(No Model.) 2 Sheets—Sheet 1.

I. M. KELLEY.

MANUFACTURE OF COKE.

No. 332,613. Patented Dec. 15, 1885.

Figure 1

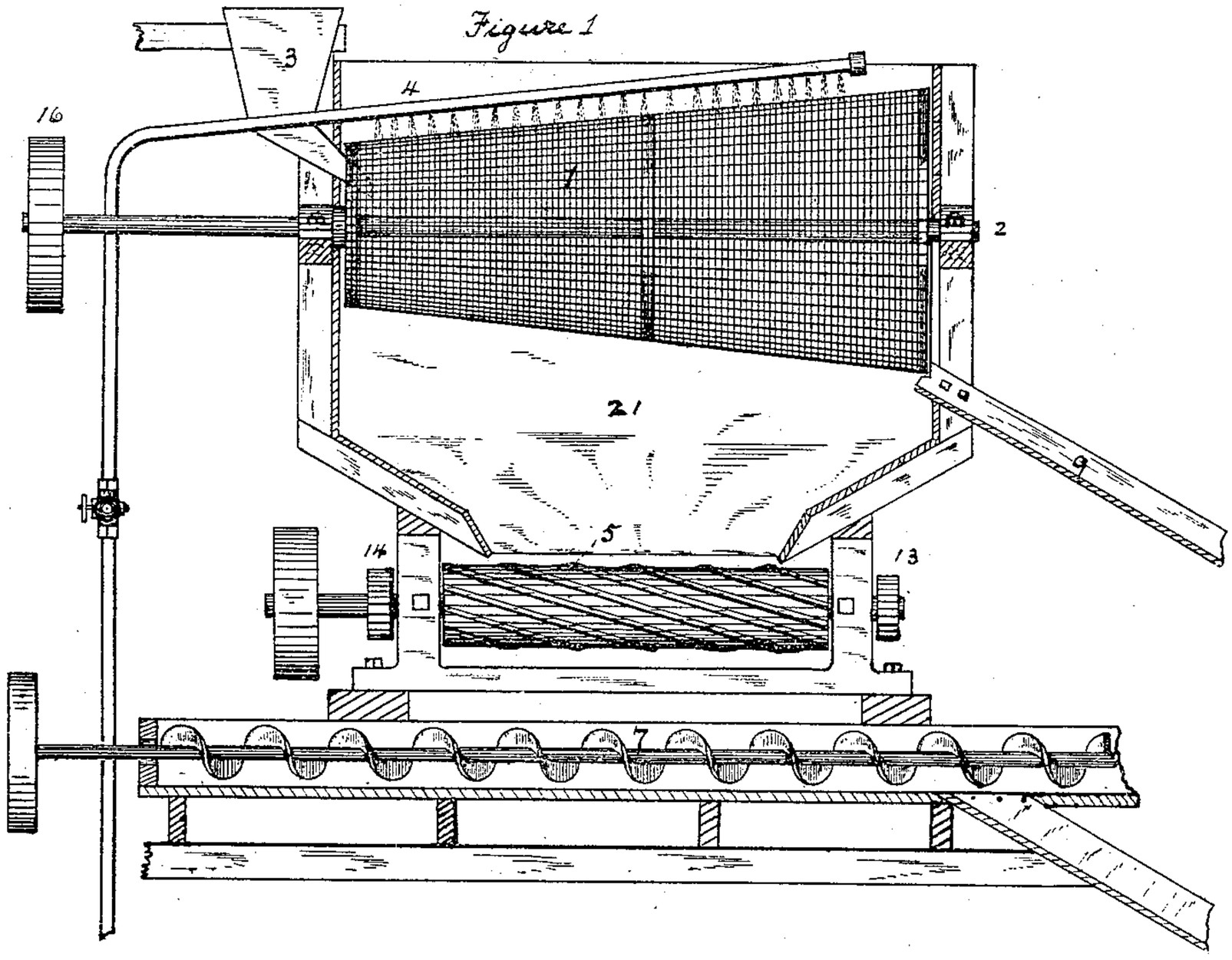
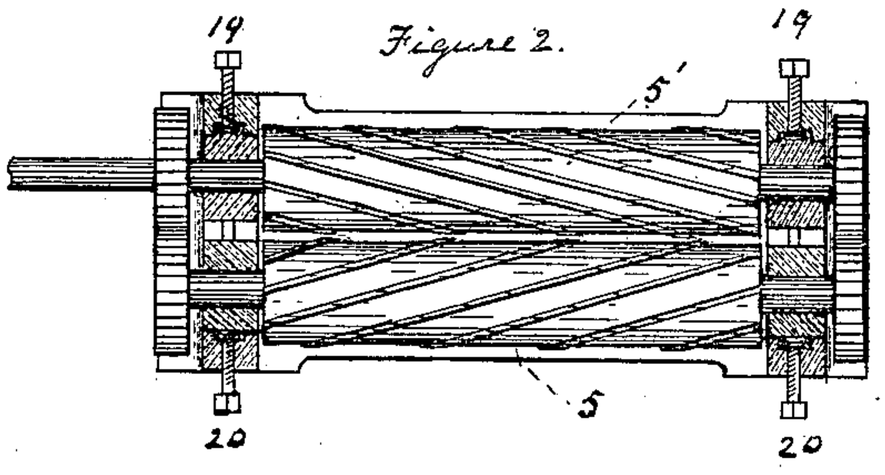


Figure 2.



Witnesses.

Ino. K. Smith.

W. B. Corwin

Inventor.

Isaac M. Kelley

by his attorneys

Bakewell & Kerr

(No Model.) 2 Sheets—Sheet 2.

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Fig 3

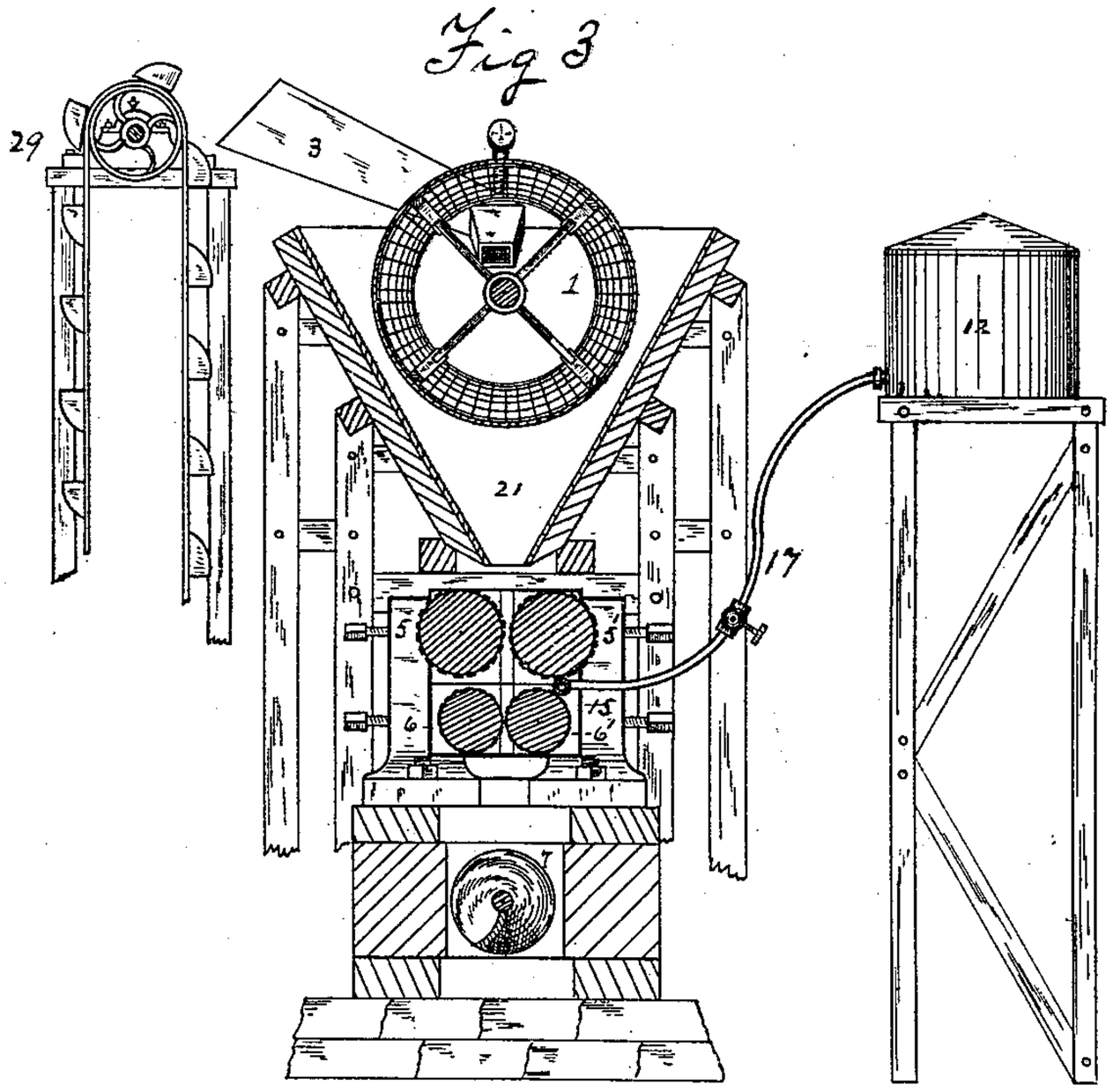
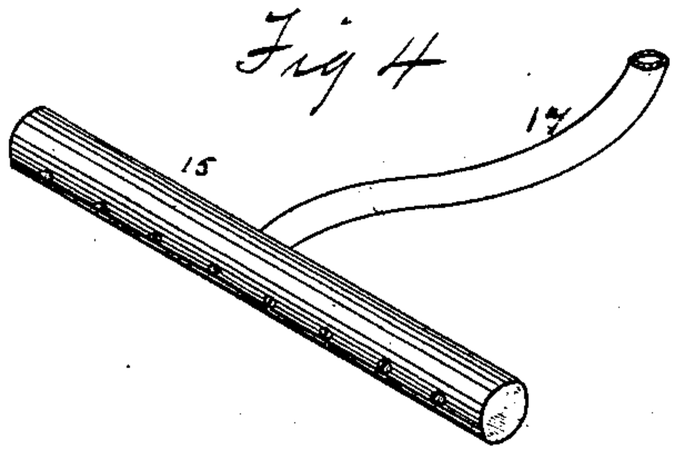


Fig 4



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UNITED STATES PATENT OFFICE.

ISAAC M. KELLEY, OF IMPERIAL, PENNSYLVANIA.

MANUFACTURE OF COKE.

SPECIFICATION forming part of Letters Patent No. 332,613, dated December 15, 1885.

Application filed September 13, 1883. Serial No. 106,295. (No model.)

To all whom it may concern:

Be it known that I, ISAAC M. KELLEY, of Imperial, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in the Manufacture of Coke; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a side elevation, partly in section, of the apparatus employed by me. Fig. 2 is a plan view of the crushing-rolls detached. Fig. 3 is an end elevation, partly in section, of the apparatus. Fig. 4 is a perspective view of the spraying-pipe detached.

Like letters of reference indicate like parts wherever they occur.

My invention relates to a new and improved process of preparing coal for the manufacture of coke, and to apparatus therefor; and it consists in first separating the slack from the coal and at the same time washing it by jets of water, after which the slack and fine coal are ground to the required size and saturated, coated, or mingled with water, hydrocarbon oils, or other hydrogenous matter during the grinding operation, to supply a sufficient amount of hydrogen or carbon to facilitate the coking of the coal in coke-ovens, all as will hereinafter more fully appear.

I will now describe my invention, so that others skilled in the art may manufacture and use the same.

In the drawings, 1 represents a hollow conoidal coal-screen rigidly mounted upon the horizontal shaft 2, which forms the axis of the screen, and is adapted to be revolved by belting, or any suitable device for communicating power at 16. The extremities of the screen are open, and slightly within the smaller base or end is a coal-chute, 3, so arranged as to discharge coal into the screen, while below the other and larger base or end is another chute or receptacle, 9, designed to receive or convey the coal as it falls from the screen. Above the center of the screen, and extending parallel with its shaft 2, is a water-pipe, 4, the under side of which is perforated, so as to permit a free discharge of water upon the contents of the screen. Beneath the screen 1, and parallel with its axis, are one or more pairs of rollers, 5 5′ 6 6′, situated above each other, the members of each pair being in the same horizontal plane and adjusted at the desired distance apart by means of set-screws 19 and 20. When two pairs of rollers are used, the members of the upper pair are arranged farther from each other than those of the lower, and are grooved or corrugated, so as to crush the coal and prepare it for being ground into smaller and equal size by the lower pair, the surfaces of which are suitably constructed for that purpose. If more than two sets of rolls are used, each set is constructed to grind more finely than the one next above it. These rollers are operated by means of cogs 13 and 14, or other suitable device, and are situate above a spiral conveyer, 7.

Thus constructed, the operation of my device is as follows: The coal is preferably washed and separated from slate, sulphur, and other impurities by any of the known methods, and the small pieces, composing what is known as "nut" or "pea" coal and slack, are conveyed by means of a lift, 29, or otherwise, into the chute 3, and thence into the smaller extremity of the conoidal screen 1. Water is then forced into the perforated pipe 4, and as the screen 1 revolves, the coal, sliding down the inclined bottom thereof, discharges its smaller particles through the interstices upon the roller 5, while the larger nut-coal, together with any slate which may remain after the separating process before mentioned, passes through the larger open end of the screen into a chute or receptacle, 9.

While this process is being accomplished, the water-jets from the pipe 4 serve to wash any dust adhering to the nut-coal down to the rollers 5, together with the small coal or slack. The fine coal, having thus passed with the water through the bottom of the revolving screen 1, falls through the guide trough or box 21 upon the rollers 5, and is crushed by the revolution of the rollers, each of which revolves in an opposite direction and toward the other, so as to discharge the water and crushed coal again upon the lower set of rolls, 6, which grind it to the desired size. If necessary, this op-

eration may be repeated through as many subsequent sets of rolls as desired, each pair grinding more finely than the one next before; or if the interstices of the screen be made fine enough only the grinding pair need be used, the object of the crushing-rollers being merely to ease the strain to which too large lumps of coal would subject the more closely-adjusted grinding-rollers. From the rollers 5 the finely-ground coal falls upon a spiral conveyer, and is by it carried into a suitable receptacle, or is immediately discharged into such receptacle, as desired.

The object of this process of grinding the coal with water is as follows: It is well known that the application of water to fine coal renders it more fit for coking, producing a finer, heavier, and more closely-grained product than can otherwise be obtained, while it also renders the coking process much more rapid and easy, and the more intimately the water and coal are united the more perfect is the result. It is impossible to attain this perfectly by simply adding water to the coal, for when fine, or in the form of dust, coal is impervious to water and will not readily mix, while large particles afford so small an amount of surface for the absorption of water that the process is rendered unnecessarily slow. These difficulties are overcome by my improved process, as the water and coal passing simultaneously through the rollers are well mixed, and the coal is ground to the degree of fineness necessary to retain the desired quantity of water.

Some sorts of coal which are more easily coked and form a better product than others do not require so great a quantity of water, and in the preparation of the slack of these less water may be added; or they may be ground more coarsely by adjusting the rollers farther apart by means of the set-screws 19 20.

In practice it has been found that other varieties of coal are so poorly adapted for coking, especially when in small particles, as to be almost useless for that purpose. This is the case in so-called "oxygenated coal," in which oxygen predominates in the volatile parts, causing the coal to burn freely without coking or adhering in mass, while hydrogenated coal, in which hydrogen predominates over the oxygen, is the strictly bituminous or coking kind, and most available for the production of coke. Coal also which is but slightly hydrogenated, while it will coke, produces coke of an inferior sort, coarse in texture, brittle, and ill adapted to sustain the heavy weight necessary to be placed upon it when used in blast-furnaces and other manufacture. This difficulty may be partly obviated by the addition of hydrogen, as it exists in water, (H_2O,) as has been fully described above; but in cases where this is not sufficient I make use of the modification of my invention shown in Fig. 3, in which 12 represents a reservoir or tank for containing liquid, 17 a supply-pipe connected with the tank 12, and 15 a perforated T or other shaped discharge-pipe situate above the rollers 6 6′, so as to discharge or spray the liquid from the tank 12 upon the surface of the rollers. The tank 12 is filled with a fluid rich in hydrogen, preferably a hydrocarbon oil or benzine, ($C_{12}H_6$,) which contains no oxygen, but a large percentage of hydrogen in combination with carbon. As this liquid is discharged upon the surface of the rollers through the pipe 15, and passes through them with the coal in a manner similar to that described, in which water is used, the effect of this process is to supply the oxygenated coal with an excess of hydrogen, which when placed in the coke-oven unites with the coal, causing it to burn easily, and producing coke nearly, if not quite, equal in quality to the product of the finest bituminous coal, while the carbon of the hydrocarbon unites with the fixed carbon of the coal, increasing the weight and amount of the resultant coke. Of course, when this process is used, the coal must be sifted through the screen 1 upon the rollers without the use of water-jets from the pipe 4, as the water would otherwise prevent the absorption and adherence of oil or benzine to the coal as it is ground.

The advantages of my invention are that by its use coke made from the best coking-coals—such as the kind known as "Connellsville coal"—may be increased in fineness, strength, and density fully twelve and one-half per centum, while oxygenated or only partly hydrogenated coals may be made to yield a much finer quality of coke than that produced by the methods formerly in use; and the above-described separation of the slack and dust from nut-coal, by means of washing through a sieve after it has been previously washed, involves great economy in utilizing waste material for coking purposes.

In place of the rolls described other suitable crushing or grinding devices may be substituted therefor.

I am aware that it has been proposed to mix petroleum residuum and like substances with coal-dust, slack, &c., in the manufacture of artificial fuels, roofing, and like compositions, and that in the manufacture of coke from brown coal, lignite, and similar coals incapable of coking by the usual coking process, coal-tar, asphaltum, bituminous coal, and equivalent substances have been mixed therewith and the mass subjected to an initial and sustained heat above a cherry-red, and do not herein claim the same; but,

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The method herein described for the manufacture of coke, which consists in first forming a mass for coking by grinding together coal and a liquid hydrogenous matter, whereby the hydrogenous matter is caused to

permeate the mass, and then subjecting the mass thus prepared to a coking process, substantially as and for the purposes specified.

2. In a machine for the preparation of coal for the manufacture of coke, a revolving screen, in combination with grinding or crushing devices, and perforated pipes or tubes arranged, as specified, to deliver liquid hydrogenous matter to the coal during the grinding operation, substantially as and for the purpose specified.

In testimony whereof I have hereunto set my hand this 6th day of September, A. D. 1883.

ISAAC M. KELLEY.

Witnesses:
JAMES MILHOLLAND,
W. B. CORWIN.