R. BOWEN.

PROCESS FOR THE PRODUCTION OF ARTIFICIAL FUEL.

APPLICATION FILED APR. 14, 1920.

1,397,572.

Patented Nov. 22, 1921.

4 SHEETS—SHEET 1.

Fig. 1.

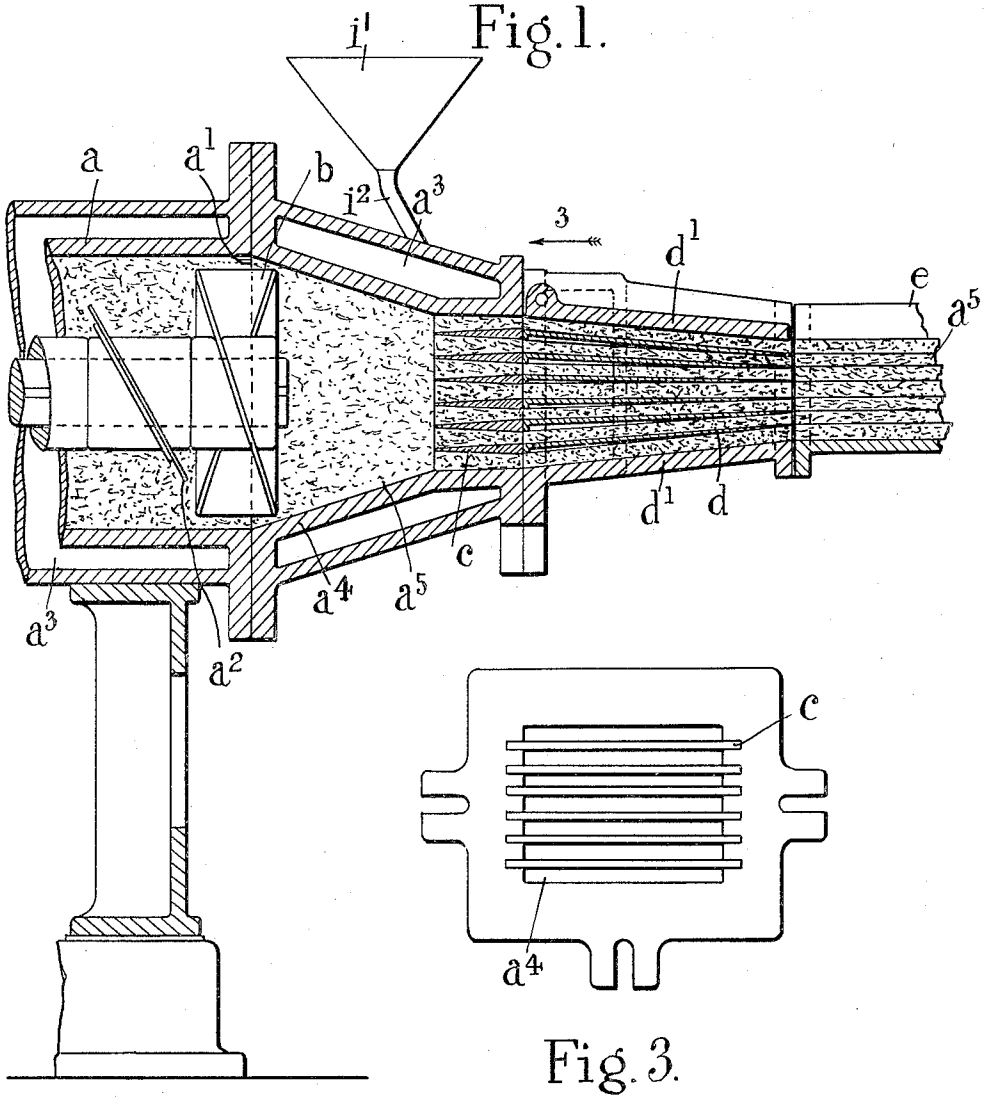


Fig. 3.

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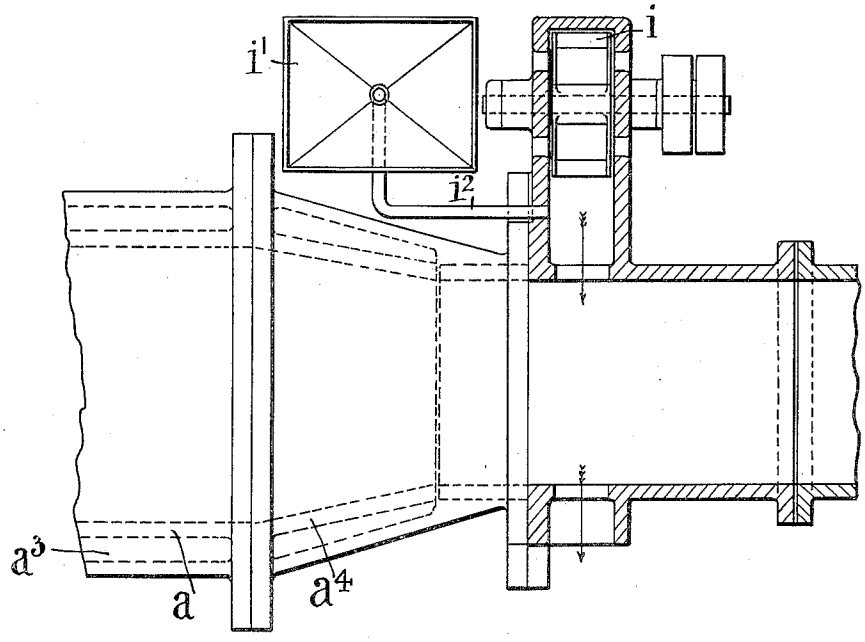
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4 SHEETS—SHEET 2.

Fig. 2.



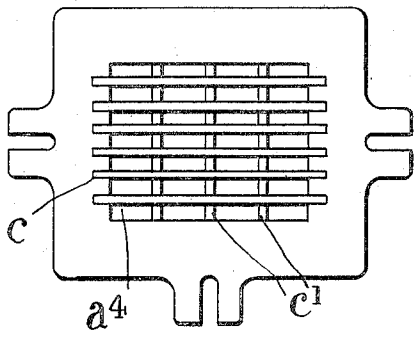


Fig. 4.

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4 SHEETS—SHEET 3.

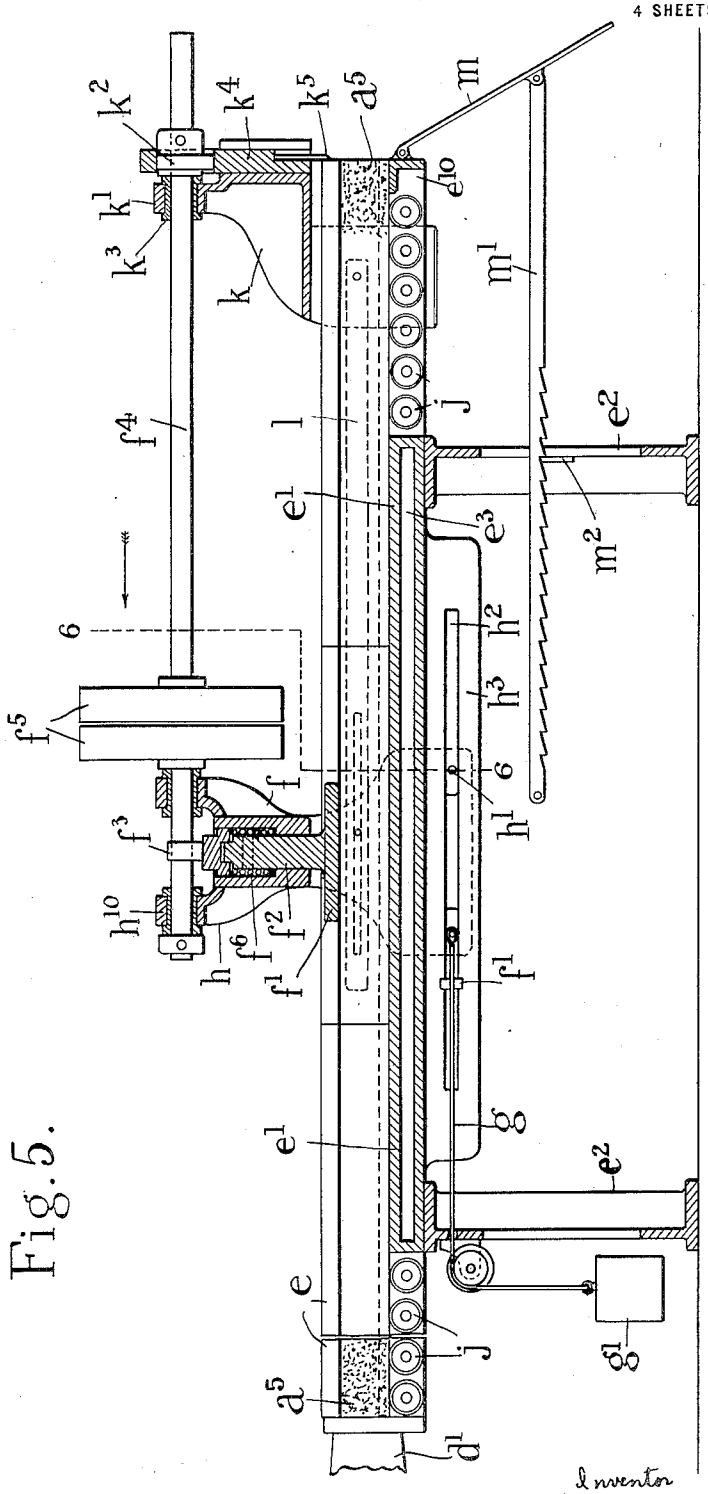


Fig. 5.

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4 SHEETS—SHEET 4.

Fig. 7.

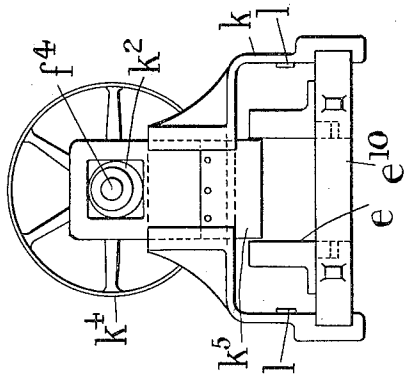


Fig. 8.

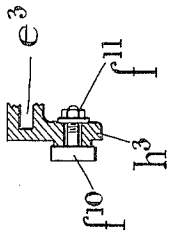
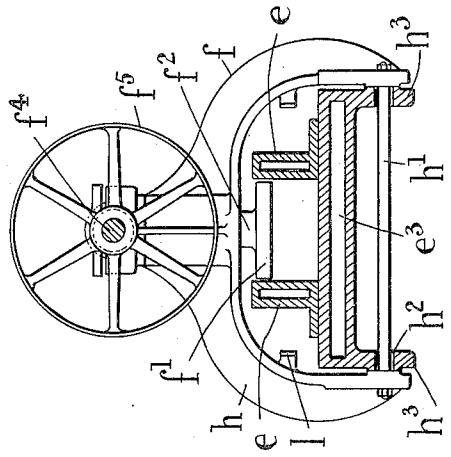


Fig. 6.



Inventor

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UNITED STATES PATENT OFFICE.

RICHARD BOWEN, OF CHELTENHAM, ENGLAND, ASSIGNOR TO LAMINATED COAL, LIMITED, OF LONDON, ENGLAND.

PROCESS FOR THE PRODUCTION OF ARTIFICIAL FUEL.

1,397,572. Specification of Letters Patent. Patented Nov. 22, 1921.

Application filed April 14, 1920. Serial No. 373,822.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, RICHARD BOWEN, a subject of the King of Great Britain, residing at Marle Hill, Cheltenham, in the county of Gloucester, England, consulting engineer, have invented a new and useful Process for the Production of Artificial Fuel, (for which I have filed application in Great Britain Sept. 30, 1916, Pat. No. 109,995, Jan. 1, 1918,) of which the following is a specification.

The invention relates to a process for the production of an improved solid fuel having the same calorific value and characteristics as good quality coal, that is to say, a synthetic coal.

The improved fuel is made from waste ignitable material such as coal dust, coke dust, wood dust, or the like and a bituminous material such as tar or pitch to which may be added volatile matter and a lime producing material.

I first ascertain by analysis the properties of the material forming the basis of the product, so that I may add to it such quantities of volatile matter, hydrocarbons and other matter, as may be necessary to obtain the desired result, namely, an artificial fuel having the qualities of any particular grade of coal.

One grade of coal may be blended with another grade of coal. By such a combination I may utilize a class of coal that separately may be useless in combination with other materials so as to convert the same into a suitable product to compete in the market with such classes of coals as there may be a demand for. For instance anthracite duff may be taken and its lacking volatile qualities may be made up so that it may enter into competition with the best bituminous or house coal.

The essential feature of the present invention is an improved method of producing the blocks in strata.

Each block appears to be a solid mass as the layers cannot be readily separated while the block remains cool. It is only while being consumed that the layers gradually separate, as in natural coal. The blocks may however be broken by a blow from a poker when cold.

The stratification of the material not only renders it more readily ignitible but it allows the volatile matter to be more regularly consumed as the layers thus formed open under the influence of heat, increase the draught, and cause ignition to take place throughout the lump instead of on the surfaces only as in ordinary briquets.

According to the present invention I form the material into layers and instead of allowing such layers to become cold and employing a binding material to connect the layers together to form a block I treat the layers so as to prevent the layers of each block when hot adhering together perfectly as they would do when in that condition under pressure. Such treatment may merely consist in allowing the layers to cool naturally to the desired extent or I may cool the faces of the layers or I may apply to the said faces a thin layer of finely comminuted material such as hydrated lime, coke dust or other suitable powder or water before applying pressure to the fuel material which powder or water may be applied in the form of a spray by an air blast.

One method of carrying the invention into effect is as follows:—

The materials deemed suitable as a base for the artificial fuel are intimately mixed in a dry heat and the superfluous moisture is driven off. Meanwhile the bituminous material and the volatile matters to be introduced into the dry materials are mixed and melted by superheated steam or other vapor until such matters are thoroughly incorporated with the vapor. These volatile matters mixed with the superheated steam are then injected under pressure into the dry and heated bases, in such proportion and for such time as may be necessary to properly impregnate said bases. The proportions of the volatile matters and the time during which the impregnation is taking place are varied according to the higher or lower grade coal which it is desired to imitate.

When mixed and impregnated the material while hot is formed into sheets in layers one above the other in known manner so as to render the finished material stratified.

The face of each layer just produced is

treated as already described by cooling or by the application of fine dust or water spray to prevent the layers forming the blocks adhering perfectly. The layers are then pressed together and adhere in an imperfect manner. When cold the material is broken up into jagged and irregular lumps similar to coal and is then fit for use.

As an example I may use the following materials in the proportions stated:

8 parts of fine coal, 10 parts of partly calcined smoke box ashes or coke, and 5 parts of fine oolithic dust or other lime producing dust, all by weight.

2 parts of bituminous material, such as tar or pitch, ½ part naphthaline or other like volatile matter, and ¼ to ½ part of creosote to assist amalgamation.

All these materials are heated, and when mixed the compound is withdrawn and made into blocks above described.

It will be understood that the proportions of materials will be modified to suit the various classes of coal which it is sought to imitate.

In carrying the present invention into effect a suitably heated container is employed which is provided with means for forming the hot material into sheets or layers and a press is employed which may be adjustable with respect to the container or with respect to the means for forming the material into sheets or layers. It is thus possible to apply the pressure after the sheets have cooled to such an extent that they will not adhere perfectly so as to lose the beneficial effect of the layers but will adhere sufficiently to allow the blocks to be handled, transported and stored.

In addition to the adjustment of the press means may be provided for forcing cool air between the sheets or layers and for applying a spray of dust between them.

A suitable apparatus for carrying the process into effect is illustrated in the accompanying drawings in which Figure 1 is a vertical section through part of the heating and mixing apparatus showing means for separating the material into superposed sheets or layers and compressing them. Fig. 2 is a plan partly in section of the apparatus shown in Fig. 1.

Fig. 3. is an elevation of the dividing and compressing device shown in Fig. 1 seen in the direction of the arrow 3.

Fig. 4 is an elevation of a modified construction of dividing and compressing device.

Fig. 5 is a side elevation, partly in section, of the remaining part of the apparatus where the sheets or layers are pressed together and where they are finally broken up into blocks.

Fig. 6 is a section on the line 6—6 of Fig. 5, seen in the direction of the arrow.

Fig. 7 is an end elevation of part of Fig. 5. Fig. 8 is a detail section showing an adjustable stop.

The apparatus comprises a suitably heated container a having an aperture a^1 through which the material a^5 in the container is extruded. The container a is provided with a suitable mixing device such as a^2 or with other suitable mixing devices of known construction. Pressure is applied to the material a^5 in the container a by any suitable means such as a screw conveyer b or in other suitable manner. a^3 is a steam or hot water jacket.

The chamber a is provided with an outlet passage a^4 which is preferably gradually reduced in cross section toward the outlet itself as shown in Figs. 1 and 2. This latter is rectangular in elevation at its outlet end as shown in Figs. 3 and 4 and has horizontally arranged knives c which are preferably much thicker at the outlet ends than at their inner ends. The outlet passage a^4 may also be provided as shown in Fig. 4 with vertical knives c^1 which will weaken the compressed material a^5 longitudinally and allow it to be more readily broken up into suitable lumps for combustion.

Such knives c and c^1 have already been used in the manufacture of briquets for cutting the plastic material into layers and strips which have been further cut into suitable lengths by means of slicing knives.

In such prior use the knives have been employed to permanently divide the material whereas in accordance with the present invention such knives are only employed to temporarily divide the material which after treatment is subsequently subjected to pressure to cause the parts to again adhere in a somewhat imperfect manner and to possess the beneficial characteristics before mentioned.

Each knife c is contiguous to a carrying plate d the upper surface of which coincides with the upper edge of a knife c and these plates d are thinner than the thick ends of the knives. The carrying plates d are sharpened at the opposite ends to the knives c and converge until their sharpened edges are at a distance apart equal to the spaces between the thick ends of the knives c. Top and bottom plates d^1 are also provided the adjacent edges of which correspond at one end with the exit of the passage a^4 through which the material a^5 is extruded. These top and bottom plates d^1 likewise converge at their ends distant from the said aperture and the top and bottom plates d^1 and the before mentioned carrying plates d all terminate at the same distance from the aperture. Beyond the ends of the carrying plates d, d^1 is arranged a trough e and table or bed e^1 which is supported by standards e^2. The standards e^2 and its upper frame or bed e^1

may slide longitudinally beneath the trough e and be fixed at any desired distance from the knives c. The frame or bed e^1 also carries a suitable press f which latter is adapted to slide horizontally on the frame or bed e^1 and means such as a cord g and weight g^1 or springs are provided for returning the press f to its original or starting position against an adjustable stop f^{10}.

This adjustable stop f^{10} may be in the form of a bolt which passes through the slot h^2 in the flange h^3 and is fastened in the desired position by a washer and nut f^{11}.

The position of the stop f^{10} is so regulated with respect to the orifice in the container that the press acts upon the material after it has cooled to the desired temperature, so that although the parts will adhere yet it will be in an imperfect manner as already described. Such sliding presses are known in the art of pressing tiles but heretofore they have not been returned against an adjustable stop and have not been employed to apply pressure to material which has partially cooled.

The press may consist of a plate f^1 carried by a vertical plunger f^2 which is depressed by a cam f^3 or eccentric f^3 mounted upon a horizontal shaft f^4 driven by a pulley f^5 and strap or other device which will allow the press to slide. The cam or eccentric f^3 preferably acts upon the plunger f^2 against the action of a spring f^6. These parts are all carried by a frame h having cross rods h^1 passing through slots h^2 in flanges h^3 depending from the frame or bed e^1.

According to the prior invention by the same applicant the faces of each layer are suitably treated to prevent perfect adhesion of the layers. The treatment may merely consist in allowing the faces to partly cool and in this case it is only necessary to adjust the press to a suitable distance from the outlet passage a^4 by sliding the frame or bed e^1 beneath the trough e or by adjusting the stop f^1 to allow the requisite cooling to take place. The amount of cooling will depend upon the temperature and nature of the mass being treated and the temperature of the atmosphere.

If further treatment be required to prevent the layers adhering too perfectly together a fan i may be employed to drive air, fine water spray or powder between the layers as they pass along the carrying plates d, d^1 toward the press at which part of their travel one face of each layer except the top layer is exposed. i^1 is a hopper to contain water or dust which passes through the pipe i^2 into the path of the air blast produced by the fan i. The table e^1 may be made hollow at e^3 and cold water or air may be caused to pass therethrough for more rapidly cooling the layers.

The bottom of the trough e is preferably provided at each end of the table e^1 with rollers j to facilitate the passage of the material. If it be desired to slide the table e^1 beneath the trough e some rollers j are removed at one end and replaced at the other end of the table.

The shaft f^4 which is supported at one end in bearings h^{10} in the sliding frame h, is supported at the other end in bearings k^1 in a support k which is mounted to slide upon the end of the extension e^{10} of the frame or bed e^1. On the shaft f^4 is fixed a cam or eccentric k^2. A sleeve or bearing k^3 is fixed on the shaft f^4 and has collars fitting against the faces of the bearing k^1. The cam or eccentric k^2 acts within an aperture in a slide k^4 adapted to slide vertically within the support k.

To the lower end of the slide k^4 is fixed a knife k^5 to cut or break up the material as it passes over the end of the extension e^{10}.

The supports h and k are connected by rods l and move together in one direction due to the contact of the press f and knife k^5 with the moving material and in the reverse direction due to the action of the cord g and weight g^1.

A plate m is hinged to the extension e^{10} and it is provided with a hinged rack m^1 which is moved over a plate m^2 carried by a standard e^2. The rack m^1 enables the plate m to be fixed at various angles to throw the broken material in the direction desired.

The apparatus acts in the following manner:—

The heated material under pressure is further compressed as it passes through the outlet passage of gradually reduced diameter and it is finally pressed as it is forced between the knives. It leaves the knives in separated layers where it cools or is otherwise treated as above explained to prevent the layers adhering perfectly when pressed. The layers then unite one above the other, travel along the trough table or bed and pass beneath the press. Immediately the press acts upon the material this latter carries the press along with it. As soon as the press releases the material the press is returned to its original position nearer to the knives and again immediately acts upon the material. The material after it has passed the press moves along the trough, table or bed and is finally broken or cut into lumps of a size suitable for combustion.

I claim—

1. A process for producing laminated artificial fuel from a combustible material mixed with a bituminous material in a heated chamber which consists in forming the material into layers, treating them to prevent perfect adhesion and then applying pressure to the layers to cause them to adhere imperfectly substantially as set forth.

2. A process for producing laminated artificial fuel from a combustible material mixed with a bituminous material in a heated chamber which consists in forming the material into layers, treating them to prevent perfect adhesion then applying pressure to the layers to cause them to adhere imperfectly and finally breaking up the material into lumps substantially as set forth.

3. A process for producing laminated artificial fuel from a combustible material mixed with a bituminous material in a heated chamber which consists in separating the material into layers, retaining such layers separated, passing a blast of air through such layers to prevent perfect adhesion and then applying pressure to the layers to cause them to adhere imperfectly substantially as set forth.

4. A process for producing laminated artificial fuel from a combustible material mixed with a bituminous material in a heated chamber which consists in separating the material into layers, retaining such layers separated, passing a blast of air through such layers to prevent perfect adhesion, then applying pressure to the layers to cause them to adhere imperfectly and finally breaking the material into lumps substantially as set forth.

5. A process of producing laminated artificial fuel from a combustible material mixed with a bituminous material in a heated chamber which consists in extruding the material through knives, retaining the layers thus produced separated by passing them along separated plates, passing a blast of air through such layers to prevent perfect adhesion and then applying pressure to the layers to cause them to adhere imperfectly substantially as set forth.

6. A process of producing laminated artificial fuel from a combustible material mixed with a bituminous material in a heated chamber which consists in extruding the material through knives, retaining the layers thus produced separated by passing them along separated plates, passing a blast of air through such layers to prevent perfect adhesion, then applying pressure to the layers to cause them to adhere imperfectly and finally breaking the material into lumps substantially as set forth.

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