To all whom it may concern:

Be it known that I, HUGH RODMAN, a citizen of the United States, and a resident of Edgewood, in the county of Allegheny and State of Pennsylvania, have made a new and useful invention in Methods of Making Case-Hardening Material, of which the following is a specification.

This invention relates to improved methods of manufacturing carbonizing materials for drying purposes. Many carbonizing materials and purely mechanical mixtures which are satisfactory chemically are of little commercial value because of being finely powdered. While admitting of intimate mixing, this finely powdered condition of the material makes difficult handling, favors separation of particles of different size and density and greatly lowers the thermal conductivity. I have discovered that these troubles may be overcome and valuable material made from dry which are now frequently wasted by fixing finely powdered materials in small masses or pebbles, preferably with a binding material, so that any coking material contained will coke internally only and so that the masses or pebbles will not disintegrate or deform or sinter together when highly heated. By "cokeing" I mean the property of coking or coking to a solid char possessed by such carbonaceous materials as leather dust and crushed coking coal when highly heated; and by "cokeing internally only" I mean the property possessed by coking material of coking and binding the material within the surface of properly constructed small masses or pebbles without deformation or disintegration of these masses and without sintering or coking to adjacent masses. By "small masses" or "pebbles" I mean rigid masses of any shape but preferably rounded masses which may be one-sixteenth or one-quarter inch in diameter.

My preferred method of carrying out my invention is to mix one hundred parts of finely powdered coking coal with ten parts of sodium carbonate and twenty parts of calcium carbonate, moisten the dry mixture with a solution of molasses in water, force the moist mass through a screen having four wires to the linear inch and then tumble in revolving barrels occasionally adding some dry mixture till rounded and compacted into firm pebbles. Undersize and oversize pebbles are then screened out and returned to the mixers while pebbles of approved sizes are dried with gentle heat or preferably coked in revolving kilns heated to about fifteen hundred degrees (1500°) Fahrenheit. The molasses and carbonates react to form a bond which allows the coal to coke internally but prevents any deformation or disintegration of individual pebbles or adherence to adjacent pebbles.

Another method is to mix one hundred parts of finely powdered coking coal with one hundred parts of Portland cement and fifty parts of barium carbonate, moisten the dry mixture with water or molasses and water and then press the mass into molds to dry. When set and hard the large masses are crushed to the size desired, the undersize being returned to the mixers and mixed with fresh material for resetting. When heated, this material will coke internally only, making a hard, strong substance, but will not deform or adhere to adjacent small masses.

Other binding material, as glucose or starch or asphaltum, may form the initial bond, the internally coking coal forming the final and strong bond, and other methods be employed in forming the small masses, the essential condition being that the small masses be so constructed and bound that the coal will coke internally only. I have found that the tendency of the pebbles to break down and coke externally is influenced somewhat by the character of the coal and the strength of the temporary bond, but mainly by the fineness of the coal particle. Coal ground to pass a screen having two hundred wires to the linear inch is satisfactory in most cases and coal that will just pass screens having one hundred wires to the linear inch will serve where strong bonding is employed.

I do not wish to be limited to the use of screens within the limits mentioned, for example, with certain kinds of coal I may utilize screens having as few as fifty wires to the linear inch.

Where the pebbles are coked in rotating kilns the coal may be coked than when coking is done in stationary pots, as usual in carbonizing operations.

I have made satisfactory material by tumbling a mixture of one hundred parts of powdered charcoal and forty parts of barium carbonate through a screen having four wires to the linear inch.
rium carbonate with enough molten asphaltum or coal tar to convert it into firm pebbles. When heated these are bonded by the coking asphaltum or tar but will not coke or adhere to each other if the pebbles have been tumbled till firm and strong.

I have moistened a mixture of equal parts of powdered charcoal and Portland cement and then pebbled this by tumbling in revolving barrels or else allowed it to set in large masses which were subsequently crushed as already described. When heated to a carbonizing temperature these will not disintegrate or deform but the cement bond is much weakened by the heat and the material is not so satisfactory as where a coking material is used to make a solid, strong bond, the small masses being so made that the coking material will coke internally only.

What I claim is:

1. The method of adapting finely divided material for use as carbonizing material, which consists in mixing the material with a binding agent and forming small masses which will maintain their identities when heated.

2. The method of adapting finely divided material, containing coking material, for use as carbonizing material which consists in mixing the material with a binding agent and forming small masses which will maintain their identities when heated.

3. The method of adapting finely divided material, containing coking material, for use as carbonizing material, which consists in mixing the material with a binding agent and forming small masses which will maintain their identities when heated.

4. The method of adapting finely divided material, containing coking material, for use as carbonizing material which consists in mixing it with a binding agent and forming small masses which will coke internally only.

5. The method of adapting finely divided material, containing coking material, for use as carbonizing material, which consists in mixing it with a binding agent and forming small masses which will coke internally only.

6. The method of adapting finely divided material, containing coking coal, for use as carbonizing material, which consists in mixing it with a binding agent and forming small masses which will coke internally only.

7. The method of adapting finely divided material for use as carbonizing material, which consists in mixing it with a binding liquid and tumbling to form small rounded pebbles which will maintain their identities when heated.

8. The method of adapting finely divided material, containing coking coal, for use as carbonizing material, which consists in mixing it with a binding liquid and tumbling to form small rounded pebbles which will maintain their identities when heated.

9. The method of adapting finely divided material, containing coking coal, for use as carbonizing material, which consists in mixing it with a binding agent and separating the resulting mass into relatively small masses of appreciable size.

10. The method of adapting finely divided material for dry packing, for use as carbonizing material, which consists in mixing it with a binding agent and separating the resulting mass into relatively small masses of appreciable size.

11. The method of adapting finely divided material for dry packing, containing coking material, for use as carbonizing material, which consists in mixing it with a binding agent and separating the resulting mass into relatively small masses of appreciable size.

12. The method of adapting finely divided material for dry packing, containing coking coal, for use as carbonizing material, which consists in mixing it with a binding agent and separating the resulting mass into relatively small masses of appreciable size.

13. The method of adapting finely divided material for use as carbonizing material which consists in mixing it with a binding agent and then forming small masses therefrom, and then heating the small masses to coke them internally only.

14. The method of adapting finely divided material, containing coking material, for use as carbonizing material, which consists in mixing it with a binding agent and then forming small masses therefrom, and then heating these small masses to coke them internally only.

15. The method of adapting finely divided material, containing coking coal, for use as carbonizing material, which consists in mixing it with a binding agent and then forming small masses therefrom, and then heating these small masses to coke them internally only.

16. The method of preparing carbonizing material which consists in fashioning finely divided material into substantially smooth-surfaced pebbles.

17. The method of preparing carbonizing material which consists in fashioning finely divided material into substantially smooth-surfaced pebbles and in then applying heat thereto.

18. The method of preparing carbonizing material which consists in fashioning finely divided material into substantially smooth-surfaced pebbles and in then coking said pebbles.

19. The method of preparing carbonizing material which consists in fashioning finely divided material into substantially smooth-surfaced pebbles and in then coking said pebbles.
divided material into substantially smooth-surfaced pebbles and applying heat thereto.

20. The method of preparing carbonizing material which consists in fashioning finely divided material, containing coking material, into substantially smooth-surfaced pebbles and applying heat thereto.

21. The method of preparing carbonizing material which consists in fashioning finely divided material, containing coking coal, into substantially smooth-surfaced pebbles and applying heat thereto.

22. The method of adapting finely divided material for use as carbonizing material which consists in mixing the material with a tacky binding agent and forming small masses which will maintain their identities when heated.

23. The method of adapting finely divided material for use as carbonizing material which consists in mixing the material with a tacky binding agent, then forming small masses therefrom, and in then coking said small masses.

24. The method of adapting finely divided material for use as carbonizing material which consists in mixing it with a binding liquid and tumbling to form small rounded pebbles, and then coking said pebbles.

25. The method of adapting finely divided material for use as carbonizing material which consists in mixing the material with a binding agent such as molasses, and then forming small masses which will maintain their identities when heated.

In testimony whereof, I have hereunto subscribed my name this 23rd day of April, 1913.

HUGH RODMAN.

Witnesses:

C. W. McGhee,
Ada Romig.