

G. KOMAREK.

BRIQUET MACHINE.

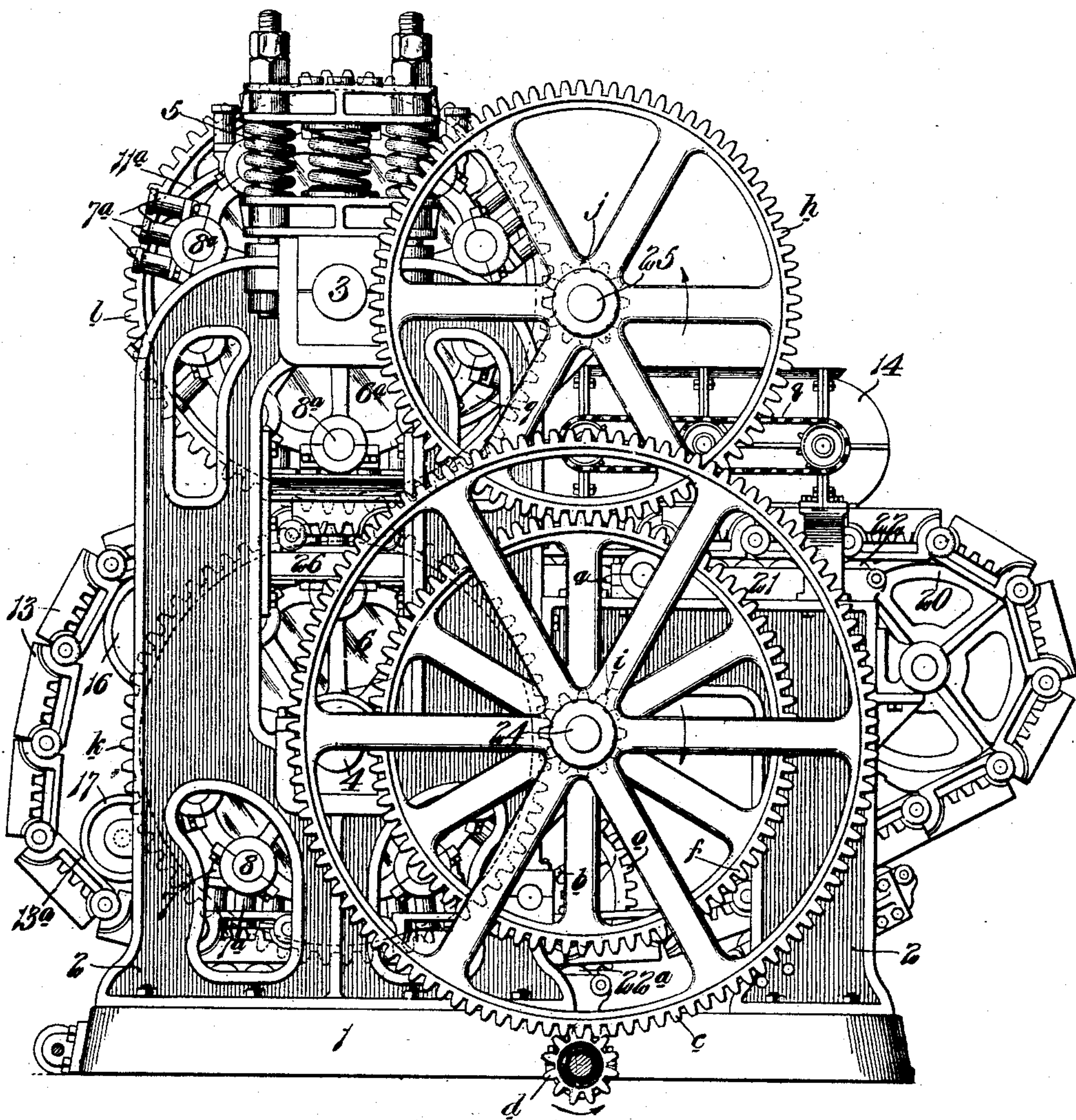
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969,540.

Patented Sept. 6, 1910.

6 SHEETS—SHEET 1.

*Fig. 1.*



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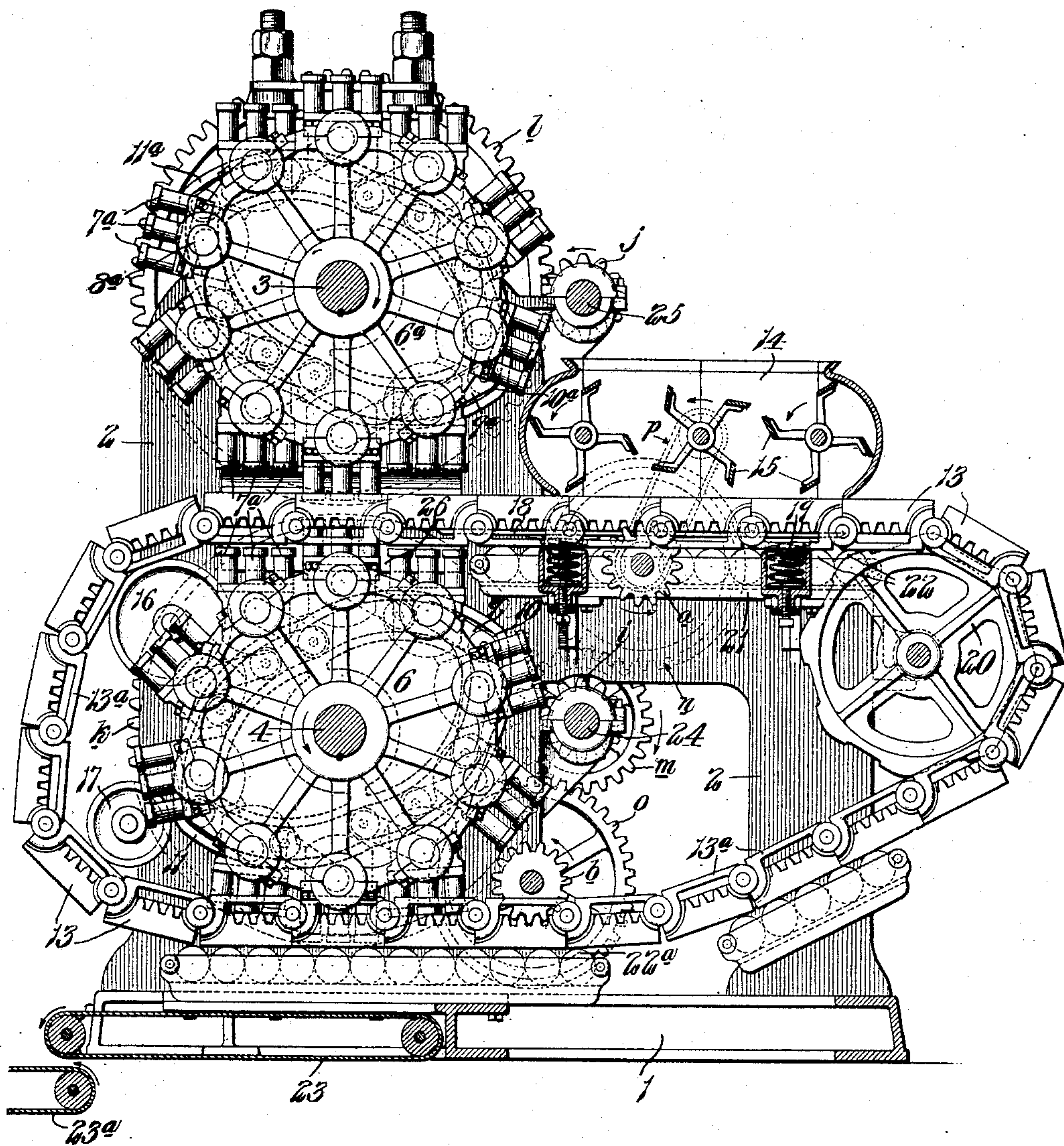
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6 SHEETS—SHEET 2.

Fig. 2.



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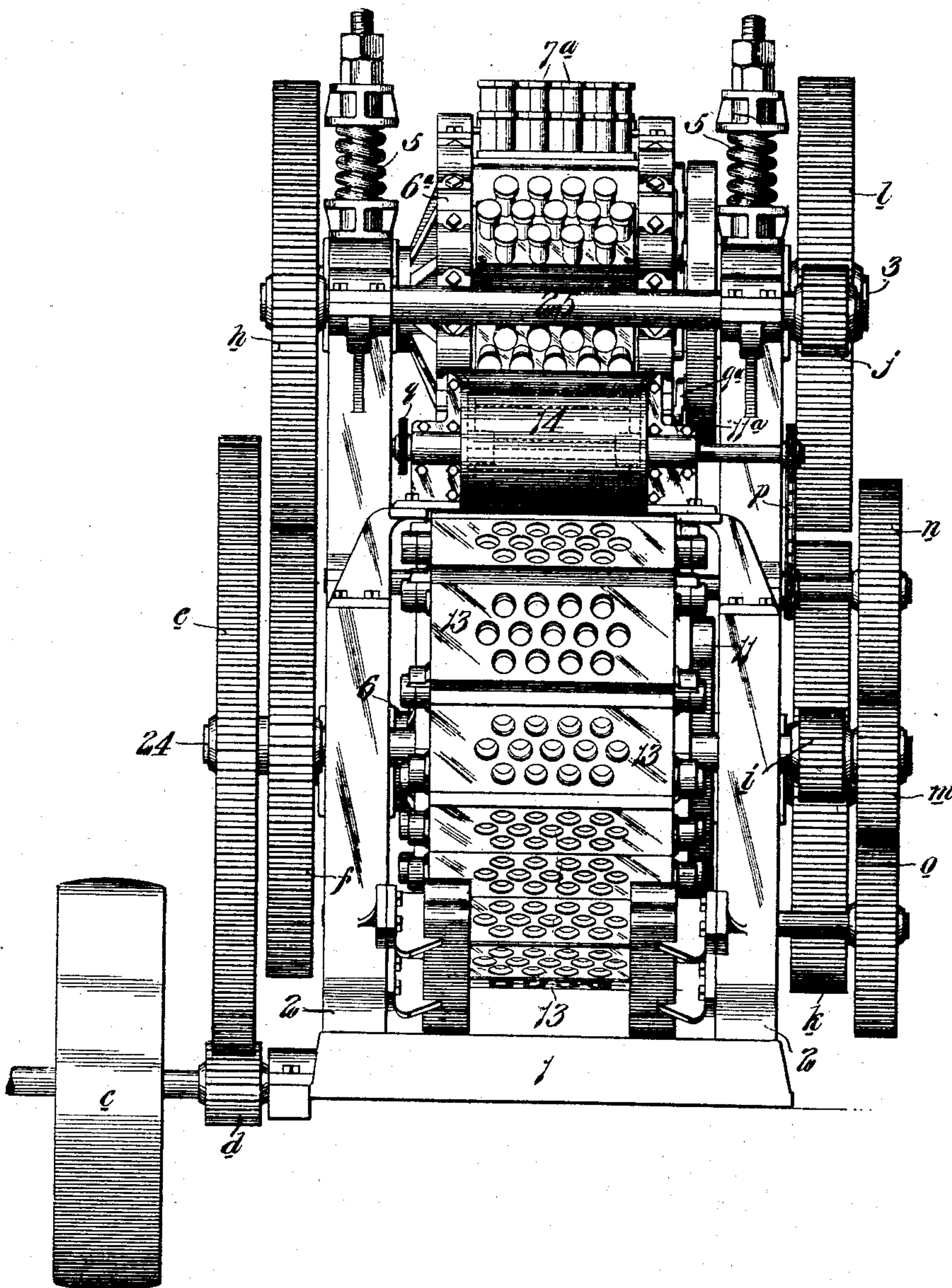
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6 SHEETS—SHEET 3.

*Fig. 3.*



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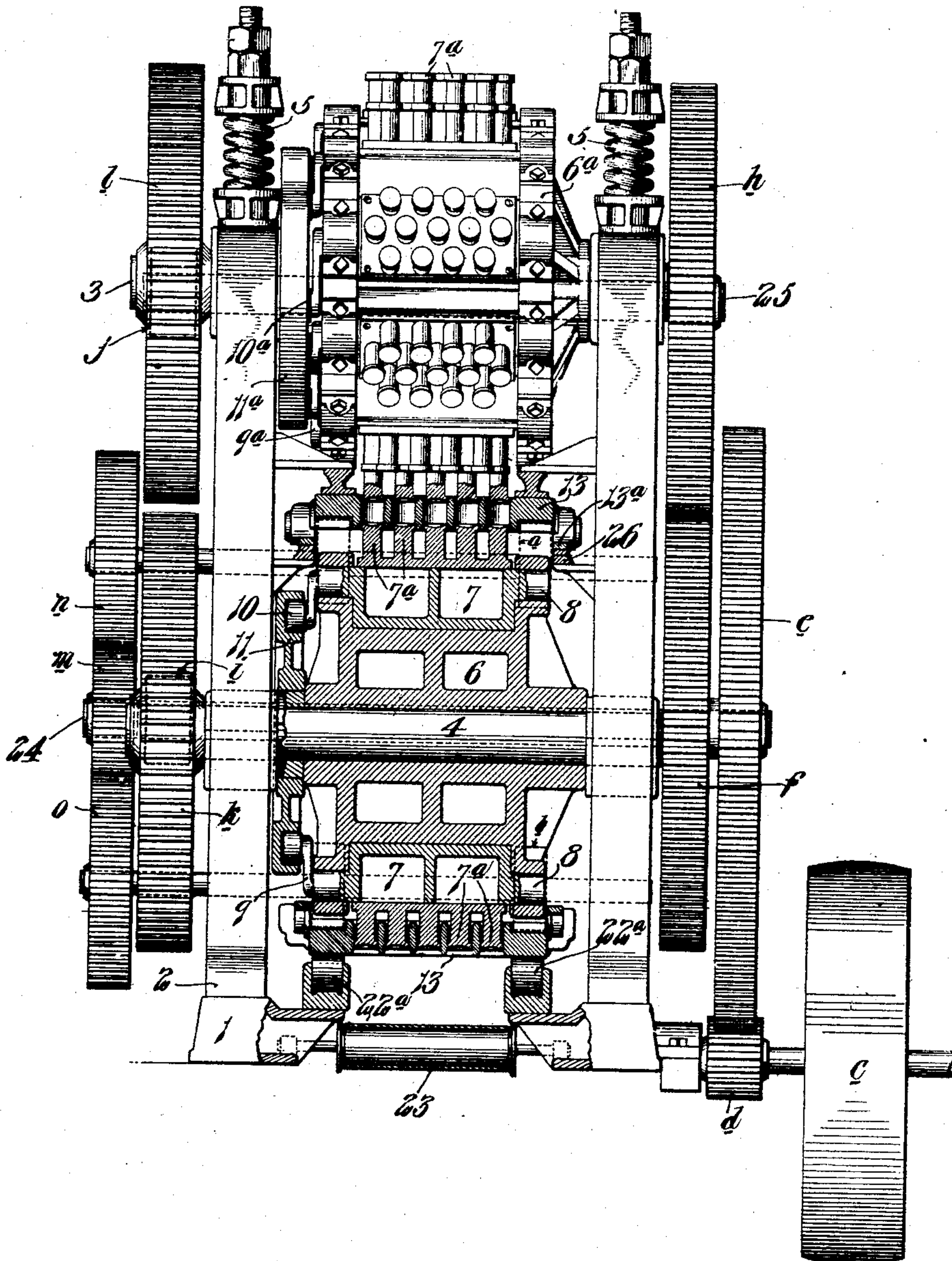
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6 SHEETS—SHEET 4.

Fig. 4.



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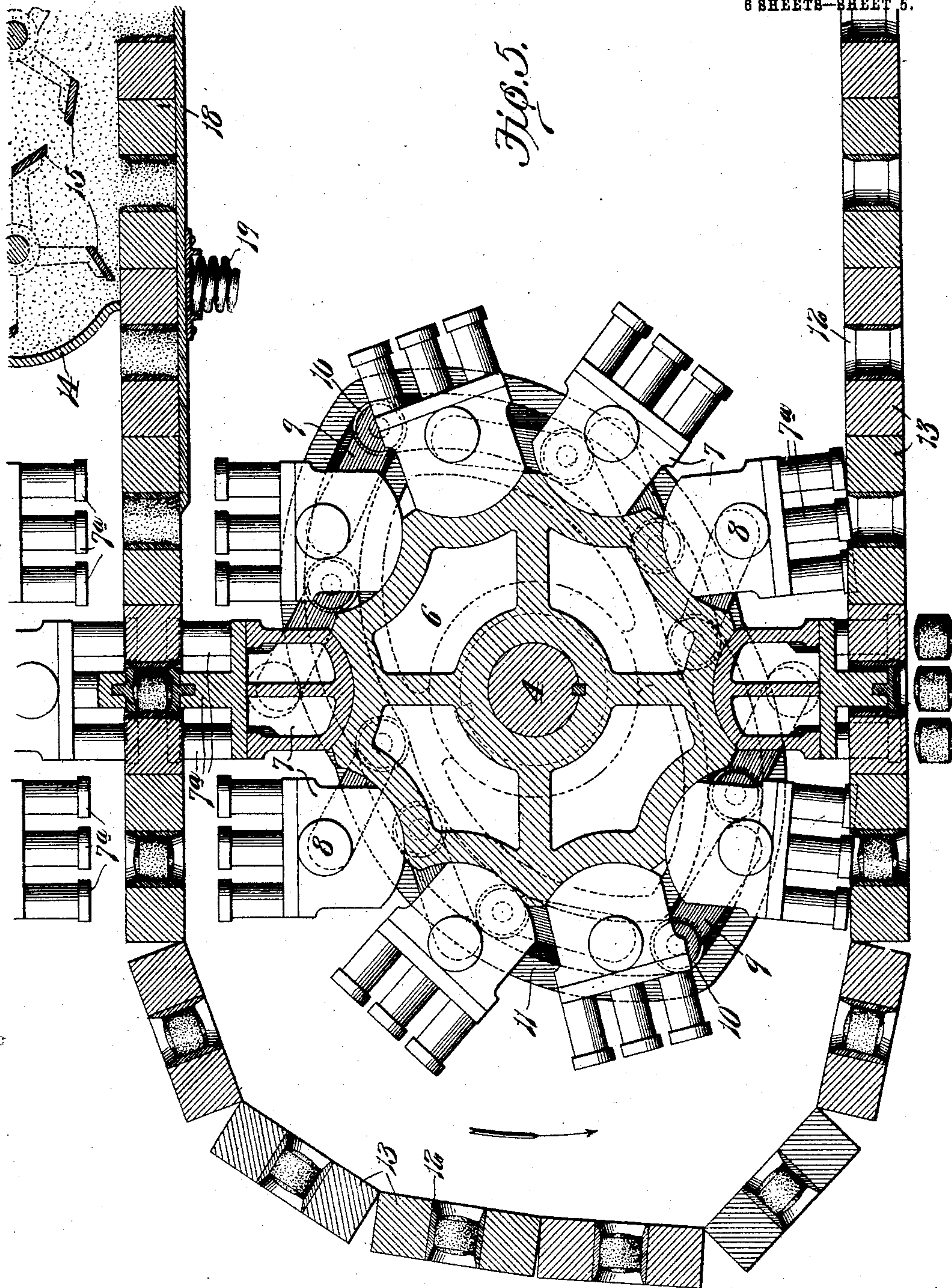


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6 SHEETS—SHEET 5.



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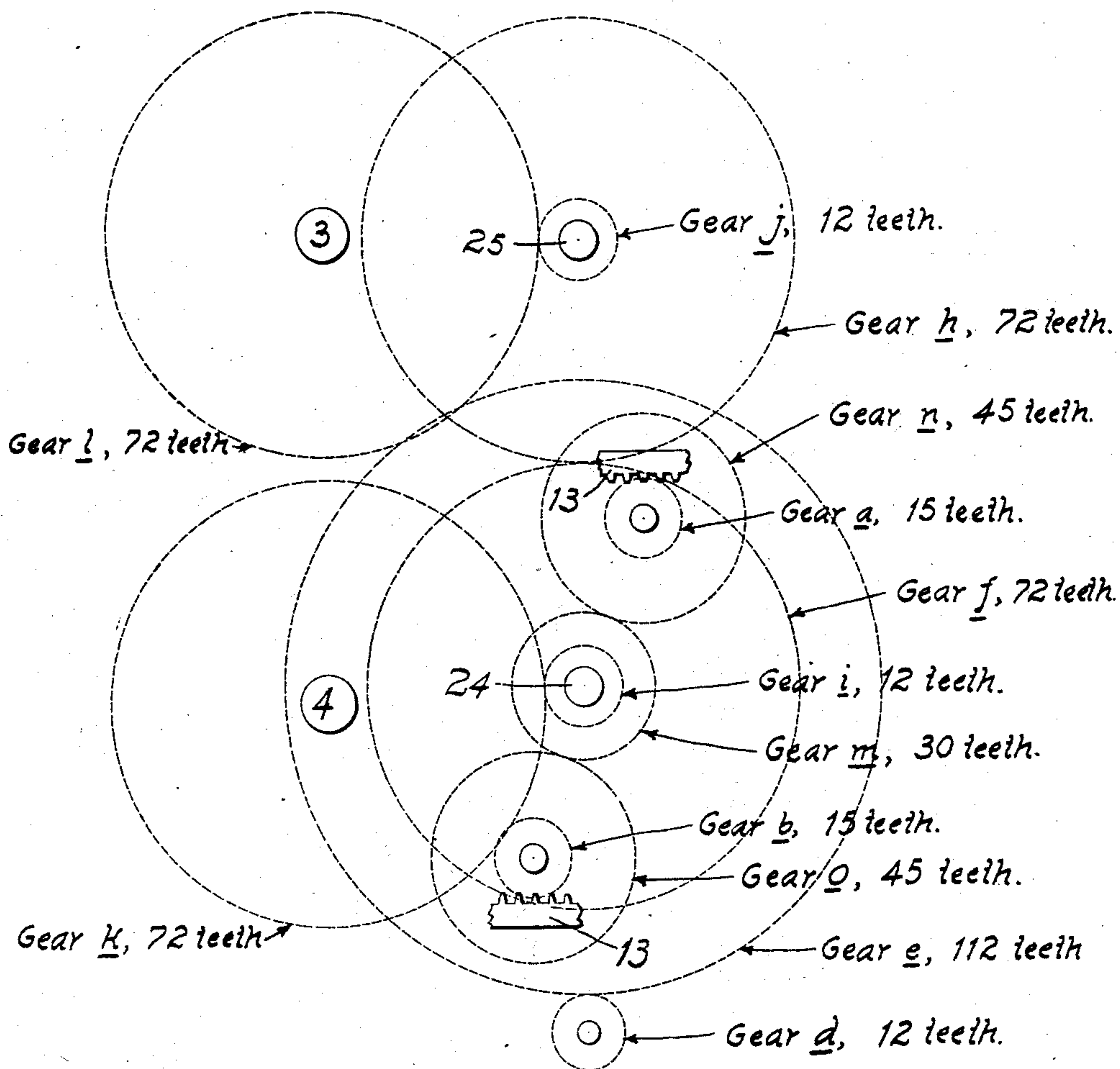
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6 SHEETS—SHEET 6.

FIG. 6.



WITNESSES

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# UNITED STATES PATENT OFFICE.

GUSTAV KOMAREK, OF ST. LOUIS, MISSOURI.

## BRIQUET-MACHINE.

969,540.

Specification of Letters Patent.

Patented Sept. 6, 1910.

Application filed December 21, 1908. Serial No. 468,494.

*To all whom it may concern:*

Be it known that I, GUSTAV KOMAREK, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Briquet-Machines, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a side elevational view of my improved briquet machine; Fig. 2 is a similar view with the near side frame removed so as to show the interior construction; Fig. 3 is an end elevational view, as seen from the rear; Fig. 4 is a similar view, partly in vertical section, as seen from the front; and Fig. 5 is an enlarged detail view. Fig. 6 is a diagrammatic view, illustrating the gearing and the number of teeth on the several gears.

This invention relates to a new and useful improvement in briquet machines.

The object is to construct a machine of the character described so that its capacity will be so great that it can be profitably operated to use up the waste product which, in certain coal mines, is discarded because the difference in price between the slack coal and the "run-o'-mine" or lump coal is not great enough to warrant the sending of the slack coal to market. The freight charge is frequently the element which determines the value of this slack coal which might be considered wasted at the mines.

Another object of my invention is to construct a briquet machine which will be simple and strong, requiring comparatively a small horse power for its operation.

With these objects in view, the invention consists in the construction, arrangement and combination of the several parts, all as will hereinafter be described and afterward pointed out in the claims.

In the drawings, 1 indicates a base casting and 2 are the side frames of the machine.

3 and 4 are cross shafts mounted in suitable bearing boxes in the side frames 2, the caps for the bearing boxes of shaft 3 being held in position by the yielding pressure of springs 5 which cooperate therewith in a well known manner (see Fig. 1). The ob-

ject of this yielding bearing, the pressure of which is preferably adjustable by means of nuts cooperating with a spring yoke arranged above the springs, is to permit shaft 3 and its carried parts to be lifted vertically to avoid damage to the plungers or die recesses in the event that a noncompressible substance is introduced into the machine. Also if the die recesses are overloaded and the plungers cannot operate to their normal extent shaft 3 and its carried parts may yield.

Referring to Fig. 5, which is an enlarged detail view of the parts carried by the shaft 4, it will be seen that there is a cylinder 6 keyed to shaft 4, the surface of which cylinder is formed with a series of curved longitudinally disposed grooves constituting seats in which are arranged plunger-heads 7. These plunger-heads are provided with trunnions 8, which trunnions find bearings in the flanges of the cylinder 6 (see Fig. 4). A trunnion for each plunger-head is provided with a crank extension 9 whose end terminates in a roller 10, said roller being arranged in the groove or runway of a cam 11, which cam is fixed against rotation to the journal bearing in which shaft 4 is mounted.

Each plunger-head 7 is provided with a plurality of plungers 7<sup>a</sup> which operate in the mold cavities of the molding plates. The recesses or seats in the periphery of cylinder 6, and the cooperating faces of the plunger-heads, are preferably on arcs of a circle described from the centers of the trunnions 8, so that in operation when pressure is exerted upon the briquet being formed in the mold, said pressure will be in a direct line throughout that portion of the circle of movement of cylinder 6 in which pressure is exerted upon the briquet.

The cylinder which is keyed to shaft 3, the plungers, their method of mounting, and the cam with which they cooperate are substantially the same as those above described, and to save repetition the same reference numerals have been applied followed by the letter "a".

The mold cavities in which the briquets are formed are preferably circular, their end walls being made flaring, as shown in Fig. 5. These cavities are formed by arranging suitable bushings 12 in openings in plates 13, said plates being connected to



gether in such manner that they form links of an endless chain.

The source of supply for the coal which has been previously treated for the purpose of being pressed into briquet form is preferably located above my improved machine, the material to be operated upon being led by a suitable chute into a chamber 14 (see Fig. 2) in which chamber are arranged revolving blades or angled flights 15 all preferably rotating in the direction of the arrow, and against the endless chain containing the mold cavities. These revolving blades 15 not only serve to agitate the material and prevent it from becoming caked in this chamber, but they also serve to force said material into the mold cavities, and, on account of their angularity, smoothing said material into said mold cavity like a trowel would be operated to lay mortar. By this arrangement the mold cavities are uniformly loaded, the material being compacted in each cavity at approximately uniform density.

The plates 13 of the endless chain containing the mold cavities constitute the bottom of the chamber 14, this endless chain being advanced continuously by means of pinions *a* and *b* which engage gear teeth formed on the ends of the plates 13. Plates 13, as shown, are pivotally connected together at their inner contiguous edges. Each plate is provided with a track extension 13<sup>a</sup> by which the plates, with the compressed briquets in their mold cavities are deflected out of engagement with the bottom plungers by means of idlers 16 and 17. The plates cooperate with said bottom plungers a second time, the second entry of the bottom plungers being for the purpose of discharging the formed briquet, as shown in Fig. 2.

A plate 18 (see Fig. 5) held yieldingly against the bottoms of the plates 13 by means of springs 19, as said plates 13 pass under the cavity 14, forms the bottom wall of the mold cavities during the time that the material is being forced thereinto. The springs 19 produce a tight joint not only between the plate 18 and the endless chain, but also between the endless chain and the end and side walls of the chamber 14.

To support and properly position the endless chain at the front end of the machine, a sprocket wheel 20 is provided. To support the weight of the chain as it passes under the chamber 14, and also to serve as a backing for the springs 19, I provide two trough-shaped boxes 21 (one of which is shown in Fig. 2), in which are arranged antifriction rollers 22, said rollers being prevented from escaping by the end walls of the trough-shaped box 21. Similar trough-shaped boxes containing antifriction devices are provided for the endless chain at the lower

portion of the machine, these antifriction devices being preferably in the form of rollers 22<sup>a</sup>, as shown in Figs. 2 and 4.

23 represents a short conveyer belt on which the formed briquets are discharged through the mold cavities by means of the bottom plungers, said conveyer belt in turn discharging said briquets onto another conveyer belt 23<sup>a</sup>, which latter may pass through a drier or convey said briquets wherever desired.

The power for driving the several parts of my improved machine is transmitted preferably by means of a belt to a pulley *c* which is conjoined to a pinion *d* meshing with a gear *e* on shaft 24. Gear *f* meshes with a companion gear *h* of the same diameter mounted on a shaft 25. Shafts 24 and 25 carry pinions *i* and *j*, respectively, which mesh with gears *k* and *l* pinned to the shafts 4 and 3.

From the above description it will be observed that it is possible to use a high speed motor with my improved machine, the gears above described cutting down the speed and proportionately increasing the power of the machine. It is intended that gears *k* and *l* which drive the shafts 4 and 3 shall be rotated about eight revolutions per minute. The shaft 24 also carries a gear *m* which meshes with gears *n* and *o* for driving the pinions *a* and *b* heretofore referred to. Pinion *a* has a sprocket wheel mounted on its shaft, which, by means of a chain *p*, drives the intermediate reel carrying the blades 15. The reels on each side of the intermediate reel are driven by a chain *q* passing over a sprocket on the ends of their shafts, as shown in Fig. 1.

The operation of the machine above described is as follows: The material to be compressed into briquet form is treated and fed to the chamber 14 where it is pressed into the mold cavities by means of the revolving angled flights. The endless chain containing the mold cavities is advanced by a continuous movement, the rear edge of the chamber 14 serving as a wiper to sweep off all surplus material from the upper surface of the chain as it leaves said chamber. The filled molds move rearwardly until they leave the plate 18. The material is so compacted in the mold cavities by the blades 15 that it will not fall out of the cavities after leaving the plate 18. The top and bottom plungers are projected into the mold cavities from above and below while the endless chain travels in a straight line. When the plungers are withdrawn the links of the chain, which have up to this time been supported by tracks 26 arranged on brackets inside the side frames 2, and which tracks cause the links of the chain to travel in a straight line, are caused to move in a downward path over the idler 16 and around and under the idler



17, where the chain is caused to travel in a straight path by means of the antifriction rollers 22<sup>a</sup> for some distance under the bottom plungers. The cam 11 is so shaped that the bottom plungers are caused to reënter the mold cavities, this time from above, and discharge the compressed briquet onto the belt 23. I have shown no means for driving either of the belts 23 or 23<sup>a</sup>, but it is obvious that suitable driving mechanism will be provided for these conveyers. After discharging the briquets, the bottom plungers are withdrawn, and the endless chain then continues advancing until it passes up and over the sprocket wheel 20, when it is caused to travel in a straight path through the bottom of the chamber 14 and between the plungers, as before described.

The cams 11 and 11<sup>a</sup> heretofore referred to are so constructed that in the revolution of the top and bottom plungers 7<sup>a</sup> said plungers are caused to assume a vertical position as they approach the mold cavities, said vertical position being maintained as the plungers enter into and recede from said mold cavities. This is necessary because of the enormous pressure which is transmitted through these plungers in compressing the briquets, which pressure is best transmitted with the briquets in alinement with each other. The approach of the top and bottom plungers toward each other in curved lines causes them to gradually compress the material in the mold cavity in a manner similar to the pressure exerted by toggle levers, and when the plungers are in alinement with the shafts 3 and 4 it is equivalent to a line of "dead centers" in a toggle movement. Passing this central line, the top and bottom plungers gradually recede from the molds, but their work is done. The briquet will naturally recover somewhat after being subjected to the greatest pressure of which the machine is capable, but such recovery or swelling is negligible.

The machine illustrated in the accompanying drawings is designed to compress thirteen briquets simultaneously, this being the number of mold cavities in each plate 13. Each briquet is intended to have a diameter of approximately 3 1/4 inches, and a thickness of about 3 inches between the surfaces of greatest convexity. Each briquet will weigh approximately 17 ounces, and driving the shafts 3 and 4 at eight revolutions per minute will enable the machine to turn out over 33 tons of briquets (about a car load) per hour. As mines are operated usually by different shifts of workmen, the machine can be operated day and night, and in twenty-four hours operating at the speed above mentioned about 795 tons or 1,591,200 pounds of briquets will be turned out per day. The plungers enter the mold cavities about one and one-eighth inches and before

they meet any considerable resistance they will be approximately within one quarter of an inch of their full stroke, and consequently the variation in speed between the die plates and the plungers will be so small as to be negligible. As the plungers approach their final limit of movement the fact that there are a plurality of plungers on each of the plunger heads 7, tends to force the plungers into perpendicular relation to the die plates, which results in a slight forward movement, and this slight movement is compensated for by the looseness in the pivotal connection between the die plates, which lost motion between the die plates is thus taken up. The rack teeth on the die plates and the teeth on the pinions which drive them are also fitted to permit of this slight independent movement of the die plates.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a briquet machine, the combination with top and bottom pivotally mounted plungers, mold carriers moving continuously in one direction between said plungers, and means for differentially and positively moving said plungers about their pivotal axes, whereby the bottom plungers are caused to enter and recede from the cavities in the mold carriers in substantially perpendicular position, and at different points in the travel of said carriers to first form and then subsequently discharge briquets.

2. In a briquet machine, the combination with top and bottom pivotally mounted revoluble plungers, one set of said plungers being yielding, mold carriers moving continuously in one direction in the path between said plungers, and means for differentially and positively moving said plungers about their pivotal axes, whereby the bottom plungers enter into and recede from the cavities in the mold carriers in substantially perpendicular position, and at different points in the travel of said carriers to first form and then subsequently discharge briquets.

3. In a briquet machine, the combination of top and bottom pivotally mounted revoluble plungers, means for driving them, an endless chain of mold carriers passing between said plungers and in the mold cavities of which said plungers compress the material, and means for moving said plungers about their pivotal axes, whereby the bottom plungers enter into and recede from said mold carriers, with their axes substantially in alinement at different points in the travel of said carriers, to first form and then subsequently discharge briquets said plungers and carriers traveling together while in such coöperative relation at uniform speed.

4. In a briquet machine, the combination



of top and bottom pivotally mounted revoluble plungers, an endless chain of mold carriers passing between said plungers, means for filling the cavities in said chain  
 5 before the plungers enter the cavities, and means for causing the bottom plungers to enter into and recede from the mold cavities at different points in the travel of said carriers, to first form and then subsequently  
 10 discharge briquets while standing substantially perpendicular to that part of the chain with which said plungers cooperate.

5. In a briquet machine the combination with an endless chain of mold plates pivotally connected together and having movement independent of each other, pivotally mounted revolving plungers adapted to enter  
 15 said mold cavities in said plates at different points to compress and then discharge the briquets, the play between the plates compensating for differential horizontal travel of the plungers and plates, and means for positively rocking said plungers on their  
 20 pivotal axes.

25 6. In a briquet machine, the combination with an endless chain of mold plates pivotally connected together, and having play between the plates, means for driving said plates, pivotally mounted top and bottom  
 30 revolving plungers cooperating with each other in the formation of briquets in the mold cavities in said plates, said bottom plungers discharging said briquets, and means for positively swinging said plungers  
 35 on their axes as they revolve, the play between the plates compensating for the difference in the speed of horizontal travel between the plungers and the plates.

40 7. In a briquet machine, the combination with a cylinder, having curved seats in its periphery, trunnion bearings at each end of said curved seats, plunger heads mounted in said seats and having trunnions mounted in said bearings, a stationary cam adjacent  
 45 said cylinder, and an arm extending from one of said trunnions and cooperating the said cam to positively rock the plunger heads in their seats.

50 8. In a briquet machine, the combination with the walls of a chamber designed to contain the material to be compressed, of a mold carrier constituting the bottom wall of said chamber, and angled flights in said  
 55 chamber said flights revolving about a horizontal axis for agitating the material and forcing it into the cavities in said mold carrier; substantially as described.

60 9. In a briquet machine, the combination with the walls of a chamber designed to contain the material to be compressed, a mold carrier in the form of an endless chain of plates continuously moving under the  
 65 bottom of said chamber and constituting the bottom wall thereof, means for forcing the material in said chamber into the mold

cavities, said means comprising angled flights revolving about a horizontal axis and means for exerting a yielding pressure to hold said plates up against the walls of said  
 70 chamber; substantially as described.

10. In a briquet machine, the combination with the walls of a chamber designed to contain material to be compressed, of a mold carrier in the form of an endless chain of plates pivotally connected together,  
 75 means for agitating the material in said cylinder so as to fill said mold cavities, said means comprising angled flights revolving about a horizontal axis and a spring-pressed plate arranged under the mold cavities being  
 80 filled; substantially as described.

11. In a briquet machine, the combination with a mold carrier in the form of an endless chain of plates pivotally connected together, angled flights for filling the mold  
 85 cavities with the material to be compressed, said flights revolving about a horizontal axis means for compressing said material in the cavities, and antifriction devices for supporting said endless chain; substantially  
 90 as described.

12. In a briquet machine, the combination with an endless chain containing mold cavities, revolving plungers adapted to enter into and recede from said cavities in the  
 95 operation of compressing the material in the cavities, and means for causing said plungers to reënter said cavities for the purpose of discharging the compressed briquet therefrom; substantially as described. 100

13. In a briquet machine, the combination with pivotally mounted revoluble plunger heads having a plurality of plungers, an endless mold carrier consisting of a series  
 105 of plates pivotally connected together, each of said plates having a plurality of cavities for cooperating with said plungers, and means in continuous relation to said plunger heads for rocking them so that the plungers will enter into and recede from the  
 110 mold carriers, substantially perpendicular to the cooperating plate, said parts traveling at uniform speed during said cooperative relation to both form and discharge the briquets. 115

14. In a briquet machine, the combination of pivotally mounted revolving plungers, means in continuous relation to said plungers for positively moving them about their  
 120 pivotal axes to bring them substantially in alinement while operating in the mold cavities to form and discharge the briquets, a series of plates pivotally connected together and constituting an endless chain of mold carriers, each of said plates being provided  
 125 with teeth at each side, and a plurality of pinions meshing with said teeth for driving said chain, whereby the movement of a given plate and its cooperating plungers during their period of cooperation is uniform. 130



15. In a briquet machine, the combination of top and bottom pivotally mounted revolving plungers, means in constant relation thereto to positively rock said plungers about their pivotal axes, so as to bring them substantially in alinement while operating in their mold cavities to form and discharge the briquets, a series of plates loosely mounted together to form an endless chain of mold carriers, each of said plates being provided with a series of mold cavities in which said plungers operate, rack teeth on each of said mold plates, a plurality of pinions engaging said rack teeth so as to drive said endless chain at different points, permitting an independent movement of the plates when in coöperative relation with the plungers.

16. In a briquet machine, the combination with mold plates loosely connected together to form an endless chain, pivoted revoluble plungers, and means moving said plungers on their pivotal axis whereby they stand substantially perpendicular to the mold plate at the time the plungers enter the mold cavities in the formation and discharge of the briquets.

17. In a briquet machine, the combination with mold plates loosely connected together to form an endless chain, pivoted revoluble plungers, and means moving said plungers on their pivotal axis whereby they stand substantially perpendicular to the mold plate at the time the plungers enter the mold cavities in the formation and discharge of the briquets, said plungers, after entering said mold cavities slightly advancing the said mold plate.

18. In a briquet machine, the combination of plates loosely connected together to form an endless chain, groups of mold cavities in said plates, said groups being arranged in two or more rows to the group, and top and bottom pivotally mounted revolving plunger heads, each of which has a plurality of plungers corresponding to the groups of mold cavities in the plates (entire plungers being located on each side of the pivotal axis of said plunger heads), whereby, when any of said plungers meet with resistance they tend to force all of the plungers in that group to assume a perpendicular position with respect to the coöperating mold plate, advancing said mold plate until perpendicularity is reached.

19. In a briquet machine, the combination of pivoted revolving top and bottom plungers, an endless chain of plates containing mold cavities horizontally disposed, angled flights for filling said cavities with material to be compressed, and means for moving said chain past said flights to the action of said plungers.

20. In a briquet machine, the combination

of an endless chain of mold carriers, revolving plungers coöperating therewith to compress the material in said mold cavities, and means for causing said plungers to reënter said cavities to discharge the briquet.

21. In a briquet machine, the combination of revoluble plungers, an endless chain of mold carriers, and means for feeding said chain over said plungers to compress the material in the cavities of the mold carriers, and under said plungers to eject the compressed briquets.

22. In a briquet machine, the combination of pivoted revolving plungers, and an endless chain of mold carriers which passes over and under said revolving plungers in substantially a straight line, said plungers entering the mold cavities at each pass.

23. In a briquet machine, the combination of pivoted revolving plungers, and an endless chain of mold carriers which passes over and under said revolving plungers in substantially a straight line, said plungers entering the mold cavities at each pass, the first time to compress the material in the mold cavities, and the second time to eject the briquet.

24. In a briquet machine, the combination of pivoted revolving plungers, an endless chain of mold carriers which passes over and under said revolving plungers in substantially a straight line, said plungers entering the mold cavities at each pass, and supporting devices on each side of the revolving plungers for moving the chain away from the plungers between the passes.

25. In a briquet machine, the combination of pivoted revolving plungers, an endless chain of mold carriers which passes over and under said revolving plungers in substantially a straight line, said plungers entering the mold cavities at each pass, and means whereby said plungers enter said mold cavities substantially perpendicular thereto.

26. In a briquet machine, the combination of pivoted revolving plungers, an endless chain of mold carriers which passes over and under said revolving plungers in substantially a straight line, said plungers entering the mold cavities at each pass, supporting devices on each side of the revolving plungers for moving the chain away from the plungers between the passes, and means for inverting the plungers between the passes, whereby they enter the mold cavities substantially perpendicular.

In testimony whereof I hereunto affix my signature in the presence of two witnesses, this seventeenth day of December 1908.

GUSTAV KOMAREK.

Witnesses:

F. R. CORNWALL,  
GEORGE BAKEWELL.