

Feb. 19, 1957

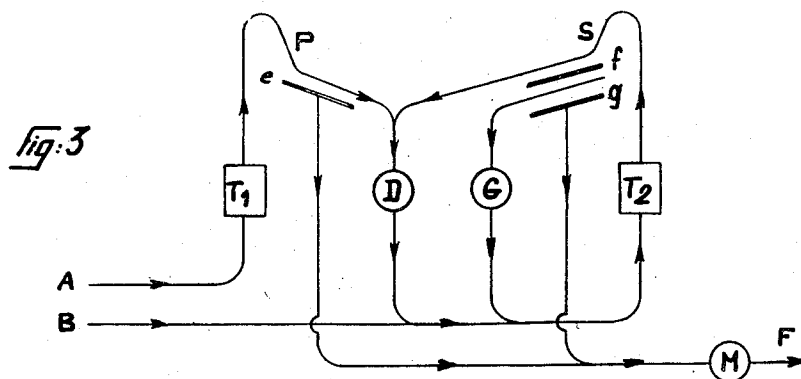
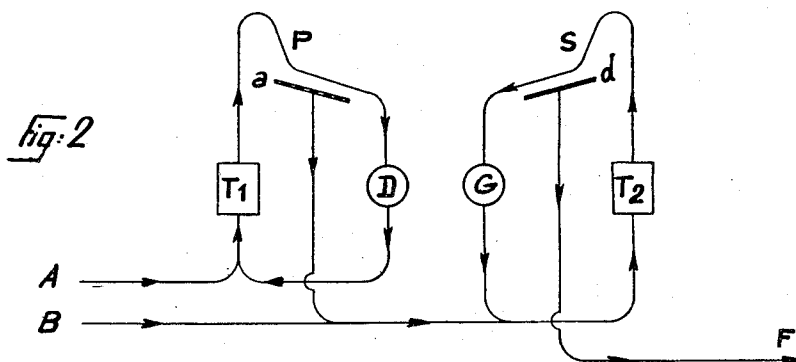
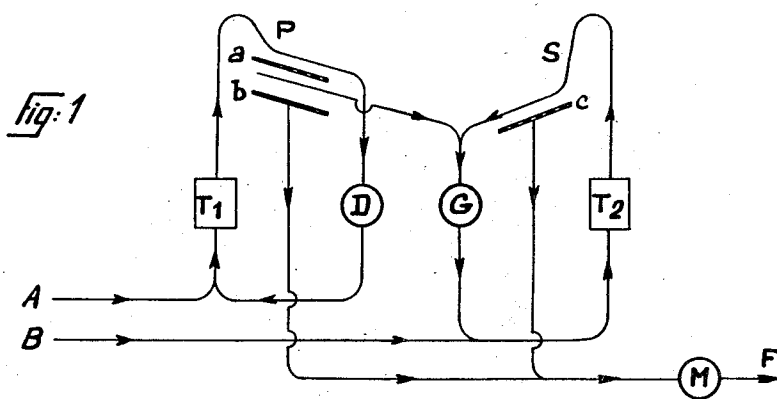
E. M. BURSTLEIN

2,782,147

PROCESS FOR PREPARING COKING BLENDS

Filed Jan. 11, 1954

4 Sheets-Sheet 1



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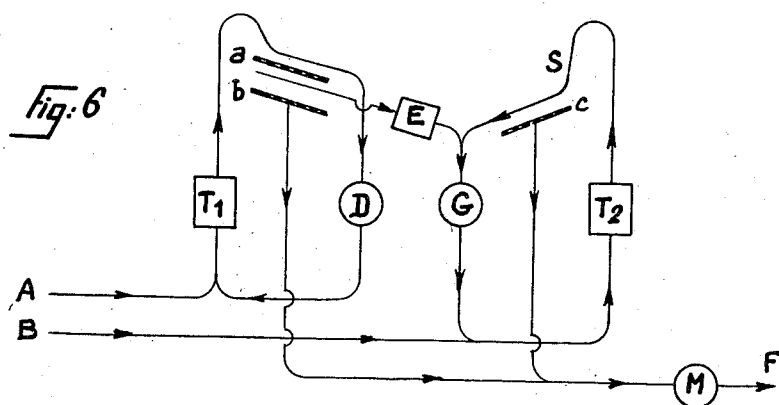
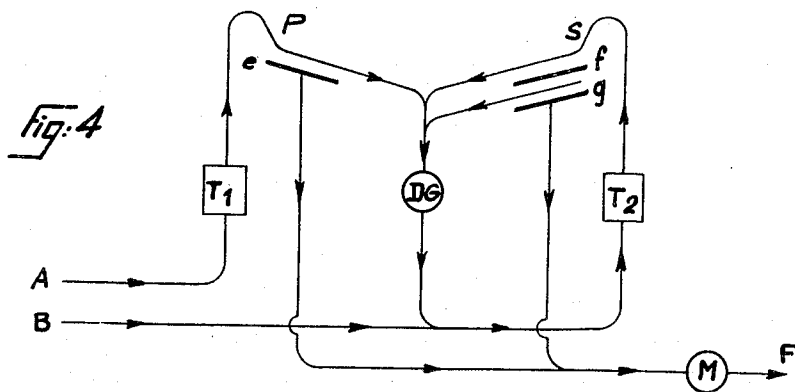
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PROCESS FOR PREPARING COKING BLENDS

Filed Jan. 11, 1954

4 Sheets-Sheet 2



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PROCESS FOR PREPARING COKING BLENDS

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Fig. 7

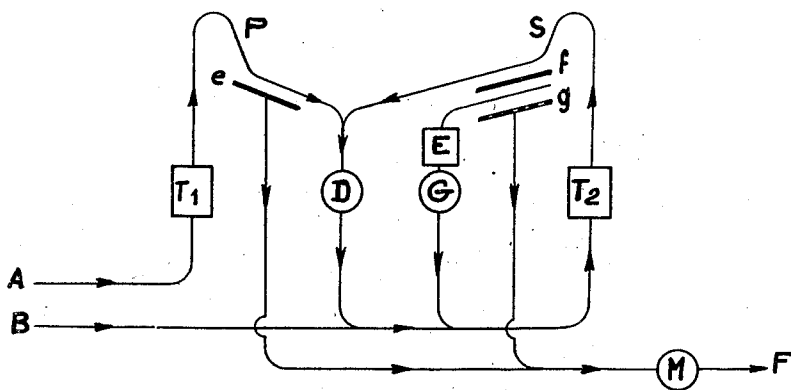
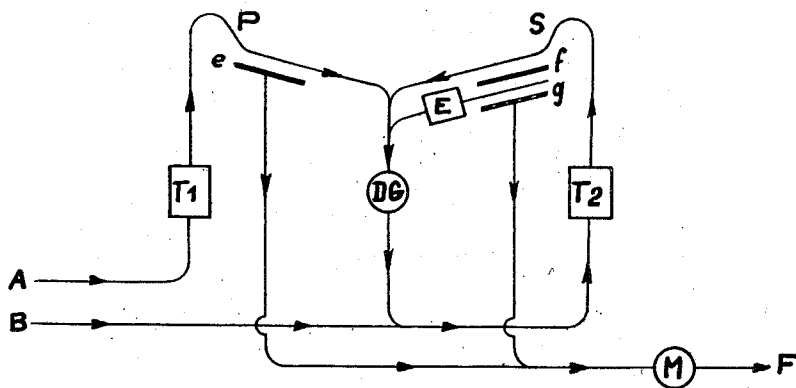


Fig. 8



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Fig. 5

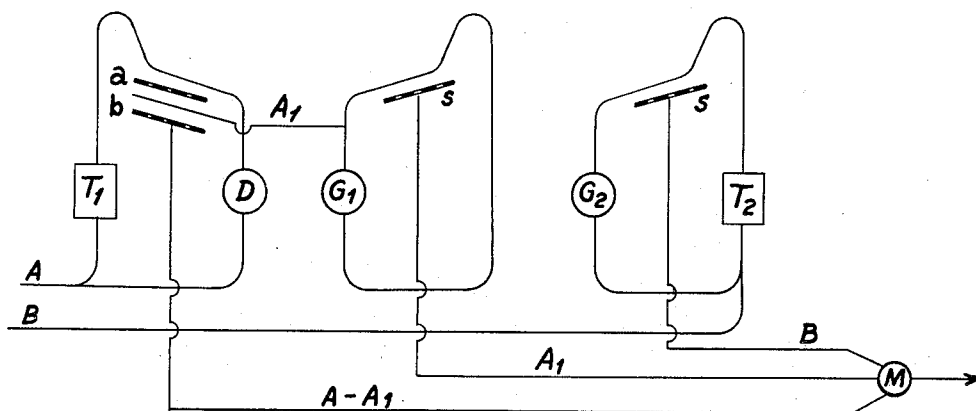
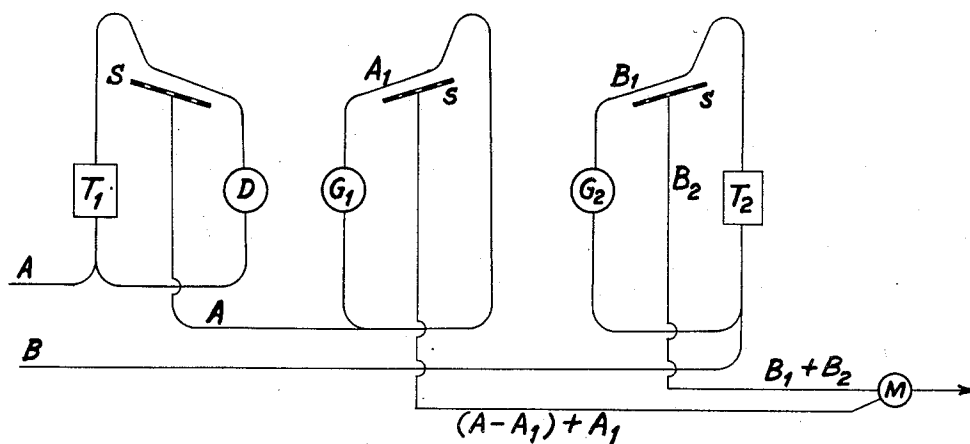


Fig. 9



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PROCESS FOR PREPARING COKING BLENDS

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Application January 11, 1954, Serial No. 403,293

Claims priority, application France January 19, 1953

14 Claims. (Cl. 202—25)

The present invention relates to a method of making coke of improved quality by carbonization at high, moderate or low temperatures of a suitably prepared coking blend.

In the U. S. patent application Serial No. 119,618, of October 5, 1949, now abandoned, it has been described how it is possible to considerably improve with the use of relatively simple means, the quality of metallurgical coke, as the result of a methodical and scientific preparation of the coals making up the coking blend taken singly or in admixture, with or without the addition of extraneous components, which preparation makes it possible to obtain:

A coking blend having the maximum bulk density consistent with the swelling pressure of the coals, that is, one in which the granulometric analysis approximates as closely as possible to the ideal filling curve;

A coking blend that is homogeneous, wherein the various petrographical constituents of the coals, through they may differ greatly in hardness, are distributed as uniformly as possible among the various granulometric fractions of the blend, the only tolerance permitted being a slight predominance of the inert, organic or inorganic constituents in the lower granulometric fractions;

A coking blend that is uniform in time, that is, one having a constant granulometric distribution and a constant petrographic composition, despite inevitable variations in the hardness, granulometric and petrographic composition of the coals making up the blend;

A coking blend wherein the total developed surface area is as low as is consistent with the fineness imposed by the petrographic structure and nature of the coals to be converted into coke, that is a blend free of any excess of fine dust;

If desired, a coking blend that is demineralized and de-sulfurized as a result of the removal of the particles having the higher specific gravity contained therein after a gradual disintegration of the coal grains in the conglomerate condition.

The blend is then subjected to high temperature carbonization with or without a preliminary stamping in the oven.

The process described in the afore-mentioned prior patent application has been industrially applied in several countries and has proved its worth both from the technical and the economical standpoints. Practical working of the method has shown that the latter provides an important contribution to the investigations made in view of obtaining a satisfactory solution of the serious problem set by the gradual exhaustion of the world resources in coals of well coking grades, due to the permanent increasing demand on coke made by the iron and steel industries.

The reason for this is that, owing to the considerable improvement in quality of the coke produced by said method, it has become possible to largely widen the range of coals capable of being used for coking purposes, so that this range may include both the less-evolved coals

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such as flaming coals having a high volatile content (40% and more) that are hardly if at all fusible, and highly evolved coals such as lean coals with a very low volatile content (as little as and less than 14%), which are wholly inert, and even anthracite coals.

This extension of the range of the coals that can be used in appreciable quantities in the preparation of a coking blend, has induced the applicants to make certain improvements and modifications in the basic process as described in the U. S. application Serial No. 119,618, and these improvements and modifications form the subject of the present invention.

According to the earlier patent application, in the event that several different coals enter into the composition of the coking blend, each of said coals is treated individually in accordance with the described process, or the coals, preliminarily mixed together, are bodily treated according to said process.

The first mentioned procedure leads to a greater improvement in the coke characteristics, because the treatment may be individually adapted perfectly well to the structure and petrographic composition of each of the coals, as well as to the hardness and granulometric analysis thereof, which in many cases may differ widely, but it has the drawback of requiring the use of as many different treating circuits as there are different grades of coal.

The second stated procedure shows the reverse advantages and drawbacks, i. e. is advantageous in that it requires only one circuit, but is objectionable in that it leads to less satisfactory technical results in cases where the various coals used have widely different characteristics.

The applicant, having further pursued his researches and experiments, has found it possible, using a single treating circuit, to considerably improve the quality of the coke, even in cases where the coals and extraneous additions, if any are present, possess widely different characteristics, whereby the initial capital outlay for constructing the plant as well as the costs of working and maintenance, may be considerably reduced.

The applicant has further discovered the possibility, as a result of the improved process to be hereinafter described, to incorporate in the coking blend, without impairing the quality of the resulting coke, greater proportions of totally inert and infusible grades of coal, i. e. coals wherein the petrographic constituents remain in the solid state when raised to a temperature within the range of from 300 to 500° C., this operation being performed under air-free conditions.

Lastly, he has found that the quality of the coke, in respect to the regularity of the cell structure, reduction of the number of cracks and increased mechanical strength, is improved, not only if the carbonization is carried out at high temperatures (900 to 1350° C.), but also at moderate temperatures (600 to 900° C.) and low temperatures (under 600° C.).

According to the invention, in producing a coke of improved quality from several coals taken in the state of fines occasionally containing moisture, or crushed coals, the said coals, together with any foreign additions, if present, e. g. coke dust, semi-coke, pitch, or the like, are separated into at least two distinct mixes:

Mix A comprising the fusible coal or coals, as defined hereinafter; and

Mix B comprising the infusible or inert coal or coals and the additional substance or substances, if present.

From mix A are removed the major portion of those petrographic constituents that are both hard and inert, whether they be organic or inorganic in character, so as to obtain two fractions, one fraction A₁ comprising the constituents thus removed, and the other A₂ comprising

the residual coal mix A with the fraction A₁ removed therefrom.

Fraction A₁ is incorporated in mix B, and the resulting mixture B+A₁ is subjected to a gradual and controlled grinding operation to bring all the particles therein to a sufficient degree of fineness without unduly increasing the total surface area of the particles (i. e. without forming an excessive amount of fine dust).

The ground mixture B+A₁ is mixed in predetermined proportions with the non-ground fraction A₂, and the coking blend thus prepared is carbonized at high, moderate or low temperature.

Thus, the treatment to which the coals in the A-mix are subjected is, in essence, similar to the process described in the prior patent application, where as the treatment undergone by the coals in the B-mix is limited only to a grinding operation; the latter, however, being performed in a special manner; the steps common to the two treatments, namely the grinding of the hard inert constituents of mix A and the grinding of mix B, being preferably carried out simultaneously and in the same apparatus.

In order to classify the coals in one of the mixes A and B, use may be made of their fluidity characteristics in the temperature range of from 300 to 500° C., determined by the known methods, for instance by means of Gieseler's plastometer, which makes it possible to plot the fluidity curve of a coal between temperature limits used for the test. The test being carried out under air-free conditions and at a heating rate of 2° C. per minute, the coals to be classified as inert and that will form the mix B, are those coals having a fluidity index determined by the Gieseler plastometer, comprised approximately between 0° and 20° of angle per minute, and having a melting range extending over not more than about 30° C. All the other coals, having a fluidity index as determined with the Gieseler plastometer higher than 20° of angle per minute appr. and a melting range between 300 and 500° C. extending over more than 30° C., are to be considered as fusible coals to be incorporated in mix A.

If the coking blend is to include foreign additions, such additions should be added to mix B comprising the infusible coals, and should be treated like the latter, whether they really are inert, as coke dust or semi-coke, or whether they are actually fusible, as pitch.

The treatments to which the coal mixes A and B are subjected may be carried out in a single circuit, by the use of the following steps, viz:

1. Mix A is subjected to a granulometric separation over a screening mesh selected, with regard to the petrographic analysis, within an approximate range of from 2 to 6 mm., so as to recover in the oversize fraction, substantially coal particles formed of conglomerate, and any hard inert constituents that may be present in the free state in the mix, while the screening will include those petrographic constituents of the coal that are in the free state, and particularly fusible vitrain.

2. The oversize obtained in (1) is subjected to a structure disintegration under highly gradual and controlled conditions, wherein the agglomerate particles are caused to split very gradually in a variable-speed apparatus, the output product from this apparatus is subjected to a granulometric separating step over a screening mesh selected within an approximate range of from 2 to 6 mm., and the oversize fractions are recycled through the said apparatus, so as to free the whole of the petrographic constituents that are trapped in the conglomerate, and the free petrographic constituents thus progressively liberated are continuously recovered in the screenings and the grains thereof are prevented from undergoing useless and undesirable destruction.

3. The screenings obtained in (2), alone or mixed with the screenings obtained in (1), are subjected to granulometric separation over a screening mesh selected, with regard to the petrographic analysis, in an approximate range of from 1 to 4 mm. so as to recover as far as possible, in the oversize, the harder and relatively inert petrographic constituents, such for example as durain and inorganic constituents, and in the screenings the remaining constituents and essentially the fusible vitrain.

4. The oversize fraction obtained in (3) is subjected to a highly gradual and controlled grinding step, its particle size being gradually reduced in a variable-speed apparatus, the output from which is subjected together with mix B to a granulometric separating step over a screening mesh selected within an approximate range of from 0.5 to 2 mm. depending on the bulk density desired for the coking blend, and the oversize from this granulometric separation is recycled into the grain-size reducing apparatus so as to recover continuously, as screenings through said mesh, the hard and inert constituents of mix A, as well as the inert coals and/or any additions in mix B having a very fine granulometric structure but free of excessive fine dust, since excessive crushing has been avoided.

5. A coking blend is formed having the desired petrographic composition and granulometric distribution, by mixing in predetermined proportions the screenings from (4), (3) and if desired (1), so as to obtain a coking blend having a volatile content of from 16% to 35%.

6. The coking blend obtained in (5) is subjected, with or without a stamping operation, to carbonization at high, moderate or low temperature.

The variable-speed apparatus used in the structural disintegration and controlled crushing steps, preferably are conventional apparatus such as impact disintegrators, Carr disintegrators or crushers, gridless hammer crushers, etc., wherein the crushing power is adjustable by action on the speed of rotation.

Owing to the progressive action of such apparatuses, the removal of the petrographic constituents liberated or of the grains having the desired degree of fineness; and to the fact that the oversize from the granulometric separation performed on the output product is recycled through the said apparatus, it becomes possible in a large measure to prevent the grain destruction in the petrographic constituents liberated, as well as excess formation of fine dust, and at the same time to obtain products having the desired granulometric distribution.

Where it is desired to improve the quality of the coke not only from the standpoint of uniform cell structure, less number of cracks and greater mechanical strength, but likewise from the standpoint of chemical composition; where, in other words, it is desired to obtain a coke that is de-mineralized and de-sulfurized to the greatest possible degree, the oversize fraction obtained in (3) may, prior to the controlled grinding operation together with the fraction of similar granulometric size from mix B, if present, be subjected to a cleaning treatment by removing all the particles having a density higher than about 1.6, so as to eliminate the heavy inorganic constituents liberated in step (2).

While this cleaning treatment may be made by scrubbing or by air-cleaning, it is preferable to apply an air-cleaning treatment using pneumatic separating tables which are particularly well suited in this case because the particles of the granulometric fraction under consideration are of substantially similar size.

If the coals to be carbonized are wet, which generally is the case, it is advantageous to carry out the various granulometric separating operations mentioned above on screens of the non-clogging type.

Moreover, experience has shown that it is extremely desirable to add small amounts of oil to mixes A and B before or during their treatment. This, by modifying the superficial tensions within the mixes undergoing treatment, considerably facilitates the screening operations because it increases the rate of flow through the screens

and reduces the amount of the ungraded particles in the various granulometric fractions, so that even with comparatively wet coals (from 6 to 8% water content), and taking into account the drying influence exerted by the recycling of oversize whose particle size has been reduced, it becomes possible, in some cases of granulometric separating processes, to eliminate completely the necessity of using screens of the non-clogging type. Subsidiarily, such addition of oil improves the quality of the coke produced and increases the yield of the coking plant owing to the increased bulk density of the coking blend.

Preferably, for the above purpose, mineral oils should be used, such as petroleum or tarry oils. The oils may be sprayed over the coals at ordinary temperature in the case of lighter oils, or the temperature may be raised to about 60° C. where heavier oils are involved. The amount of oil used may be varied in a range of from 0.1% to 2% by weight of the combined mixes A and B being treated, depending on the fluidity of the oils used and the moisture content of the coal undergoing treatment.

The fraction A₂ comprising mix A from which the petrographic constituents that are both hard and inert in character have been removed, may be obtained separately and directly delivered into a mixer which further receives mixture B+A₁. Alternatively, it may be gradually extracted together with the fraction A₁ of mix A as the disintegration of mix A proceeds, and delivered together with mix B into another group of apparatuses from which it is subsequently extracted together with that portion of the combination B+A₁ which possesses the requisite degree of fineness, to be conveyed directly to the carbonizing furnaces; with the latter procedure, the provision of a mixer becomes superfluous.

The gradual and controlled grinding of fraction A₁ may be performed by means of a variable-speed grinding apparatus and a cut-off screen that are separate and distinct from the variable-speed grinding apparatus and cut-off screen used in treating the coals of mix B. Preferably however, in order to simplify the plant and diminishing the capital outlay as well as operating and maintenance costs, both operations may be carried out simultaneously in the same apparatus units. In a similar fashion, by suitably combining and grouping the steps of treatment and apparatus units, it is possible to utilize a common variable-speed grinding apparatus to carry out simultaneously both the disintegration of the conglomerate in the mix A of coals and the grinding of the mixture A₁+B.

The following description, made with reference to the accompanying drawings, will disclose, by way of non restrictive examples, a few types of plants suitable for preparing the improved coking blend and will provide a clear understanding of the manner in which the invention may be carried into practice. All features that may result from the description and the drawings should be construed as forming a part of the present invention.

Figs. 1, 2 and 3 are flowsheet diagrams of plants wherein the progressive and controlled disintegration and grinding processes are performed in separate apparatuses.

Fig. 4 is a similar diagram of plant wherein the grinding and disintegration are performed in a common set of apparatuses.

Fig. 5 is a diagram similar to Figs. 1 and 2 except that different circuits are provided for treating the separate coal mix.

Fig. 6 is a similar diagram of plant similar to Fig. 1, wherein granulometric fraction A₁ containing the hard constituents of coal group A is purified prior to grinding.

Figs. 7 and 8 respectively show flowsheets of plants similar to Figs. 3 and 4, wherein the A₁ fraction and the fraction of equivalent grain size from coal group B are purified prior to grinding.

Fig. 9 is a diagram showing a variation of the system of Fig. 5.

Referring now to Fig. 1, the mix A first flows through the mixer T₁ which may be of the revolving drum or

trommel type, provided with vanes over its internal surface, and may be terminated on the outlet end by a squirrel cage having bars spaced from about 15 to about 30 mm. apart, so as to protect the plant against the ingress of large lumps of coal or any foreign bodies such as blocks of wood, stones, pieces of metal and the like that may have accidentally been introduced into mix A, all such oversize bodies being arrested and separated by the squirrel cage. The output product from T₁ is passed over a screen *a* of the primary screening unit P, selected with a mesh size in an approximate range of from 2 mm. to 6 mm. depending on the petrographic analysis, e. g. a mesh size of 4 mm., so as to recover as oversize essentially the grains of conglomerate, and in the screenings the free petrographic constituents. The oversize from screen *a* is discharged for disintegration in the variable-speed apparatus D.

The speed of apparatus D is so regulated as to be high enough for obtaining a progressive disintegration of the agglomerate by splitting the grains of coal, while not so high as to produce any notable destruction of the grains of the free constituents. The partially disintegrated product from unit D is fed into mixer T₁ where it is intimately mixed with mix A, whereby the latter mix is dried to a considerable extent in the event of its being wet, and the net screening process is facilitated. The partially disintegrated product flowing from T₁ is passed again over screen *a* and the oversize is recycled into D until complete removal of the coal particles in the conglomerate condition, as a result of the progressive and controlled disintegration process thus described.

The screenings or materials passing through screen *a* essentially comprise free petrographic constituents. Said screenings are subjected to granulometric separation on screen *b* of the primary screening unit P, the mesh size of which is selected with due regard to the petrographic analysis within an approximate range of from 1 mm. to 4 mm., e. g., 2 mm., in order to recover as oversize those constituents that are both hard and inert (A₁ fraction), e. g. the durain and the sedimental inorganic materials, and in the screenings (fraction A₂), the remaining constituents, and substantially the well fusible vitrain with, perhaps, some small amount of inert fusain, of such fineness—owing to its great friability—that its incorporation in the coking blend is not objectionable.

The oversize from screen *b* (fraction A₁) is delivered for progressive and controlled grinding in the variable-speed apparatus G. The speed of grinder G is so adjusted as to reduce the size of the grains at a very gradual rate in order to minimize the formation of fine dust.

The screening from unit G is combined with mix B in the mixer T₂ similar to T₁ described above. In the event mix B is wet, it will be dried to a considerable extent by the incorporation therein of the output from crusher G, thereby facilitating the subsequent screening step.

The output from mixer T₂ is discharged on screen *c* of the secondary screening unit S, having a mesh size in the approximate range of from 0.5 mm. to 2 mm., e. g. 1.2 mm., so as to recover in the screenings grains having the desired fineness and thus avoid their being subjected to excessive grinding. The oversize fraction from *c* is recycled through apparatus G until complete disappearance of the oversize; in this way the gradual and controlled grinding process is carried out, conferring to 100% of the inert petrographic constituents of mix A and the inert constituents of mix B, a predetermined fineness without at the same time excessively increasing the total surface area of the grains and thereby forming an excessive amount of fine dust, as would be the result of excessive grinding.

The screenings from screen *b* (fraction A₂) together with the screenings from screen *c* are delivered into a mixer M for homogenizing the mix. This mixer may comprise a conventional type of mixer, e. g. a Carr mixer rotated at low speed, or a mixer screw, or the like.

The final coking blend discharged from M is delivered as indicated at F to the coking units operating at high, moderate or low temperatures.

According to the flowsheet of Fig. 2, the gradual and controlled disintegration of the conglomerate coal particles in mix A is conducted as in the process described in connection with Fig. 1, by a combination comprising mixer T₁, screen *a* of primary screening unit P, and variable speed apparatus D. The granulometric separating treatment applied to the screenings of screen *a*, which substantially comprise the free petrographic constituents of mix A, in order to remove therefrom the hard and inert constituents (fraction A₁) from the remaining constituents is here performed over screen *d* of the secondary screening unit S. The gradual controlled grinding of the hard inert constituents separated from mix A as well as the gradual controlled grinding of mix B are performed, as in the Fig. 1 process, by a combination of apparatuses comprising mixer T₂, screen *d* of the secondary screening unit S and grinder G. The screen *d* inasmuch as it has to effect simultaneously both the A₁ fraction extracting operation after disintegration of the conglomerate in mix A, and the progressive grinding control function, should preferably have a mesh size within a range of from about 1 mm. to 2 mm., e. g. 1.5 mm.

The screenings from screen *d*, which constitute an intimate mixture, may be directly delivered as indicated at F to the coking step without having to be passed through a mixer.

A plant designed in accordance with the diagram of Fig. 2, has the advantage over a plant according to Fig. 1 to be simpler, since the mixer M is omitted and the primary screening apparatus P is single-stage. However, it has a disadvantage in that it is applicable only in cases where the mesh size for extracting the hard constituents from mix A is substantially the same as the mesh size required for controlling the gradual grinding process.

Should mix A contain a comparatively small amount of hard and inert petrographic constituents in the free state, the process may be conducted in the manner indicated by the flow-sheet of Fig. 3. The mesh size of screen *e* of the primary screening apparatus P is selected in a range of from 2 mm. to 6 mm., e. g. 3 mm., in order to recover as screenings, substantially only vitrain with perhaps a small amount of fusain, and as the oversize, substantially only conglomerate particles with a small proportion of hard constituents in the liberated condition. The conglomerate grains in the oversize are subjected to a progressive controlled disintegration in the circuit including apparatus D, mixer T₂ and screen *f* of secondary screen unit S, the mesh size of which is also selected within a range of from 2 mm. to 6 mm. depending on petrographic analysis, it being noted that the particular mesh size selected for screen *f* may differ from that selected for screen *e*. The removal of hard inert constituents from the disintegrated mix A (fraction A₁) is performed on screen *g* of the secondary screen unit S and the gradual controlled grinding of mix B and of the materials extracted from mix A is effected in the circuit comprising grinder G, mixer T₂ and screen *g*. The screenings from screen *e* (fraction A₂) together with that from screen *g* are intimately mixed in mixer M and discharged to the carbonization plant.

In the case of plants having only a low production capacity, the flowsheet of Fig. 3 may be simplified somewhat as indicated in Figs. 4 and 5.

As shown in Fig. 4, the disintegrating step and the grinding step are carried out in a common unit DG, and the oversize from all three screens *e*, *f* and *g* is discharged into a common rough grinding unit DG, appropriately adjusted for this purpose.

The flowsheet shown in Fig. 5 is derived from that shown in Fig. 4 by omitting the screen *f* of the secondary screen unit S. This is possible because the screen *f* becomes superfluous since the oversize from this screen is

subsequently mixed with the oversize from screen *g*. The screen *f* is useful only in the case of materials difficult to screen, in order to relieve screen *g* from part of the work.

If it is desired not only to improve the characteristics of the coke from the standpoint of cell structure, cracks and mechanical strength, but also from the chemical standpoint by reducing its ash and sulfur content, it may be advantageous to subject to purification those granulometric fractions in which the inorganic constituents have become more highly concentrated during the process.

This may particularly be the case for fraction A₁ formed with the hard constituents of the coals of mix A after gradual controlled disintegration of said coals. By subjecting this fraction, prior to grinding, to a purifying step as by means of a pneumatic separating table, the ash and sulfur contents in the coke may be notably reduced.

In the case of Fig. 6, only the fraction A₁ is purified the purifying separator E being consequently provided between the screen *a* of the primary screening apparatus P and the adjustable-rate unit G. If the separator is placed between unit G (Fig. 7) or DG (Fig. 8) and the screen *g* of the secondary screening unit S serving to separate the hard constituents liberated from coal mixes A and B for grinding the latter, the advantage is had that the purifying operation is effected on the major part of all the coals used rather than only on the fraction comprising the hard constituents of mix A as was the case in the plant illustrated in Fig. 6.

Figs 5 and 9 are related and illustrate systems wherein the mix A and mix B are treated in completely separate circuits and are co-mingled only after treatment is complete. In Fig. 5, mix A is first mixed in mixer T₁, then passed over screen *a*. The oversize from screen *a* is discharged to disintegrator D and recycled for admixture in mixer T₁ with incoming portions of mix A. The throughput from screen *a* goes to screen *b* of smaller mesh than screen *a*, as was mentioned in connection with the designation of other embodiments. The throughput from screen *b* is discharged as fraction A-A₁ to a mixer M. The oversize from screen *b* is fed to a grinder G₁, screened on screen *s* and recycled to grinder G₁, all of fraction A₁ being eventually passed through the screen and discharged to mixer M.

Mix B is fed to a mixer T₂ and the product from mixer T₂ is screened on screen *s* with the throughput from the screen being discharged to mixer M and the oversize being fed to grinder G₂ and recycled to mixer T₂ for admixture with an incoming portion of mix B. The fractions of mix A, as well as mix B, are intimately mixed in mixer M and discharged to the carbonization plant.

The system of Fig. 9 differs from that of Fig. 5 only in that mix A is screened only once on a screen S after mixing in mixer T₁ with the throughput from screen S being discharged to screen *s*. The oversize from screen *s* (fraction A₁) is fed to grinder G₁ and recycled to screen *s*. The throughput from screen *s*, which eventually includes fraction A₁ and thus may be designated (A-A₁)+A₁, or A, is fed to mixer M where it is mixed with the previously ground and mixed mix B as before.

In case it is desired to add oil to the coal in order further to increase the quality of the coke, it is desirable to make the addition, in the case of Figs. 1 to 8, into the mixers T₁ and T₂, so that it will be made prior to any screening operation; this is particularly true with wet coals.

Where units T₁ and T₂ are trommels or revolving drums, the oil may be injected in the form of a very fine spray into the closed casing of the trommel, such spray being obtained for example by discharging the oil under pressure of from about 1 to about 10 kg./sq. cm. through an atomizer, the oil being heated if necessary in case its fluidity at the prevailing temperature is not great enough.

In the case of very wet coals, non-clogging screens

of any suitable type should preferably be used for the screening units P and S of Figs. 1 to 8.

It should be understood that modifications may be made to the plant herein above described, particularly by replacing some of the means shown therein by functionally equivalent means, without departing from the scope of the present invention. In particular, if it were desired to eliminate the fusain contained in either or both of the mixes A and B, all that would be necessary would be to provide in the primary and/or secondary screening units an additional screen, or provide an additional screen in the flow circuit before the mixer M, if the latter is provided, so as to extract and discard the finer particles. Similarly, in the case of very large plants, the controlled grinding of the inert coals in mix B may be carried out in a unit different from that used for the controlled grinding of fraction A₁ of coal mix A, as specified in the preamble to this specification.

It will be understood that in a continuously running industrial plant, the proportioning of the constituents in the coking blend is effected by suitably proportioning the coals respectively introduced into the mixes A and B, and delivering predetermined proportions of each of these mixes into the plant in which the coking blend is prepared.

What I claim is:

1. A coking process, using a plurality of different grade coals in a divided state, and if needs be additional substances, comprising the steps of: (a) making from the different grades of coal predetermined amounts of two separate mixes calculated on account of the characteristics of the coke to be obtained, viz. a first mix A consisting substantially of the fusible coals and a second mix B consisting substantially of the inert coals and any additional substances; (b) granulometrically separating the first mix A on a predetermined mesh size selected within a range of from about 2 mm. to about 6 mm. depending on petrographic analysis of the coals, to obtain a first oversize consisting predominantly of conglomerate coal particles and in the screenings petrographic constituents of the coal already liberated and essentially fusible vitrain; (c) progressively and controllably disintegrating said first oversize separated in step b by a splitting operation in combination with a screening operation on a mesh-size selected within a range of from about 2 mm. to about 6 mm. depending on petrographic analysis of the coal, and recycling the oversize of said screening operation to the disintegrating step whereby to obtain continuously in the screenings the liberated petrographic constituents of the coals forming mix A which are thus subtracted from any destruction of the grains; (d) granulometrically separating the screenings obtained in step b and the screenings obtained in step c on a mesh size selected within a range of from about 1 mm. to about 4 mm. to obtain an oversize fraction consisting predominantly of hard and comparatively inert petrographic constituents of the coal, viz. durain and mineral constituents, and screenings consisting of the other petrographic constituents of the coal and essentially fusible vitrain; (e) progressively and controllably grinding said oversize fraction obtained in step d in combination with a screening operation of the ground product on a mesh-size selected within a range of from about 0.5 mm. to about 2 mm. depending on the desired bulk density in the coke ovens and recycling to the grinding step the oversize obtained in said screening operation to continuously obtain in the screenings the hard and inert petrographic constituents of the coals forming said mix A, and simultaneously treating the coals and additional substances of said mix B by the same process applied to said oversize fraction obtained in step d for giving to said mix B and said oversize fraction a very fine granulometric size without producing a high quantity of fine dust; (f) forming a coking blend by mixing predetermined proportions of the screenings obtained in steps e, d and b

calculated to give in said coking blend a percentage of volatile matters comprised between 16% and 35%; (g) carbonizing said coking blend.

2. A process as claimed in claim 1 wherein said oversize fraction obtained in step d is ground and admixed with said mix B₁ and the operations of step e are effected on the mixture thus obtained for simultaneously giving to said coals of mix B and to said oversize fraction a very fine granulometric size without formation of a high quantity of fine dust.

3. In a coking process using a plurality of different grade coals in a divided state or different slack-coals, the steps comprising making with said coals at least two separate mixes, the one A consisting substantially of the fusible grades of coal and the other B the inert grades of coal; granulometrically removing from said mix A the grains having a grain size larger than a predetermined grain size S ranging between 1.5 and 6 mm. according to the coking characteristics of the coals of said mix A; subjecting said large grains of coal A to a progressive and controlled disintegrating operation for progressively giving to said whole mix A a grain size lower than said predetermined grain size S without unduly reducing the grain size of the coals of said mix; subjecting said disintegrated mix A to a screening operation on a mesh selected for separating as a fraction A₁ the larger grains of said disintegrated mix formed by the harder and inert constituents of the coals; granulometrically separating from said mix B a fraction B₁ consisting of the grains having a grain size larger than a predetermined grain size s ranging between about 0.5 mm. and 2 mm. according to the bulk density desired in the coking blend to be obtained, and a fraction B₂ consisting of the grains having a grain size lower than s; subjecting said fraction A₁ and said fraction B₁ to a progressive and controlled grinding operation by screening the ground product on the mesh s and recycling the oversize to the grinding zone for progressively reducing the grain size of said fractions A₁ and B₁ below the predetermined grain size s without unduly producing fine dust; admixing the ground products from A₁ and B₁ with the unground fractions (A-A₁) and B₂ for obtaining a coking blend, and carbonizing said coking blend.

4. In a coking process using a plurality of different grade coals in a divided state or different slack-coals, the steps comprising making with said coals at least two separate mixes, the one A consisting substantially of the fusible grades of coal and the other B the inert grades of coal; circulating said mix A into a screening and disintegrating circuit for continuously removing from said mix A the grains having a grain size smaller than a predetermined grain size S, selected according to the caking characteristics of the coals between about 2 mm. and about 6 mm. and progressively reducing by disintegrating the grains of said whole mix A to a grain size lower than said predetermined grain size S without unduly reducing the grain sizes of said coals, circulating said mix B into a screening and grinding circuit for continuously removing from said mix B the grains having a grain size lower than a predetermined grain size s selected within a range of about 0.5 mm. to 2 mm. according to the bulk density desired in the coking blend to be obtained, and progressively grinding the larger grains of said mix for giving to said whole mix B a grain size below s without unduly producing fine dust; separating from said disintegrated mix A by a screening operation a fraction A₁, formed of the larger grains and consisting of the major portion of the hard and inert constituents of the coals of said mix; treating said fraction A₁ as said mix B into a screening and grinding circuit for reducing the grain size of said fraction A₁ below s; admixing the so treated mix B with said ground fraction A₁ and the remaining unground portion (A-A₁) of said mix A for forming a coking blend, and carbonizing said coking blend.

5. A process as claimed in claim 4 wherein said frac-

tion A₁ is admixed in the screening and grinding circuit for mix B and is ground simultaneously with said mix.

6. A process as claimed in claim 5 wherein said fraction A₁ is subjected to a density separation for removing therefrom a major amount of the heavier inorganic constituents having a specific gravity higher than about 1.6, before being admixed in said screening and grinding circuit for mix B.

7. A process as claimed in claim 4 wherein the grains of mix A having a grain size larger than S are admixed with the grains of mix B having also a grain size higher than S and are simultaneously disintegrated therewith in a common screening and disintegrating circuit and thereafter mixed with the fresh mix B fed to the screening and grinding circuit; and the screening operation for separating the grains of said disintegrated mix A having a grain size larger than s is effected in the screening and grinding circuit for said mix B which is common for said mix B and said fraction A₁.

8. A process as claimed in claim 7 wherein the grains extracted from the screening and disintegrating circuit common to a portion of said mix A and to said mix B in view of being circulated into said screening and grinding circuit are subjected to a density separation for removing therefrom a major amount of the heavier inorganic constituents having a specific gravity higher than about 1.6 before being fed into said screening and grinding circuit.

9. A process as claimed in claim 4, wherein small quantities of oil are added to both said A and said B mixes.

10. A process as claimed in claim 5, wherein oil is sprayed into said first and second mixes in an amount of from about 0.1% to about 2% by weight of said mixes.

11. A process as claimed in claim 4 wherein said disintegrated mix A is admixed with said mix B and screened simultaneously with said mix B over a mesh size s, the oversize of said mesh being ground and recycled in the screening and grinding circuit until all the grains are withdrawn as screenings from said circuit.

12. A process as claimed in claim 4 wherein the grains of mix A having a grain size larger than S are admixed with the grains of mix B having also a grain size higher than S and are simultaneously disintegrated therewith in a common screening and disintegrating circuit and thereafter mixed with the fresh mix B fed to the screening and grinding circuit; and the screening

operation for separating the grains of said disintegrated mix A having a grain size larger than s is effected in the screening and grinding circuit for said mix B which is common for said mix B and said fraction A₁, and said distinegrating operation of the larger grains of mix A and the grinding operations of mix B and of said fraction A, are effected in a common disintegrating and grinding zone.

13. A process as claimed in claim 4 wherein the grains of mix A having a grain size larger than S are admixed with the grains of mix B having also a grain size higher than S and are simultaneously disintegrated therewith in a common screening and disintegrating circuit and thereafter mixed with the fresh mix B fed to the screening and grinding circuit for mix B, the grains of the mixture B with a portion of mix A having a grain size larger than s are simultaneously extracted from the the screening and disintegrating circuit, then are subjected to a gravimetric separation for removing therefrom a major amount of the heavier inorganic constituents having a specific gravity higher than about 1.6, and the cleaned grains are fed again into the disintegrating zone used as grinding zone for the fraction of both mixes of coal to be ground.

14. A process as claimed in claim 4 using a plurality of different grade coals and further additional substances such as impoverishing or fusible organic substances in which said additional substances are intimately mixed with said coal mix B before circulating the latter into said screening and grinding circuit.

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