips by adhesive, and third, by securing each end of each transverse strip by a wood screw extending through the associated longitudinal strip. The rubber corner pieces are indicated in connection with the transverse strips **37** and **38** and are marked by numerals **60/61** and **62/63**, respectively. The wood screws **64/65** and **66/67** are likewise indicated in connection with the transverse strips **37** and **38**. The adhesive designated as EC–870 was furnished by the Minnesota Mining and Manufacturing Company. The rubber corner pieces are shown only on one side of each of the transverse strips; it is understood, of course, that they may be provided on both sides.

The completed resilient mounting composed of the strips is put in place on the stationary frame formed by the angle pieces on top of the air chamber and by the transversally extending top portions of the discharge casings and, if desired, may be secured thereto by adhesive, and the vibratory deck structure is then placed thereon

and its normal position is adjusted by the spring device 57.

The rubber strips forming the resilient mounting may receive different forms.

As indicated in Fig. 4, the rubber strip 70 may be molded to provide channels or grooves 71 at the bottom of recess 72. Such a strip may be mounted between members 73 and 74 of the stationary frame and the deck, respectively, as indicated in Fig. 5. The strip is thus held in place, secured against slipping and the longitudinal grooves provide for peripheral resilience.

The strip may also be of generally rectangular shape as indicated in connection with the strip 75 in Fig. 6, and may be held against slippage with respect to the associated structural members 76 and 77 of the deck and the stationary frame, respectively, by fingers 78/79 and 80/81 welded to and extending from the members 76 and 77, so that they overlap the sides of the rubber strip, holding it in place. Longitudinal grooves may be molded in the strip if desired to provide for the increased peripheral resilience.

Another way of securing the rubber strip between the associated structural members is indicated in Fig. 7. The strip 82 is again of cross-sectional rectangular shape. Each structural member 83 and 84 is provided with punched nipples or fingers 85 and 86, as shown. These nipples or fingers which are provided at longitudinally spaced points of the corresponding structural members project into the strip material in the manner of spikes and thus hold the strip securely assembled with the structural members. If desired, actual spikes or screws or the like may be used.

The invention has been described in connection with a specific coal separator, but it is understood, of course, that it may also be used in differently constructed separators as well as in separators for other materials. The separator may have a single trough comprising serially related decks or deck sections as shown, or there may be two or more troughs and deck structures placed side by side.

As has been mentioned before, the vibrator may be mounted differently, e. g., on suitable supports at any part of the deck intermediate its opposite ends, either above the deck or in a suitable casing within the air chamber. When the vibrator is mounted as shown in Fig. 1, the deck will be vibrated primarily longitudinally thereof and the resilient mounting will convert such vibrations at the forward end where angular components will become effective to support the agitation and thereby the separation of the material moving along the deck plates at the forward end. When the vibrator is mounted above or below the deck at a desired point, e. g., about midway thereof, the vibrations will have primarily angular components. Just where the vibrator is to be placed will be determined by the vibratory effect that may be desired in connection with the material that is to be treated.

What is believed to be new and desired to have protected by Letters Patent is defined in the following claims.

I claim:

1. In a pneumatic material separator of the class described having an elongated generally rectangular inclined vibratory deck disposed for vibration above a stationary air chamber to which air is supplied for upflow through said deck while said deck is being vibrated to cause heterogeneously intermixed particles delivered thereto at the elevated end thereof to move therealong for separation thereon in accordance with the specific gravities of said particles and having at least one transversally extending opening in said deck for discharging separated particles therefrom, a device for resiliently mounting said deck, said device comprising a pair of first elongated rubber strips one underlying each side of the deck longitudinally substantially throughout the length thereof and resting on the corresponding side of said stationary air chamber, and a pair of second rubber strips extending transversally between said first strips forming a discharge chute extending from said opening in said deck.

2. The structure defined in claim 1, wherein said rubber strips are made from pure gum rubber.

3. The structure defined in claim 1, wherein said rubber strips are made from pure gum rubber, each strip being of cross-sectionally generally rectangular shape and its height being at least one third in excess of its width.

4. The structure defined in claim 3, comprising means for securing the ends of said second strips to said first strips.

5. The structure defined in claim 4, wherein said means comprises chemically acting and mechanically acting means, respectively.

6. The structure defined in claim 4, wherein said means comprises three elements, namely, first, a mechanically acting element which secures the end of each second strip to the associated first strip, second, an angular member which secures one side of the second strip to one side of the first strip, and third, an adhesive which secures said second strip to said first strip and the side of said second strip to the side of said first strip, respectively.

7. The structure defined in claim 4, comprising holding means for securing said strips in engagement with the associated parts of said vibratory deck and said stationary air chamber, respectively.

8. The structure defined in claim 7, wherein fingers extending from said parts constitute said holding means.

9. The structure defined in claim 8, wherein said fingers overlap said strips on the outside thereof.

10. The structure defined in claim 8, wherein said fingers project into the material of said strips.

11. The structure defined in claim 7, wherein said holding means comprises marginal extensions projecting from said strips for partially embracing the associated parts of said deck and said air chamber, respectively.

12. The structure defined in claim 4, wherein a longitudinal groove is formed in at least some of said strips at least on one side thereof which is in supporting engagement with a structural part of said separator to provide greater resilience thereof throughout the area of such supporting engagement.

13. The structure defined in claim 7, wherein a longitudinal groove is formed in at least some of said strips at least on one side thereof which is in supporting engagement with a structural part of said separator to provide greater resilience thereof throughout the area of such supporting engagement.

14. The structure defined in claim 1, comprising a vibrator disposed at the elevated end of said deck, which is the feed end thereof, for imparting vibrations thereto which are effective primarily in longitudinal direction of the deck, said mounting comprising said rubber strips being effective to cause the forward portion of said deck to execute a vibratory motion having angular components to intensify agitation of the material moving along said forward portion.

15. The structure defined in claim 1, comprising a vibrator disposed intermediate the opposite ends of said deck for imparting vibrations thereto which are primarily composed of angular components.

References Cited in the file of this patent

UNITED STATES PATENTS

2,155,235	Morgan	Apr. 18, 1939
2,204,379	Overstrom	June 11, 1940
2,513,960	Ore	July 4, 1950