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C.G.C. SIMPSON'S

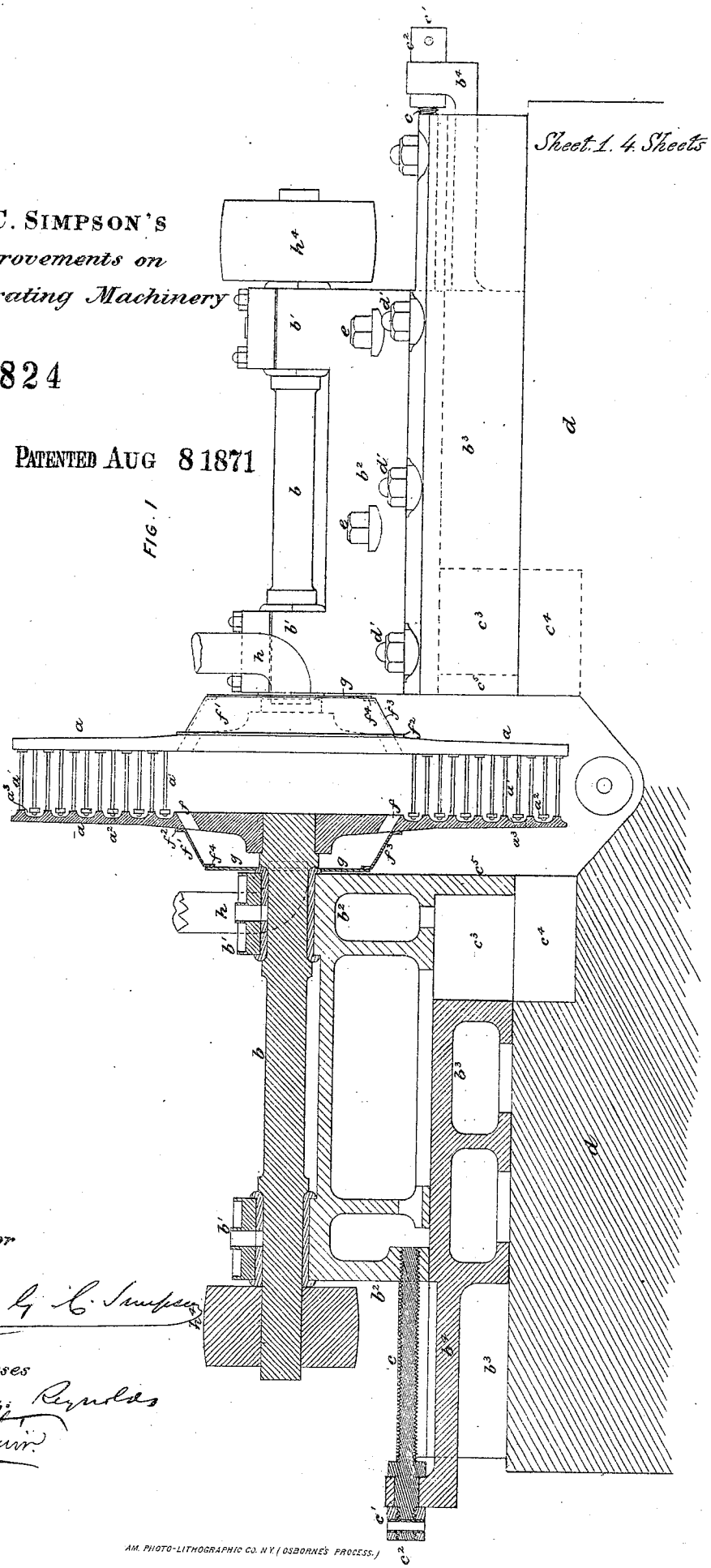
Improvements on

Disintegrating Machinery

117824

PATENTED AUG 8 1871

FIG. 1



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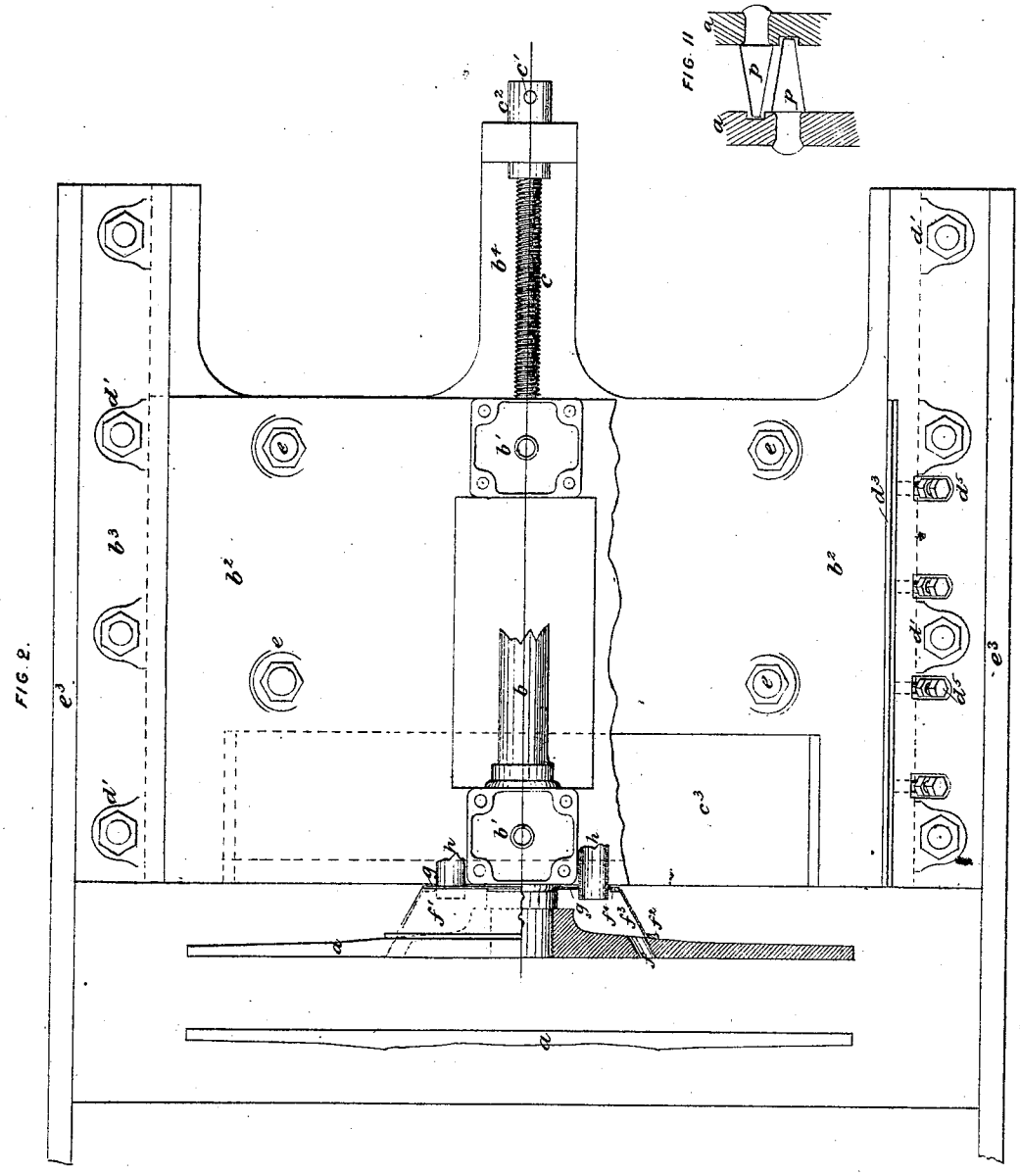

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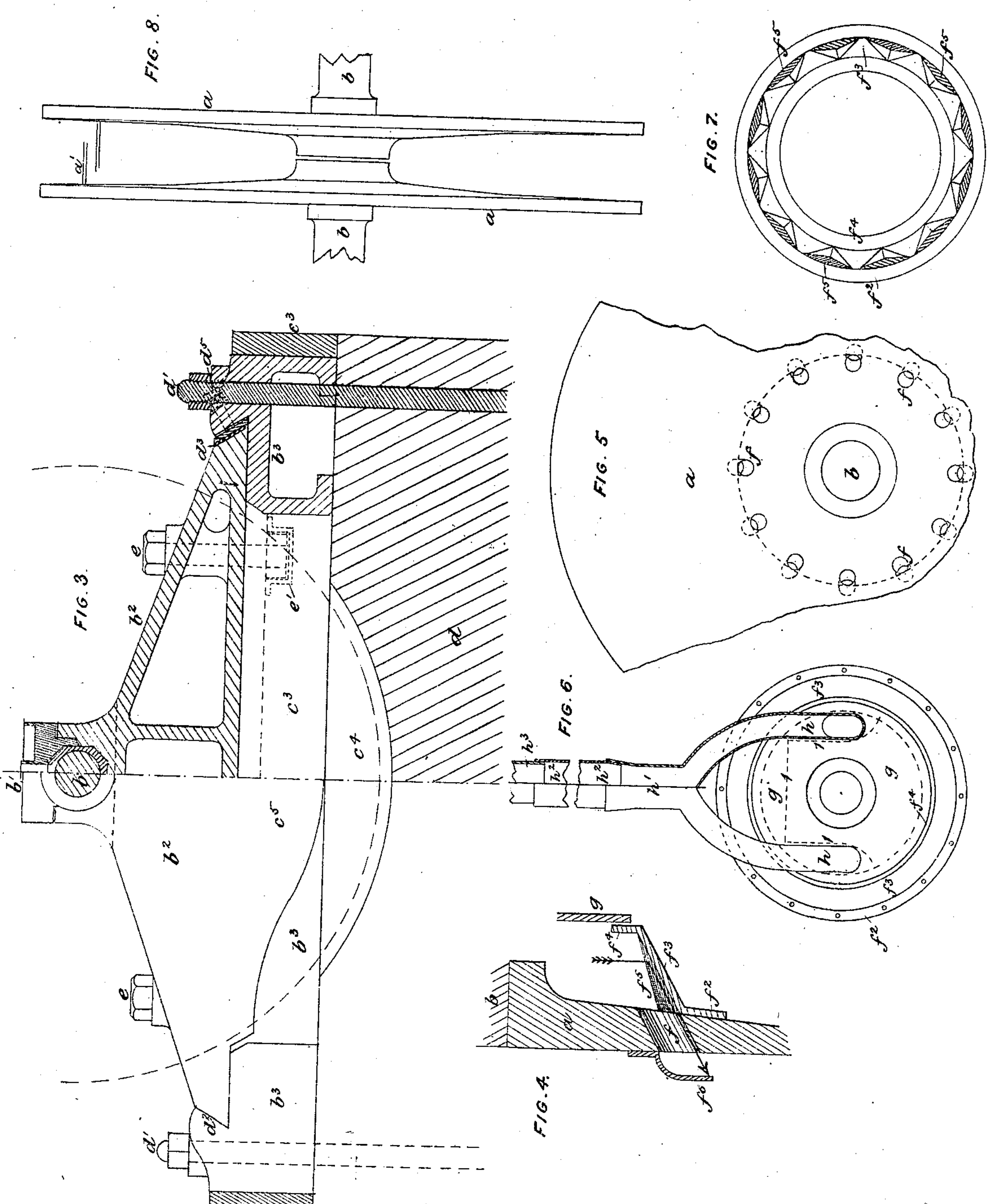

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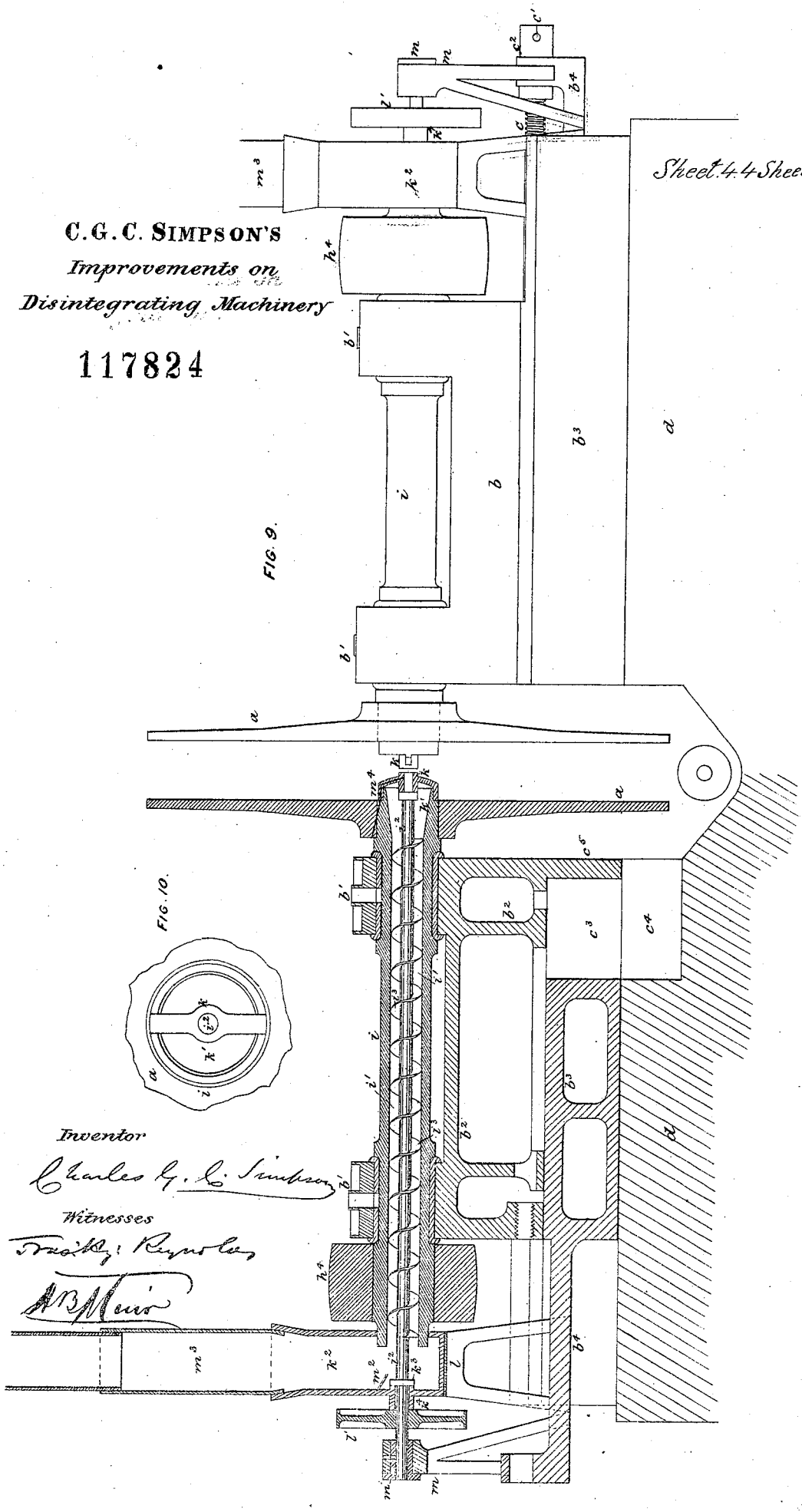

FIG. 9.

FIG. 10.

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UNITED STATES PATENT OFFICE.

CHARLES GRAHAM CHAPPELL SIMPSON, OF MONTREAL, CANADA.

IMPROVEMENT IN APPARATUS FOR DISINTEGRATING SUBSTANCES.

Specification forming part of Letters Patent No. 117,824, dated August 8, 1871.

To all whom it may concern:

Be it known that I, CHARLES GRAHAM CHAPPELL SIMPSON, of the city of Montreal, in the district of Montreal, in the Province of Quebec, Canada, engineer, have invented new and useful Improvements on Disintegrating Machinery; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawing, where—

Figure 1 represents a side sectional and elevational view of my improved disintegrator, first modification. Fig. 2 represents a part plan of Fig. 1. Fig. 3 represents a half-end section and end elevation of bed, &c. Figs. 4 and 5 represent a detail of disks. Fig. 6 represents a detail of casing and feed-spouts. Fig. 7 represents a detail of casing. Fig. 8 represents a detail of disks modified. Fig. 9 represents a side sectional and elevational view of my improved disintegrator, second modification. Fig. 10 represents a detail of shaft end, Fig. 9. Fig. 11 represents a detail of improved bars.

This invention has reference to improvements on disintegrating machinery generally, but more particularly that class invented by Thomas Carr, and for which Letters Patent of the Kingdom of Great Britain and Ireland were granted to him as follows: No. 778, 29th day of March, A. D. 1859; No. 3,235, 22d day of October, A. D. 1868; No. 1,895, 29th day of December, A. D. 1870; and No. 2,149, 29th day of December, A. D. 1870, and for which also various patents have been obtained in many other countries.

The invention, for which a patent is now sought consists of various improvements, hereinafter described, on these so patented machinery for the following purposes: First, to obviate the large amount of very accurate workmanship essentially necessary to enable Carr's machine to work without endangering the lives of those employed about it, as also for the safety of the machine itself and the building in which it is placed. Secondly, to produce a machine capable of being taken apart and put together or transhipped without extraordinary care to prevent its being injured. Thirdly, to produce a machine having the above advantages at a less cost in price. Fourthly, to produce a machine that the inner or disintegrating-bars may be got at in case of any foreign substance having entered the machine and injured any of them, (or any other circumstance that may cause them to require examination,) without lifting the shafts and disks out of the bearings. Fifthly, to produce a better form of bar, or one capable of being easily removed and replaced.

My first improvement consists in making each disk in one solid plain piece attached directly on the main shaft. These can only be injured by a blow of such force as will bend either the disk or the shaft carrying it. This arrangement also obviates the large amount of overhang of one of the disks, and consequent tendency to friction and heating of the adjoining bearing.

My second improvement consists in bringing the material to be disintegrated through openings made in the disks by first introducing it into a casing revolving with the disk and secured to it. This I call my first modification.

My third improvement consists in bringing the material to be disintegrated into the machine by providing it with hollow shafts and various other arrangements, hereinafter described, to accomplish that object. This I call my second modification.

My fourth improvement consists in making the bed in three or four parts, one or two attached securely to the mason-work bed, and forming guides for the other two parts of the bed which hold the shafts to slide upon, after the fashion of a slide of a lathe, to enable the disks to be moved apart when required without the shafts and disks being lifted.

My fifth improvement consists in a new form of bar, constructed of such figure as to stand on the revolving disk by itself and withstand the centrifugal force, together with the strain caused by disintegrating, doing away with the steel ring heretofore required, and allowing any one particular bar to be removed without disturbing any of the remainder, thus saving much trouble and expense in repairing.

It may be well here to remark that the above improvements may be used separately, or those contained in the first modification may be combined in any machine with all the others, except those mentioned in the second modification, and comprised under the head of my third improvement.

In like manner my second modification may be used alone or in combination with all the

other improvements mentioned above, except those described under the head of my second improvement or first modification.

In the drawing hereunto annexed similar letters of reference indicate like parts.

Describing the improvements under my first head, and referring to Figs. 1, 2, 3, 4, 5, 6, 7, and 8, *a* are two disks, made, preferably, of best hammered iron or steel, and of suitable size and strength for the work they are to be employed in. As shown in Fig. 1, they are provided with bars a^1, similar to those employed by Carr, their ends being attached together by steel rings a^2, with a recess, a^3, cut in the opposite disk, opposite each, to enable them to enter a short distance within the disk. Each of the disks *a* is made in one piece and concentrically secured on a stout steel or iron shaft, *b*, carried in suitable bearings, b^1, formed in a movable portion of the bed or "saddle" b^2.

My improvements under the fourth head are as follows: The saddles are made, as shown in Figs. 1, 2, and 3, to slide in the sub-beds b^3, in the manner so clearly shown as to require no further explanation than to say that b^4 are projections of the bed, either cast in one with it, as shown in the drawing, or attached by flanges and bolts in the ordinary way, and arranged to hold a jack-screw, *c*, with any suitable thread, working into the saddle correspondingly screwed or into a nut arranged in it, the screw being actuated by any suitable lever introduced into the hole c^1 in the head c^2; or this end of the screw may be provided with a ratchet, and the lever working it with a double pawl, as commonly used in engine-lifting jacks. The bed b^3 is formed with a recess, c^3, opposite the disk, and correspondingly extended in the masonry at c^4 to give it sufficient size, so that when the saddle is drawn back by the screw *c* sufficient room may be had for the disks to retire into. To compensate for the unsupported center part of the saddle when in position, caused by this recess, the saddle is provided with a strong deep flange, c^5, forming its end in that direction and extending below it, as shown in the drawing. The masonry bed *d* is built preferably of large blocks of stone put together in the best form to resist vibration; on this the sub-bed b^3 is bolted with any suitable bolts, d^1. The grooves in the sub-bed in which the saddles slide are shown at d^2. One of these is removed back a sufficient distance to leave room for the introduction of a strip of hard wood, d^3, and back strip of steel; these are pressed forcibly and made to hold the saddles laterally when in place by any suitable "set-bolts," d^5, the strip of wood being used to give a sufficiently yielding or elastic substance to prevent damage to the sub-bed by expansion from heat, should the journals in the bearings, by accident, heat and cause the saddle slightly to expand. The bolts *e* are also provided for more firmly securing the saddles on the sub-beds after they are in place. They are arranged with the heads of the bolts above and the nuts under the sub-bed, the nuts being put in place and secured there by any suitable caps, e^1, attached by flanges and tap-bolts to the under side of the bed before the same is laid upon the masonry. The caps e^1 do not, however, hold the nuts rigidly, being only of such size as to prevent the nuts from getting away from the bolt when it is introduced to connect with it, and to prevent the nuts from turning round, and by this means, when the bolts *e* are withdrawn and those of d^5 slackened back, the saddles are free to slide by action of the screws *c*. If desired, the nuts and caps e^1 may be dispensed with and the hole in the bed screwed to receive the end of the bolt. The sub-bed, made in two parts, is connected together by any suitable wale-piece, e^3, as shown in Figs. 2 and 3, extending between and secured to each; or the sub-bed may be made in one, if desired, the only objection being the difficulty of casting so large a mass in one.

The improvements under the second head are as follows: In the disks *a*, constructed as before described, openings *f* are formed, as shown most clearly in Figs. 4 and 5, as suitable to a machine for manufacturing flour, or disintegrating seeds generally, or other substances of but small size; but these openings may be increased in size and decreased in number to provide a sufficient space for such substances as broken or partly-crushed ores, without materially diminishing the strength required for the disks. On the back of each disk a casing, f^1, is placed. The details of their construction are shown in Figs. 4, 6, and 7, also in other figures. They consist of an annular flange, f^2, attached by tap-bolts to the disks, and of such diameter that they inclose the whole of the holes *f*, as shown by the large dotted circle in Fig. 5, this flange being put on concentrically with the disk. From it springs an inclined side, f^3, being at any suitable angle, for the purposes hereinafter described; this terminates in an annular flange, f^4, at right angles to the line of the shaft. This casing is best made of wrought-iron or steel, and turned up true on all sides, after which flat semi-pyramidical pieces, f^5, of any suitable substance, such as cast or wrought-iron, will be introduced and fitted to the inner side of the inclined side f^3, and attached in position by tap-bolts passing through f^3 and screwed into f^5; these are, in number and situation, so placed that they form a double incline between each of the openings *f*; or the pieces f^5 may be, if preferred, made in one, with the inclined side f^3. f^6 are guards, attached in any suitable manner at the inner side of the openings *f* to prevent the material passing through them, being thrown too much on the surface of the opposite disk. By referring to the drawing it will be seen that this revolves in very close proximity to the end of the saddle. To inclose the casing, a stationary plate, *g*, (if preferred made in halves, but shown in the drawing as one,) is attached to the saddle by brackets or in any other suitable manner. The face of the plate *g* presented toward f^4 is turned or planed to a true surface, and it is supported as closely as possible to it, as shown in Fig. 4, without actually touching it. In Fig. 6 the dotted lines 1 1 1 represent the outline of the bearing formed by the end of the saddle,

while the dotted circle indicates the inner circumference of f^4. It will, therefore, be seen that there is room for the introduction of two branches, h, of a feeding-spout, h^1, into each of the casings f^1 through the plate g. The branches h, formed as shown in the drawing, do not obstruct the free lubrication of the shaft, and are attached firmly by strips or brackets to the adjacent part of the saddle. The upper end of the spout h^1 is splayed to form a matrical reception for the male end of a telescopic extension, h^2, of the spout; this connects with and slides upon any suitably-formed spout, h^3, leading from a general receiving or supply-chamber above. The spouts h h^1 h^2 h^3 will be made, preferably, of sheet-iron or copper, and will be provided with one or more stop-valves or slides to regulate the supply of material to be disintegrated. By the arrangement of the spout as above, when it is desired to stop the machine and move back the disks, shafts, and saddles, it is only necessary to stop the supply by valve or slide above, slide up the telescopic part h^2 on the fixed part h^3 a sufficient height to clear the disk, which may then be moved, the parts h h^1 traveling with it. As in Carr's invention, the shafts b are driven by pulleys h^4, but the heavy counterbalancing wheels he uses are done away with by making the pulleys solid. The machine is also inclosed in a suitable casing, as in the previous invention, and any suitable means are provided, as in analogous cases, by which the material is removed as it descends and settles at the bottom of the recess in which the disintegrator works. Fig. 8 shows the disks arranged the reverse way for the purpose of giving more room within the casings f^1 and utilizing the waste space within the center of the machine, which is so obvious as to require no further explanation, and may be applied in either of my modifications to diminish the overhang of the disks from the bearing. The improvements under the last-described head operate as follows: The disks being set in motion in contrary directions and at the required speed for the work to be accomplished—say, for flour, eight hundred revolutions per minute—the material is allowed to enter the casing f^1 by the spouts h h^1, &c., and, falling by gravity, comes in contact with the inclined side f^3 or the inclined surface of f^5, and is at once induced to partake of the revolving action of the parts. Any particles rebounding in this operation are prevented leaving the casing by the plate g. No sooner do the particles, grains, or masses thus revolve with the casing than centrifugal force induces them to seek the largest circle in which they can revolve, as indicated by the arrow in Fig. 4; they are thus caused to come in front of the openings f (which are also inclined from the center of revolution) with immense force. The guard f^6 prevents them from striking against the opposite disk, as before mentioned. Proceeding onward, they meet the bars a^1, and are acted upon as in other similar machines.

The improvements under the third head or second modification are as follows: The disks are the same as in my first modification in every respect, except that the openings f are dispensed with, as also the casing f^1, and spouts h^3, h^2, h^1, and h, the other parts also remaining the same, as hereinbefore described, but with the following exception and other necessary adaptations well understood to be required: The saddles b^2 are arranged with bearings to carry shafts i of greater external diameter. These shafts are made hollow by boring them out, but leaving a sufficient amount of material to give the required strength to carry the disks. In the bore i^1, and concentric with the shaft, a spindle, i^2, is placed, and supported by providing the end of the shaft with a socket, k, screwed on the end of the shaft projecting through the disks or otherwise securely attached to it. On the spindle i^2 an Archimedean screw, i^3, is formed, preferably by casting it on the spindle in copper, extending from the enlargement k^1 of the bore to a little within the other end of the shaft i, as shown in Fig. 9. The extremity of the shaft at this end is received within a hopper, k^2, with an opening closely fitting around the end of the shaft, but not actually touching it. The spindle i^2 passes, as shown, through the hopper k^2, and at the back on the inner side is provided with a collar, k^3, working against a socket, k^4, and keeping the shaft in position longitudinally, at the same time preventing the escape of the material to be disintegrated. The hopper k^2 is supported on an iron tressel, l, attached to the projection b^4 and firmly holding it in place. On the extension of the spindle i^2 beyond the socket k^4 a driving-pulley, l^1, is placed, of suitable size, hereinafter described, while the extreme end of the spindle i^2 is carried by a bracket, m, attached to the projection b^4, in the position indicated in the drawing, by any suitable bolt. The end of the bracket may be made with a block, cap, and brasses in the ordinary form of plumber-blocks, but I prefer to provide it with a simple bush, m^1, which may be reversed when worn in one direction, and may be replaced at pleasure by having spare bushes on hand. m^2 is a small projection within the hopper k^2 to prevent small particles from entering between k^3 and k^4. The hopper is also provided with a telescopic feed-spout, m^3, and otherwise arranged as described for Fig. 6. The heavy black lines m^4 indicate an oil passage drilled in the parts, to enable the oil to be supplied to the end of the spindle i^2 in the socket k, when the machine is stationary. The operation of the improvements under this head are as follows: The shafts and disks being rotated, as in my previous modification, the material to be disintegrated is conveyed to the hoppers k^2, and by gravity enters the end of the shafts i, and by making the pulley l^1 of a different diameter to that of k^4, thus giving to the spindle a difference of speed of revolution in a given time to that of the shaft. The screw i^3 acts in conveying the material through the shaft to the part where its bore is enlarged; here, by centrifugal force, it slides down the inclines formed by the enlarged bore k^1, and escapes at the end, and comes in contact with the bars, as in Fig. 1 or 2. Regarding the difference of speed of revolution between the shaft i and spindle i^2, above mentioned, when

the required number of revolutions to give the proper amount of feed is known, the pulley may be a plain one, as shown at l^1, of such diameter as will give the necessary difference of speed; but when the speed requires to be varied and is not known, the pulley l^1 may be made the frustum of a cone, as also the pulley on the driving-shaft that actuates it, the speed being varied by causing the belt to act in the ordinary way on different parts of the pulleys; or the pulleys l^1 and corresponding one on the driving-shaft may be constructed after the fashion of the differential pulleys so commonly used in lathes, &c. Due attention must be given to make the pitch of the screw either right or left-handed, as the case may require, so that the spindle i^2 may, revolving preferably at a slower speed than the shaft i, cause the material to be carried through the shaft, or otherwise it will act in the wrong direction. If desired, the material to be disintegrated may be introduced through the hollow shafts i by inserting a stationary tube extending a considerable distance down the bore, and propelling the material through the tube by means of a current of air, caused by a fan or other suitable apparatus.

The improvements under my fifth head consist in a new form of bars to be attached to the disks a. As shown in Fig. 1, the bars are similar to those used by Carr, in which case they require to have their ends furthest from the disk supported by a steel ring, attaching the ends of all the bars in each cage together. Now, as great care and expense are involved in manufacturing these rings to make them true when in place, and as they are very frail and easily injured when the machine is apart for repairs or in transshipment, it is very desirable that a more suitable form of bar should be used. Referring to Fig. 11, I show my improved form of bar, which consists of a turned cast-steel pin, p, of conical form, with a neck fitting the hole in the disk for its reception, and riveted on the back. They are distributed in circles on the disks in the same manner as Carr's bars, and are of such length that their ends enter into recesses formed in the opposite disk, to which they are attached. The base of the cone forming the pin p is made in proportion to the length of the pin, and to the amount of centrifugal force and strain they meet with in the action of disintegrating. These will vary, under different circumstances, in every description of machine, and therefore no exact proportion can be laid down; but, with a view of rendering the bars better capable of withstanding the centrifugal force in the rows nearest to the periphery of the disks, the disks may be formed so that they approach each other as they extend from the center to the periphery. By the above improvements under this head, not only is an individually strong and substantial bar obtained, but also, when any bar requires to be removed, the work can be accomplished without disturbing the remainder of the bars, and with very much less delay and expense.

Having thus described the construction and operation of my invention, to which I have given the name of "Simpson's Disintegrator," what I claim as my invention, and wish secured by Letters Patent, are the new and useful improvements on disintegrating machinery, as follows:

1. The novel disks a, each in one piece, and attached to the shafts b or i, substantially in the manner and for the purpose described.

2. The novel saddles b^2, sub-bed b^3, projections b^4, and screws c, substantially as and for the purposes set forth.

3. The novel openings f, casing f^1, semi-pyramidical pieces f^5, plate g, feed-spout h, and guards f^6, substantially as and for the purpose set forth.

4. The novel hollow shafts i, spindle i^2, screw i^3, hopper k^2, pulley l, and socket k, substantially as and for the purpose set forth.

5. The novel bar p with disk a, substantially as and for the purpose set forth.

Montreal, 18th day of April, A. D. 1871.

CHARLES G. C. SIMPSON.

Witnesses:

FRAS. HY. REYNOLDS,

A. B. MUIR.