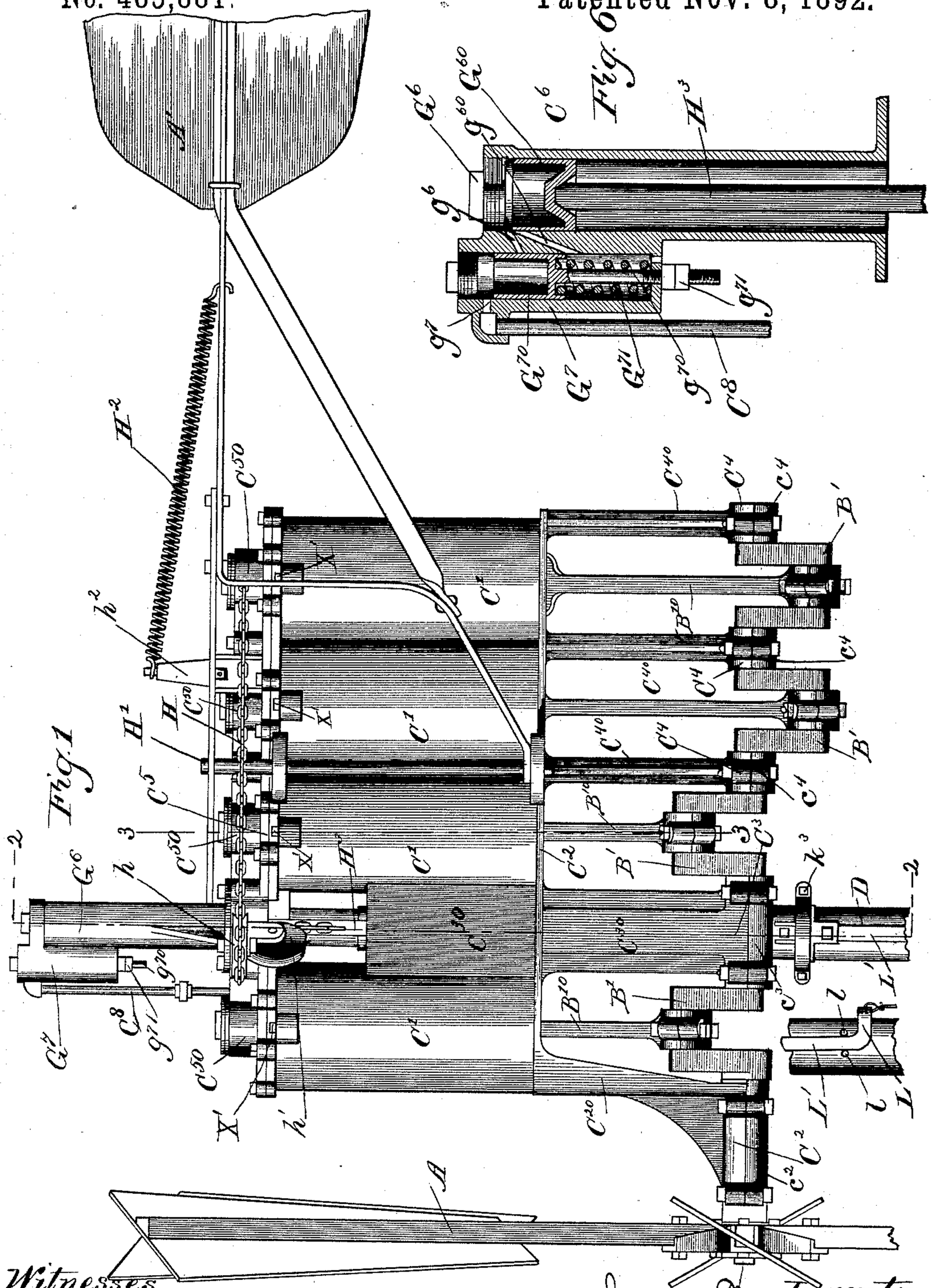
(No Model.) 4 Sheets—Sheet 1.

T. O. PERRY.

WINDMILL AIR COMPRESSOR.

No. 485,881. Patented Nov. 8, 1892.



(No Model.) 4 Sheets—Sheet 2.

T. O. PERRY.

WINDMILL AIR COMPRESSOR.

No. 485,881. Patented Nov. 8, 1892.

Witnesses.
J. L. Tunison
Jean Elliott.

Inventor:
Thos. O. Perry
By Burton & Burton
his Attorneys.

(No Model.) 4 Sheets—Sheet 3.

T. O. PERRY.

WINDMILL AIR COMPRESSOR.

No. 485,881. Patented Nov. 8, 1892.

Fig 7

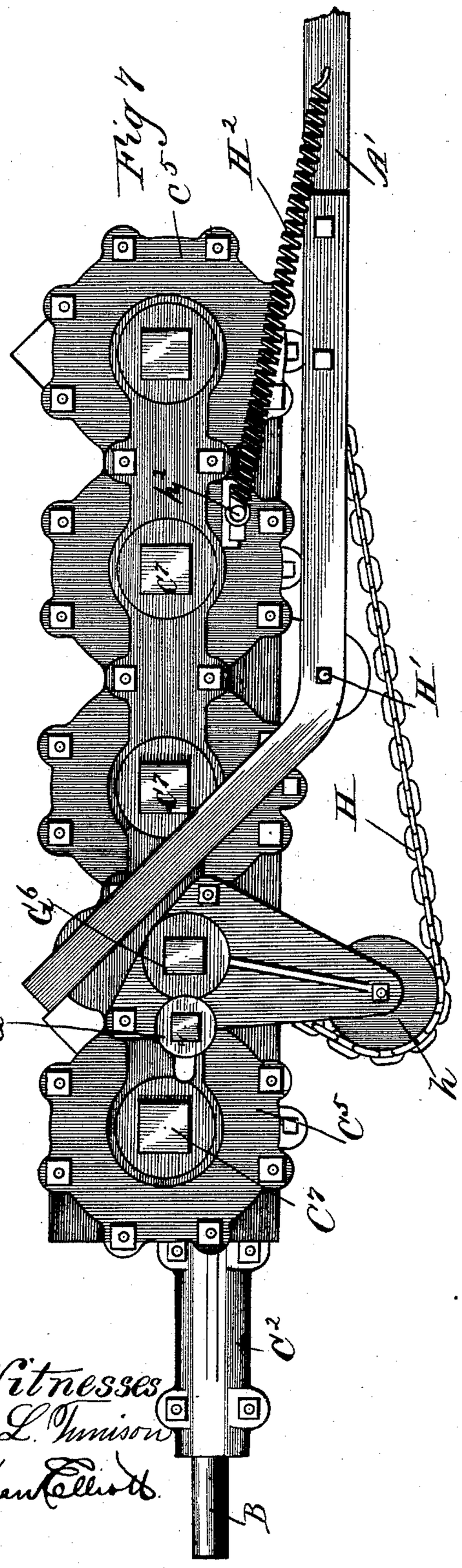
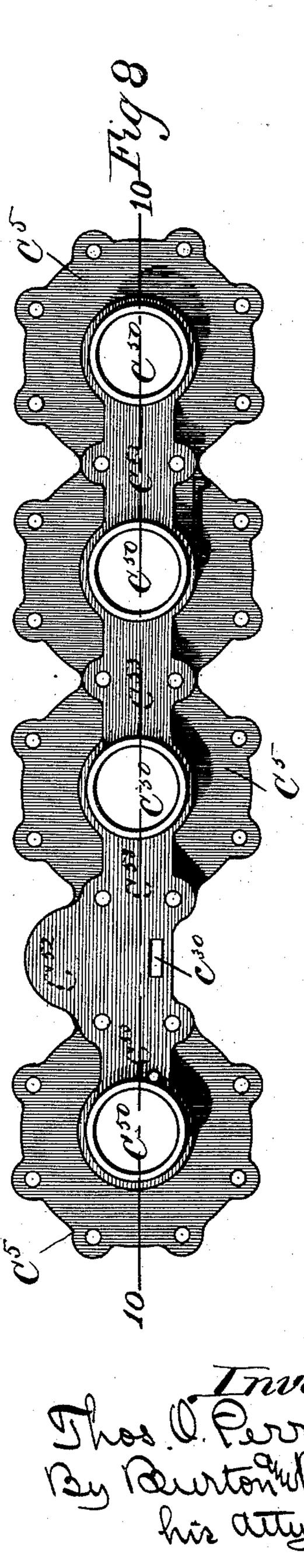


Fig 8



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(No Model.) 4 Sheets—Sheet 4.

T. O. PERRY.

WINDMILL AIR COMPRESSOR.

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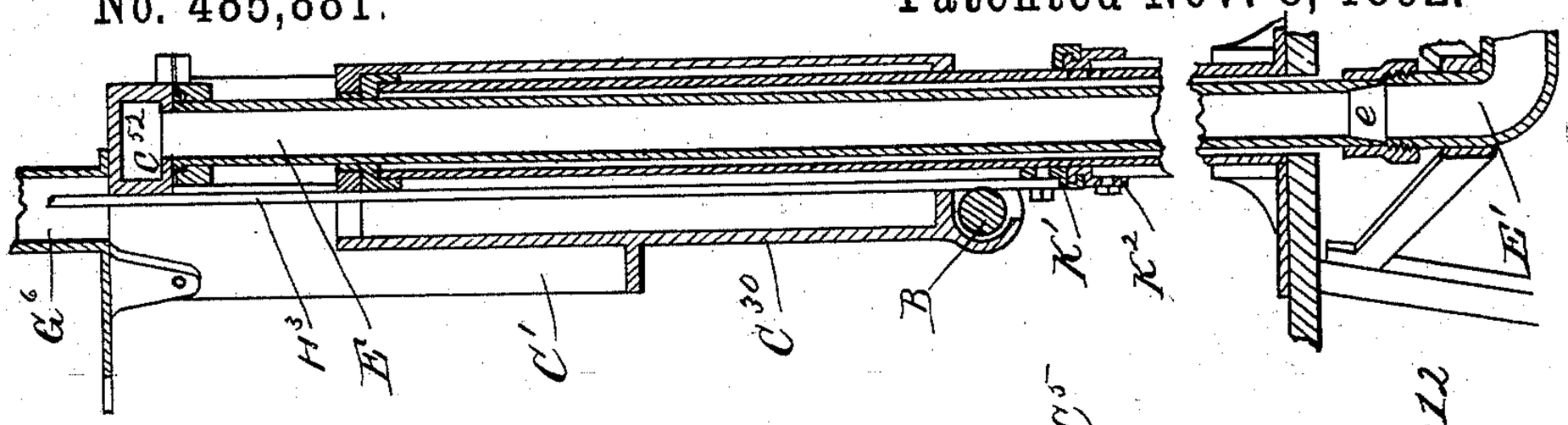

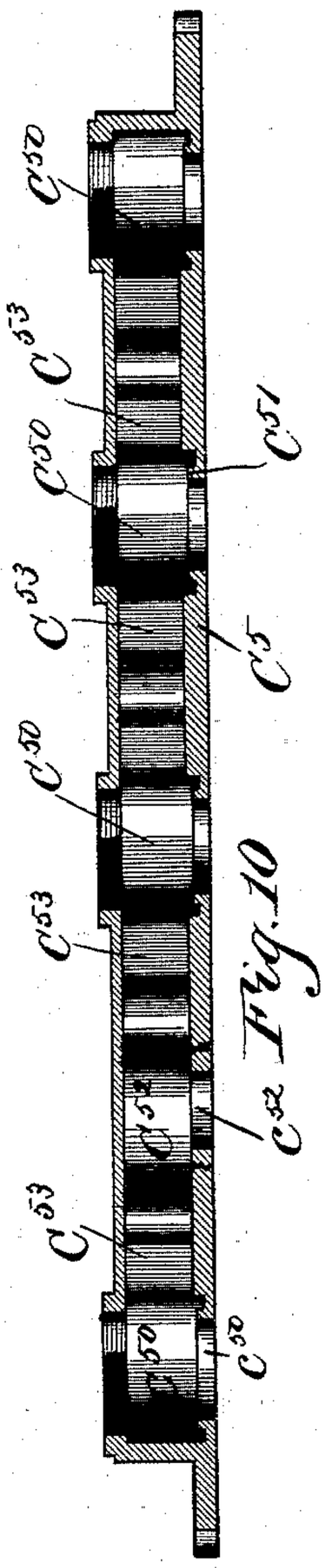

Fig. 10

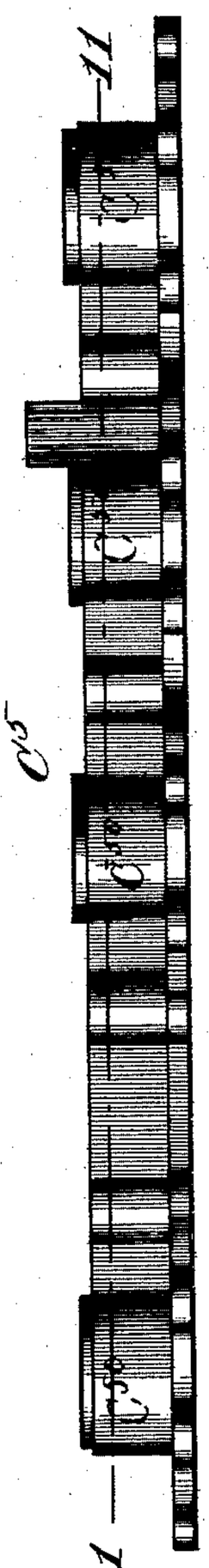

Fig 9

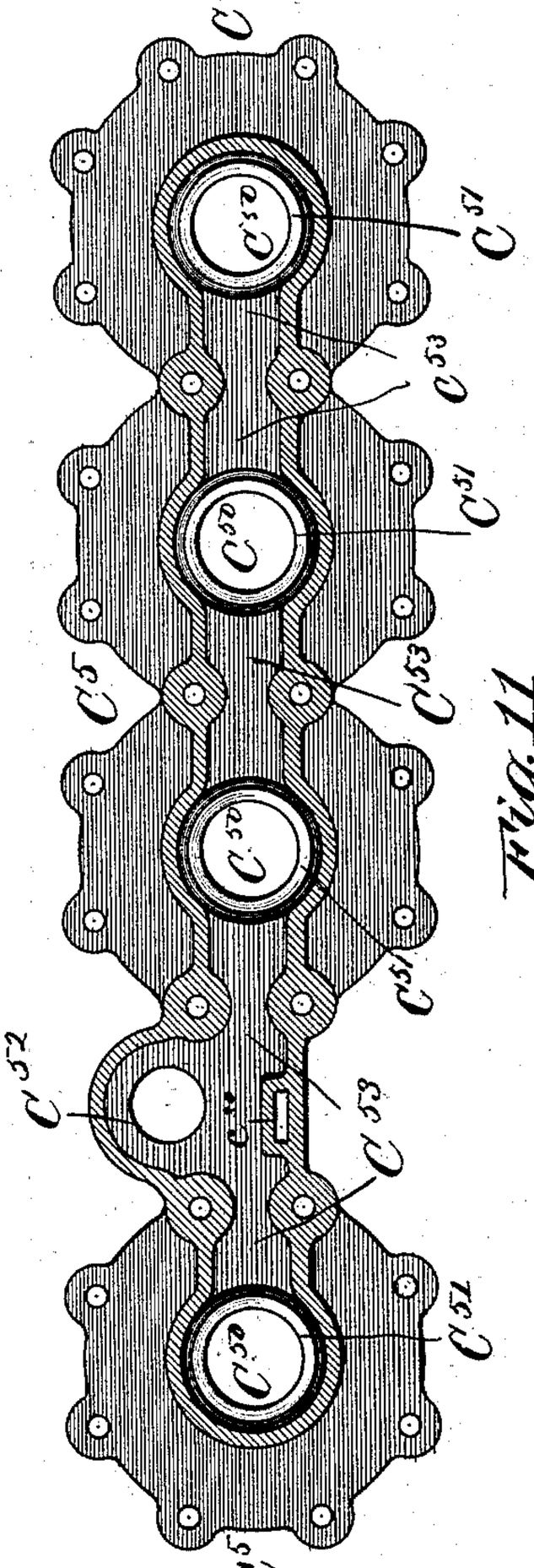

Fig. 11

Fig. 12

Witnesses
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UNITED STATES PATENT OFFICE.

THOMAS O. PERRY, OF CHICAGO, ILLINOIS.

WINDMILL AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 485,881, dated November 8, 1892.

Application filed September 5, 1891. Serial No. 404,855. (No model.)

To all whom it may concern:

Be it known that I, THOMAS O. PERRY, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in a Windmill Air-Compressor, which are fully set forth in the following specification, reference being had to the accompanying drawings, forming a part thereof.

In the drawings, Figure 1 is a side elevation of a portion of a windmill and my air-compressing devices annexed thereto. Fig. 2 is a partly-sectional elevation at the plane indicated by the line 2 2 on Fig. 1, showing the tower-top only partly cut by that plane and the remainder thereof in elevation. Fig. 3 is a section at the line 3 3 on Fig. 1. Fig. 4 is an enlarged detail of that part of Fig. 2 alongside which it is placed, showing the swivel-joints about the axis of the tower where the mill is pivoted thereto. Fig. 5 is an enlarged detail of a portion of Fig. 2, showing the swivel-like connections of the furling mechanism. Fig. 6 is a vertical detail section at the line 6 6 on Fig. 2. Fig. 7 is a top plan of the mechanism seen in Fig. 1 with the wind-wheel removed from its shaft. Fig. 8 is a plan of the top casting or cap of the air-compressor cylinders. Fig. 9 is a side elevation of the same. Fig. 10 is a vertical section at 10 10 on Fig. 8. Fig. 11 is a horizontal section at 11 11 on Fig. 9. Fig. 12 is a vertical section through the tower in the plane of the axis of the turn-table, showing a modified construction, wherein the discharge-pipe from the compressed-air chambers extends down through the tower-top, instead of discharging into and utilizing said tower-top as a part of the conduit.

The purpose of this invention is to provide a mechanism for compressing air by the power derived from a windmill such that it may be located on the turn-table pivoted on the tower which supports the mill without interfering with the turning of the mill about the vertical axis of the tower to keep it faced toward the wind.

A represents, conventionally, a wind-wheel of any construction.

B is its shaft.

C is the turn-table or frame in which the wheel-shaft is journaled and which is rotatable about a vertical axis on the tower-top D. The turn-table comprises or supports as rigidly fixed upon it any desired number of air-compressor cylinders C′, four of such chambers being shown in the drawings. The shaft B has as many cranks B′ as there are cylinders C′, and there being four such cranks in the structure represented in the drawings. They are ninety degrees apart about the axis of the shaft B. The turn-table C has five bearings for the shaft B, one between each two consecutive cranks and one outside the cranks at each end of the series. The extreme bearing C^2 next the mill is of good length and is formed at the lower end of the downward limb C^{20} of the turn-table. The next bearing C^3 is adjacent to the tower-top and is formed at the lower end of the main trunk C^{30} of the turn-table, said trunk being arranged, as hereinafter described, to afford the swiveled connection of the turn-table to the tower-top. The other three bearings C^4 C^4 C^4 are each formed at the lower end of a limb C^{40}, projecting down from the body of the turn-table for that purpose.

C^5 is the top plate or cap of all the cylinders C′. It has for each cylinder the chamber C^{50} and valve-seat C^{51} for the discharge-valve C^6. Said chambers and the chamber C^{52}, which is longitudinally between the first and second chambers C^{50} at the left—*i. e.*, next the mill—have free communication through the passages C^{53}, so that the compressed air forced from all the cylinders enters finally the chamber C^{52}, which is located axially in line with the tower-top and communicates with the latter, which is hollow, as hereinafter explained.

C^7 C^7 C^7 C^7 are the plugs or caps of the valve-chamber C^5 and afford guide-bearings C^{70} for the valves C^6, respectively. The main trunk C^{30} of the turn-table terminates at top and bottom in horizontal heads C^{31} C^{32}, which are pierced from the tower-top D and constitute the bearings of the turn-table on said tower-top. Said tower-top is tubular and open at the upper end, and at that end is provided with the shouldered collar D′, which is made fast by an air-tight joint onto said tower-top, and by its shoulder *d′* affords a seat on which the upper head or bearing C^{31} of the main trunk C^{30} of the turn-table turns freely, and the lower bearing or head C^{32} turns freely on

the cylindrical tower-top at a distance below the upper end of the latter. For the purpose of making substantially-tight communication from the cylinders into the tower-top, I provide the tube E, which is made fast by air-tight joint to the under side of the chamber C^{52} in the cap C^5 at the opening c^{52} in the bottom of said chamber C^{52}, so that the chamber discharges through said pipe, and which may be hereinafter referred to as the "compressed-air-discharge pipe." This discharge-pipe may be made of brass or copper, and its lower end enters and fits quite closely within the upper end of the tower-top, and it is reduced in thickness at that part marked *e*, so that when the compressed air is contained within it the interior pressure stretches the metal of the discharge-pipe at the part *e* and assists it to make air-tight contact by its outer surface with the inner surface of the collar D', which terminates the tower-top D. Each of the cranks B', by means of a suitable pitman B^{10}, operates a piston G in one of the cylinders C', said piston in its downstroke taking in air past the induction-valve G' and in its upstroke compressing and discharging the same through the port c^5 past to the check-valve C^6, and the air thus compressed in all the cylinders passes from the chambers C^{50}, pertaining to said cylinders, respectively, through the passages C^{53} to the discharge-chamber C^{52}, and through the discharge-port c^{52} of said chamber enters the discharge-pipe E, and thence passes into the tubular tower-top D, from the lower part of which at any desired point it may be conducted to the point of use. It will be observed, upon considering this structure, that the compressed-air-discharge passage leading from the cylinders, which are mounted on and rotate with the turn-table, must terminate in a fixed portion in order that connection may be made to it to transmit the pressure to points at a distance, and that therefore such compressed-air passage must comprise two parts, one of which shall be fixed, while the other is carried with the rotating turn-table, and in order that it may comprise two such parts—one fixed and the other rotating—these two parts must be swiveled together at some point and such swivel-joint must be substantially coaxial with the turn-table. In the construction thus far described it will be seen that these conditions are met because the tower-top itself, which is fixed in position, constitutes part of the compressed-air-discharge passage, and the compressed-air-discharge pipe E, constituting the portion of the compressed-air passage which rotates the tower-top, is made coaxial with the latter and swiveled thereto; but it will also be obvious that this is not the only construction which will meet the requisite conditions above stated, and that such conditions might be met by extending a compressed-air-discharge pipe E down to any distance coaxially with the turn-table and providing it with the swiveled connection to a portion of such discharge-pipe which might be fixed at any point below the lowest bearings of the turn-table on the tower. Such modification is illustrated in Fig. 12, the fixed portion E' of the discharge-pipe being connected in a swivel-joint at C^{10} to the portion E, which is rigid with the turn-table and passes down within the tubular tower-top, which, however, need not in that case be air-tight or provided with any air-tight connection to the discharge-pipe, and might therefore be an open frame-work, if preferred. The essential feature of this modified construction is that the portion of the compressed-air-discharge pipe which is fixed to the turn-table passes within the bearings of the latter to the tower, and that the swivel-joint is substantially coaxial with the turn-table.

H represents the furling-chain, by which the windmill is operated to control its relation to the wind to cause it to operate more or less powerfully. It is connected in the usual way to the frame of the tail or rudder A', which is pivoted upon the vertical post H', rigid with the turn-table C. The spring H^2, connected at one end to the tail and at the other end to the post h^2 on the turn-table, tends to hold the tail in position to keep the wheel facing the wind, and the furling-chain therefore operates against the spring to draw the wheel more or less out of the wind. The mechanical operation of this part of the structure is one which is familiar in the art and need not be more specifically explained. The furling-chain is guided around the horizontal pulley *h* and the vertical pulley *h'* journaled on the turn-table and is connected to the furling-rod H^3. This rod has slide-bearings at c^{31} and c^{32}, adjacent to the bearings C^{31} and C^{32}, respectively, of the turn-table on the tower-top, and it has a further slide-bearing c^{30} adjacent to the chamber C^{52} in the cap C^5 of the cylinders. Onto the top of the cap C^5 there is secured a casting comprising a cylinder G^6, and adjacent to its upper part another cylinder G^7, the former being in line vertically with the furling-rod H^3 and being open at the bottom, so that said rod may extend up into it. It is suitably closed at the top by a plug g^6. In the cylinder G^6 there is a piston G^{60}, in the under side of which there is formed a socket or seat to receive the upper end of said furling-rod. In the cylinder G^7 there is also a piston-valve G^{70}, whose stem g^{70} extends from its lower side down through the lower head of the cylinder, and between the piston and said lower head of the cylinder there is located the spiral spring G^{71}, reacting against the cylinder-head and piston to force the latter upward—*i. e.*, in direction contrary to the air-pressure admitted to said cylinder, as hereinafter explained. The stem g^{70} is threaded, and upon it are applied outside the cylinder G^7 nuts g^{71}, whereby the piston may be drawn down to give any desired tension to the spring G^{71}. The said lower head is not air-tight, but constitutes

merely a guide for the piston-stem and a stop for the spring. The piston-valve G^{70} is of considerable length relatively to the cylinder G^7. From the upper end of the cylinder G^6 a duct g^6 leads into the cylinder G^7, which it enters at a short distance below the lower end of the latter, but at such distance that its entrance is covered by the piston-valve G^{70} when the latter is in the position to which it is forced by the spring G^{71}. Another duct g^{60} leads from the upper end of the cylinder G^6 into the cylinder G^7, which it enters at a point just below the lower end of the piston-valve G^{70} when the latter is at its highest position in the cylinder G^7, so that at such position the duct g^{60} is not closed at its entrance into the latter cylinder. A pipe C^8 leads from the cavity in the cap C^5 and, as illustrated, between the left-hand chamber and the chamber C^{52}, into the cylinder G^7, which said pipe enters through the port g^7, above the highest position of the cylinder G^{70}. The purpose of this construction of the cylinders G^6 and G^7 and their appurtenances is to cause the pressure produced in the cylinders C′, and thereby in the entire cavity in the cap C^5, from which the pipe C^8 leads, to regulate the mill by operating the furling-rod, which it does as follows: The spring G^{71} being held at any desired tension by nuts g^{71}, the piston-valve G^{70} will remain at its highest position in the cylinder G^7 until the tension of the compressed air transmitted through the pipe C^8, above the piston-valve G^{70}, is sufficient to overcome the tension of the spring and force the piston-valve down. When the piston-valve has been thus forced downward far enough to uncover the duct g^6, the air-pressure is transmitted through said duct into the cylinder G^6, above its piston G^{60}, and tends to force said piston, and thereby the furling-rod, downward and cause the latter to furl the windmill more or less, according to the tension of the compressed air. It will be observed that the first movement downward of the piston-valve G^{70} closes the duct g^{60} at its entrance into the cylinder G^7, and that it will remain cut off from communication with the outer air during all the further downward movement and at all the lower positions of the piston-valve G^{70}. If the furling of the mill should reduce the rate of compression of the air below the rate at which the compressed air is being employed or exhausted, so that the tension of the air in the cavity of the cap C^5 should diminish until it is no longer sufficient to hold the piston-valve G^{70} down against the tension of the spring G^{71}, the latter will prevail and the piston-valve G^{70} will rise, and, having first covered the duct g^6, will at the end of its upward movement uncover the duct g^{60}. When this occurs, the compressed air in the cylinder G^6 above its piston G^{60} will find vent through the duct g^{60} and out at the bottom of the cylinder G^7, and the spring H^2 will then operate to draw the wheel into the wind and permit the furling-rod H^3 to ascend and raise the piston G^{60}. It will be obvious that this construction will result in holding the mill furled only to such degree as necessary to maintain the tension of air corresponding to the adjustment of the spring G^{71}. It is desirable to be able to control the mill independently of the degree of tension, so that it may be furled even when there is no tension maintained in the chambers, and for this purpose means of operating the furling-rod from the ground are provided. Since the furling-rod has its slide-bearings in the turn-table, so that it revolves around the tower with the turn-table, it is necessary that connection from it to the ground should be made by means which will permit such rotation of the furling-rod without requiring the rotation of the lower connections therefrom. For this purpose I provide the two collars K and K′, encircling the tower-top below the lowermost bearing of the turn-table thereon, said collars being each made in two parts, so that they can be put together about the tower and secured by bolts k^3 through suitable lugs on the collars. The collar K has the horizontal flange k, and the collar K′ has the interior groove k', which is adapted to receive the flange k, so that when the two collars are fastened together about the tower-top, as seen in Fig. 2, they are mutually engaged against displacement or change of relative position along the axis of the tower by the engagement of the flange k in the groove k'. The collar K′ has the lug K^{10}, to which the lower end of the rod H^3 is bolted. The collar K has the two lugs k^2 k^2 diametrically opposite, and to them, respectively, are bolted the upper ends of the arms L′ L′ of the yoke L, which half encircles the tower-top, said arms being guided in eyes l l on the tower and having connected to it the furling-cord M, which extends to the ground. It will be seen that the yoke L may be reciprocated vertically, its arms L′ obtaining guidance in the eyes l, and that the collar K will be prevented from turning about the tower by its connection with said yoke, while the swivel-like connection of the two collars K and K′ permits the latter to revolve freely, carried by the furling-rod H, as the latter is carried by the turn-table in its rotary movement about the tower. In order that the mill may be shut off or furled by an operator at any point however distant from the mill to which the compressed-air pipe may lead, a shut-off valve S may be provided in the compressed-air pipe at such point, and by closing the same and arresting thereby the discharge of air the pressure will be forced up to the degree necessary to operate the automatic furling device above described. I do not limit myself to the interposition of the cylinder G^7 between the air-pipe C^8 and the cylinder C^6. The essential requisite is that there is a conduit by which the compressed air is admitted above the piston G^{60} in the cylinder G^6, so that its pressure is experienced by the said piston to cause it to operate the furling-rod.

The cylinder G^7 and its piston-valve and spring G^{71} are merely means which postpone the action of the compressed air on the piston G^{60} until a certain degree of pressure, predetermined by the tension of the spring G^{71}, is attained.

I will now describe certain details of construction which are of minor importance and yet worthy of notice. The bearings C^2 C^3 and C^4 C^4 C^4 of the shaft B in the turn-table C are obtained in boxes whose caps or removable halves c^2 c^3 c^4 c^4 c^4, respectively, are the under halves of said boxes, and it will be observed that said caps or removable halves therefore are the ones which will receive substantially all the wear, as they receive all the weight of the windmill and its shaft, and not only so, but also the pressure due to the reaction of the air compressed in the cylinders by the upward stroke of the pistons, which are actuated by the cranks of said shaft. The convenience and importance of this feature of construction is that the only portion of said boxes which is likely to require removal for repairs and babbitting is the said lower portion or cap, and that that portion being thus removable such repairs can be made readily and without dismounting the mill, one or more but not all the boxes being removed at a time, while the remainder hold the mill in place. This is a matter of great convenience as compared with any construction in which the portion of the box requiring repairs should be fixed upon the turn-table, so that the repairs could only be made by mounting to the top of the tower, and in most cases providing a scaffolding whereon the operator might stand to do the work, or, as the only alternative, entirely dismounting the structure to bring it to the ground for the purpose of repairs. The turn-table comprising the cylinders and the downwardly-extending arms which afford the bearings for the mill-shaft and the trunk which affords bearings for turn-table on the tower being all cast together, the cylinders are utilized as a means of giving stiffness in a horizontal direction to said turn-table, so that although it is supported only at one point—viz., the trunk—with its weight extended on either side of that support, nevertheless there is practically no danger of the bearings of the shaft drooping out of line. A further precaution in the same direction consists in making the cap C^5 for all the cylinders in one piece, so that when secured in place by the bolts which bind it to the several cylinders it adds its strength to prevent any vertical springing of the structure.

The specific construction of the several cylinders is the subject-matter of my application, Serial No. 404,853, dated September 1, 1891, and is not claimed herein, but for the purpose of making the drawings which necessarily illustrate this feature intelligible, I will explain that the port *x* at a short distance from the upper end of the cylinders which leads in the chamber X, which has an exit controlled by the outwardly-seating check-valve X′, serves the purpose of permitting the air forced in advance of the piston before the latter covers said port to escape without compression or with only slight compression when the piston moves slowly, as under weak action of the mill; but when the action of the piston is more rapid the smallness of the port *x* and also the action of the check-valve X′, which will be seated by the rapid movement of the piston, causes a greater proportion of the piston-stroke to be effective in compressing the air. I will also explain the connection of the pitman B^{10} to the piston by means of the elongated eye B^{100} and the interposition of the spring Y between said pitman and piston, and the proximity of the stem of the valve G′ to the end *y* of the pitman being such that the play of the eye on the pivot of the pitman to the piston is sufficient to permit the pitman to encounter the stem of the valve and open the latter, and is a contrivance designed to prevent over pressure of air in the cylinders or discharge connections in case of any stoppage in the latter or derangement of devices for shutting off the power. Another feature, which is part of the subject-matter of my said application, Serial No. 404,853, is the provision of an annular oil-pipe Z at the bottom of the cylinder, into which the flange G^2 of the piston dips at each stroke and takes oil to lubricate its path in the cylinder.

I claim—

1. A windmill, the turn-table in which its shaft is journaled, and a tower-top which constitutes the vertical pivotal support of the turn-table, such tower-top being open around its vertical axis, combined with air-compressing mechanism on the turn-table and a discharge-pipe from such mechanism coaxial with the tower-top and adapted to extend within the axial opening of the latter, substantially as set forth.

2. A windmill, its turn-table, and a tubular tower-top on which the turn-table is pivoted, combined with air-compressing mechanism on the turn-table, the discharge-pipe from such mechanism being swiveled to the tubular tower-top, substantially as set forth.

3. A windmill, the turn-table in which its shaft is journaled, and a plurality of air-compressing mechanisms on the turn-table operated by the windmill-shaft, the air-chambers of said mechanisms communicating with a common discharge-pipe, the tower-top to which the turn-table is pivoted being coaxial with said discharge-pipe and having an axial opening large enough to admit the latter, substantially as set forth.

4. In combination with the turn-table, the air-compressing mechanism mounted thereon and the discharge-passage therefrom, comprising the pipes E and D, one fixed with respect to the turn-table and the other fixed with respect to the support of the turn-table, said parts being coaxial and swiveled together,

their common axis coinciding with the vertical axis of the turn-table, substantially as set forth.

5. In combination with the windmill and the tower-top, the turn-table having a vertical trunk C^{30} and the vertical arms C^{20} and C^{40} and the cylinders C′ C′, rigid with each other and with the said trunk and arms, the horizontal bearings for the mill-shaft at the lower ends of said arms and on said trunk, and the vertical bearings of the turn-table on said trunk, whereby the cylinders stiffen the turn-table and tend to preserve the shaft-bearings in line, substantially as set forth.

6. In combination with the mill and the tower-top, the turn-table having horizontal bearings for the mill-shaft and vertical bearings for the tower-top and comprising the cylinders C′C′, arranged horizontally side by side and rigid with each other and with the remainder of the turn-table, and the arms which afford bearings for the mill-shaft projecting downwardly from the base-plane of the cylinders, substantially as set forth.

7. The mill, the tower-top, and the turn-table which has horizontal bearings for the mill-shaft and vertical bearings for the tower-top, such turn-table comprising the air-compressing cylinders, combined with the cap-plate C^5, having the valve-chambers for all said cylinders and made integrally and bolted to all the cylinders, whereby it stiffens the turn-table, substantially as set forth.

In testimony whereof I have hereunto set my hand, in the presence of two witnesses, at Chicago, Illinois, this 2d day of September, 1891.

THOMAS O. PERRY.

Witnesses:
CHAS. S. BURTON,
JEAN ELLIOTT.