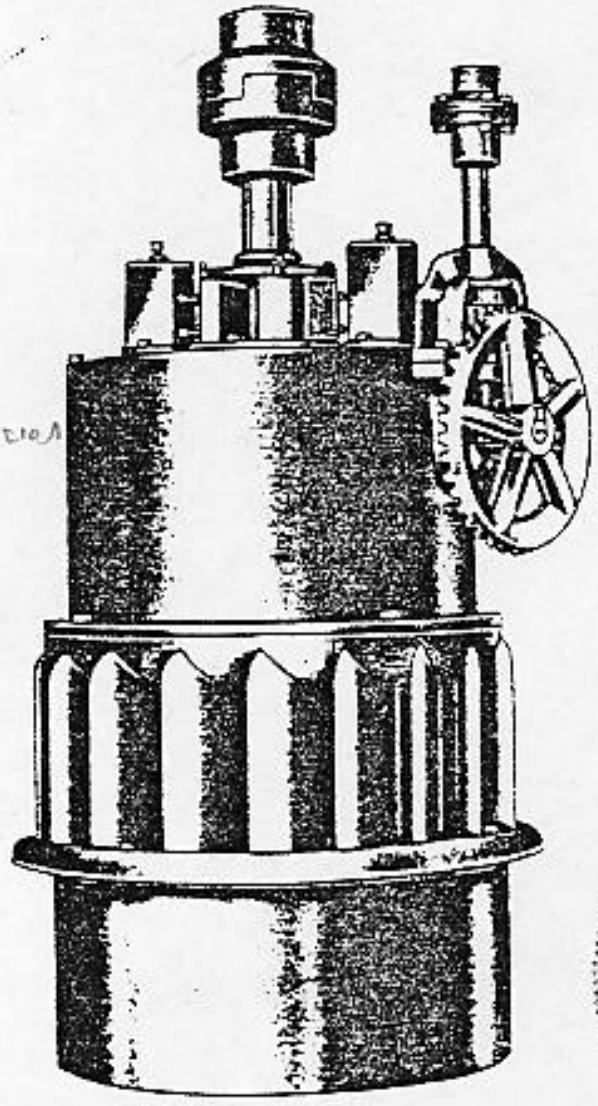
CATALOG NUMBER THIRTEEN

# The Hercules Turbine Water Wheel



Red bridge station
matched pair
exciter runners
Type AS
550 RPM
600 AMPS
125 volts
15" dia.
75 KW
(45 1:2,1)

STATE OF MAINE
WILLIAM
KEVIN
FAY
No. 5098
REGISTERED
PROFESSIONAL ENGINEER

## Holyoke Machine Company

Holyoke, Massachusetts, U. S. A.

# Holyoke Machine Company

Holyoke, Massachusetts

MANUFACTURERS OF

## The Hercules Turbine

Wheel Cases, Penstocks

Head Gate Work

Water Wheel Governors

*and*

Machinery for the

Transmission

of Power

HOLYOKE MACHINE COMPANY,

HOLYOKE, MASSACHUSETTS.

# INTRODUCTION

THE HERCULES TURBINE is the product of more than fifty years' continuous experience in developing and manufacturing Water Wheels of highest power and efficiency.

The first test of a Hercules Wheel in the Holyoke Testing Flume was made in 1876, in regard to which James Emerson, who at that time was hydraulic engineer in charge of the Testing Flume, reported that, "As high useful effect at whole gate had been obtained by several builders, but no such average at all stages of gate opening. In capacity, however, the Hercules took a stand entirely above that of any turbine ever before produced."

Commencing with such favorable results and continuing with frequent tests in the Holyoke Testing Flume, the patterns of our type "A" Hercules Wheels were perfected until the figures given in our catalog tables had been obtained by actual test from every size and each hand in the Holyoke Testing Flume, a work that had never before been attempted by any water wheel manufacturer.

The rapid development of hydro-electric power; the advantage of connecting generators direct to the water wheel shafts, and the requirements of speed and power under various heads, with high efficiency at part gate, called for a wider range of speed and power than our type "A" Wheels possessed, and necessitated patterns for new types which we have made and now catalog for the first time.

The patterns for each size and hand up to the limits of the Holyoke Testing Flume have been tested, and the tables in this catalog are based on these tests, enabling us to guarantee results from every size and type of Hercules Wheel when installed under our direction.

Our "A," "B," "C," and "D" Wheels are made with cylinder gates. We also make types "C" and "D" with balanced swing gates of excellent design to meet conditions of limited space which would not permit the use of cylinder gate Wheels.

Although the tables herein are not carried above a head of 50 feet, most of the sizes are adaptable to higher heads, and we would be glad to advise any prospective customer about types and sizes of the Hercules to meet specified conditions under any head above the tables herein not greatly exceeding 100 feet.

# The Hercules

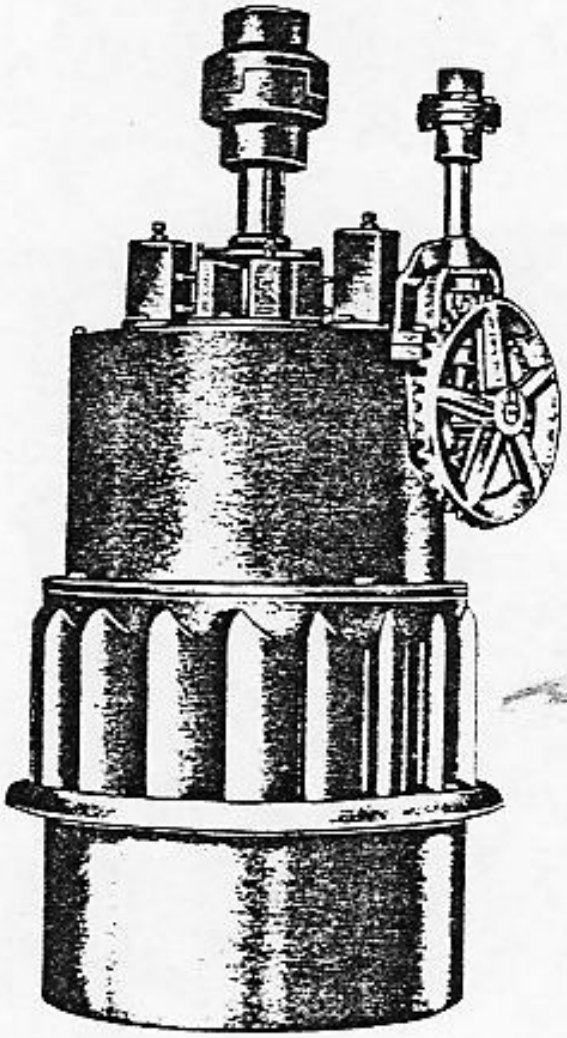


Plate No. 1

Simple in construction; compact; durable; great power for its size.
High efficiency from full to half water

# ECONOMY IN THE USE OF WATER

The importance of economically utilizing water powers, and the usual condition of seasonal variations of the quantity of water make the choice of a wheel having high average efficiency over a wide range of gate opening advisable.

A wheel for general use should have power with three-quarters or seven-eighths water to do the work required, as a considerable margin of gate is at all times necessary in order to regulate the speed by means of a governor, and in case of back water more water is required to maintain speed. The power required to drive a mill is often underestimated. With a good part gate wheel an increased speed may be maintained or new machinery added.

In developing and improving water powers great care should be taken in the selection of wheels. In places where the flow of water is very variable and deficiency in power is made up by steam, we advise the use of two or more wheels of different diameters, for with wheels arranged in this way good results can be obtained at all stages of water.

When wheels of different diameters are used, they should be so selected that the larger wheel will discharge about two-thirds the capacity of the two wheels. When the flow of water reaches this point the smaller wheel should be disconnected and the larger wheel used until the amount of water discharged by it equals that of the smaller wheel. At this point, the larger wheel should be disconnected and the smaller wheel used for developing the remaining power.

The HERCULES, wherever introduced, has maintained its reputation as a reliable and economical wheel. In the city of Holyoke, Mass., where the Water Power Company tests all the wheels that are put in and charges its lessees with the amount of water thus shown to be used, there are now running 76 HERCULES Wheels giving an aggregate of over 19,000 horse power. This alone shows the appreciation by the manufacturers of the merits of the wheel.

# GENERAL DIRECTIONS

## FOR THE APPLICATION OF WATER TO TURBINES

The general arrangements required for the proper erection of Turbines are well understood by competent millwrights and do not in ordinary cases, perhaps, present any serious difficulties; but, from extensive observation, we are led to conclude that some of the essential points involved are often neglected in such works. For this reason it may be of interest to many users of water power, as well as to the advantage of others who may do so, if we present here a few general remarks on the subject.

In practice there is almost always some loss of head due to the velocity with which the water passes through the channels leading to, and away from the wheel, and it should be the aim in constructing these to reduce the loss to a minimum. When the size of the wheel and the quantity of water to be used, have been determined, the size of the conduit for carrying the water to the wheel, the width and depth of the wheel-pit and tail-race, and the dimensions and location of the flume for the wheel are to be considered and properly arranged. All of these should be of such dimensions as will insure the flow of the water through them at a moderate velocity, and with as little change of direction as may be practicable.

We have known of instances where the water was carried through long tubes at such velocity that there was a loss of two feet in the head at the flume, and at the same time the raceway from the wheel was so narrow and shallow that the water backed up under the wheel fully two feet when running. This is, of course, an exceptional case, but illustrates sharply the law governing the flow of water.

Of course, the larger the canal or tube the better, but there must be a limit in practice, and it may be laid down as a general rule that, in canals and tail-races excavated in earth, the velocity should be from one to two feet per second. In tubes of uniform section of not more than fifty feet in length, a velocity of three feet per second is admissible; but the velocity should be reduced as the distance increases, till in a length of 200 feet it should not exceed two feet per second.

The dimensions of the pit below the wheel should vary somewhat according to the quantity of water discharged into it.

For the HERCULES Wheel, the following is an approximate rule for the dimensions of the pit for heads of about twenty feet: Width of pit equal to four times the diameter of wheel; depth below the end of draft-tube one and a half times the diameter of wheel. When the pit is not in solid rock, we advise putting down a bottom of timbers, covered with thick planking, wide enough to build thereon water-tight walls, and in building the walls, providing for a gate to close the outlet, for the sake of convenience in pumping out the water for inspection or repairs.

The flume for the wheel should be about three times the diameter of the wheel, in its inside width or diameter, and if it is decked over at the top it should be high enough inside to clear the coupling on the wheel shaft. We advise in most cases that the flume be set so that the floor on which the wheel rests will be nearly as low as the level of the tail-water, or low enough to leave one-half the length of the draft-tube in the tail-water. The dimensions given in the tables accompanying the cuts will be found convenient for reference in arranging flumes for these wheels.

# The Hercules

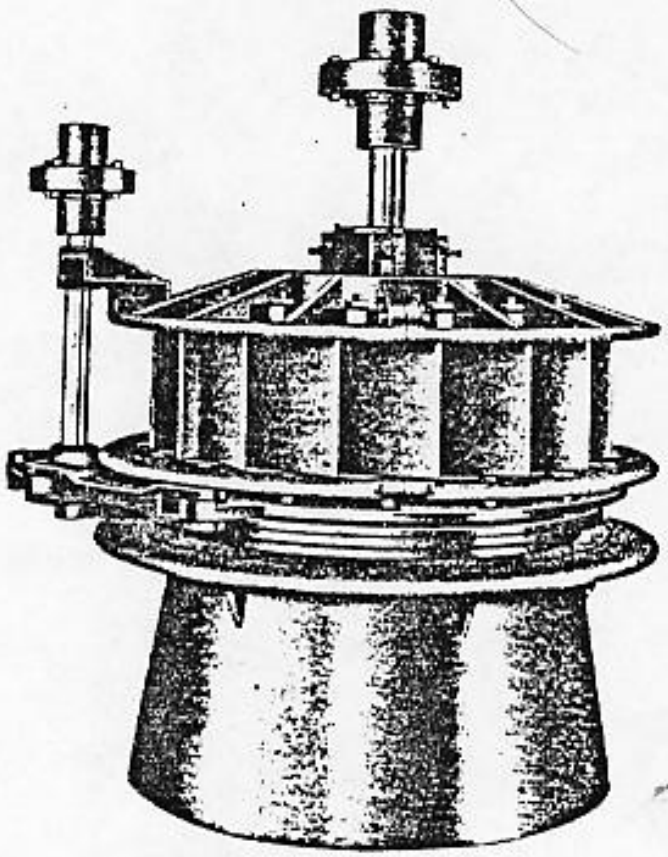


Plate No. 2

Types C and D with balanced swing gates

# DIRECTIONS FOR SETTING WHEELS

In setting a wheel in the ordinary flume, in order that its foundation may be exactly level it is generally most convenient to lay down a ring of soft wood around the hole in the floor, and dress it off with a plane. As the flange on which the wheel rests is turned true, the wheel will, when placed on this leveled ring, stand in the exact position required. The floor should be supported by posts under the timbers around the hole, so that there will be no settling after the foundation is once made level. If the wheel is a large one and is taken apart for shipment, the draft-tube is first placed in position and the shaft with the runner is next placed on its step, the other parts being put on in their order. The step and other bearings are adjusted before leaving the shop, but it may sometimes happen that they will in some way get shifted, and as the wheel is being put together, they should be inspected and readjusted, if necessary. The only change that can take place in the step is in its height, which is regulated by screws. When this is at the right height, the broad band around the lower part of the wheel should stand about one-sixteenth of an inch below the under side of the base of the guide rim where it rests on the draft-tube. The adjustable bearing on the top of the cover plate should be fitted up closely around the shaft, but not screwed so tightly as to bind it.

All of our cylinder gate wheels above fifteen inches in diameter are provided with chain and weights to counterbalance the weight of the gate, so that it will move easily. It is best, when it can be done without much trouble, to carry the weights outside of the flume, but they can be used inside where the height is sufficient, although it will require a little more weight to be as effective. When the wheel is not likely to be started up at once, it is a good plan, when putting it together, to besmear the step and the shaft at the bearing with tallow, as a protection against rust while it remains idle.

It is sometimes necessary to use a draft tube longer than is ordinarily furnished with the wheel. If properly constructed and applied there will be no sensible loss of power, but it must be made air-tight, and when of considerable length it is better to enlarge gradually toward the lower end, especially in cases where it may be necessary to carry it near the pit bottom.

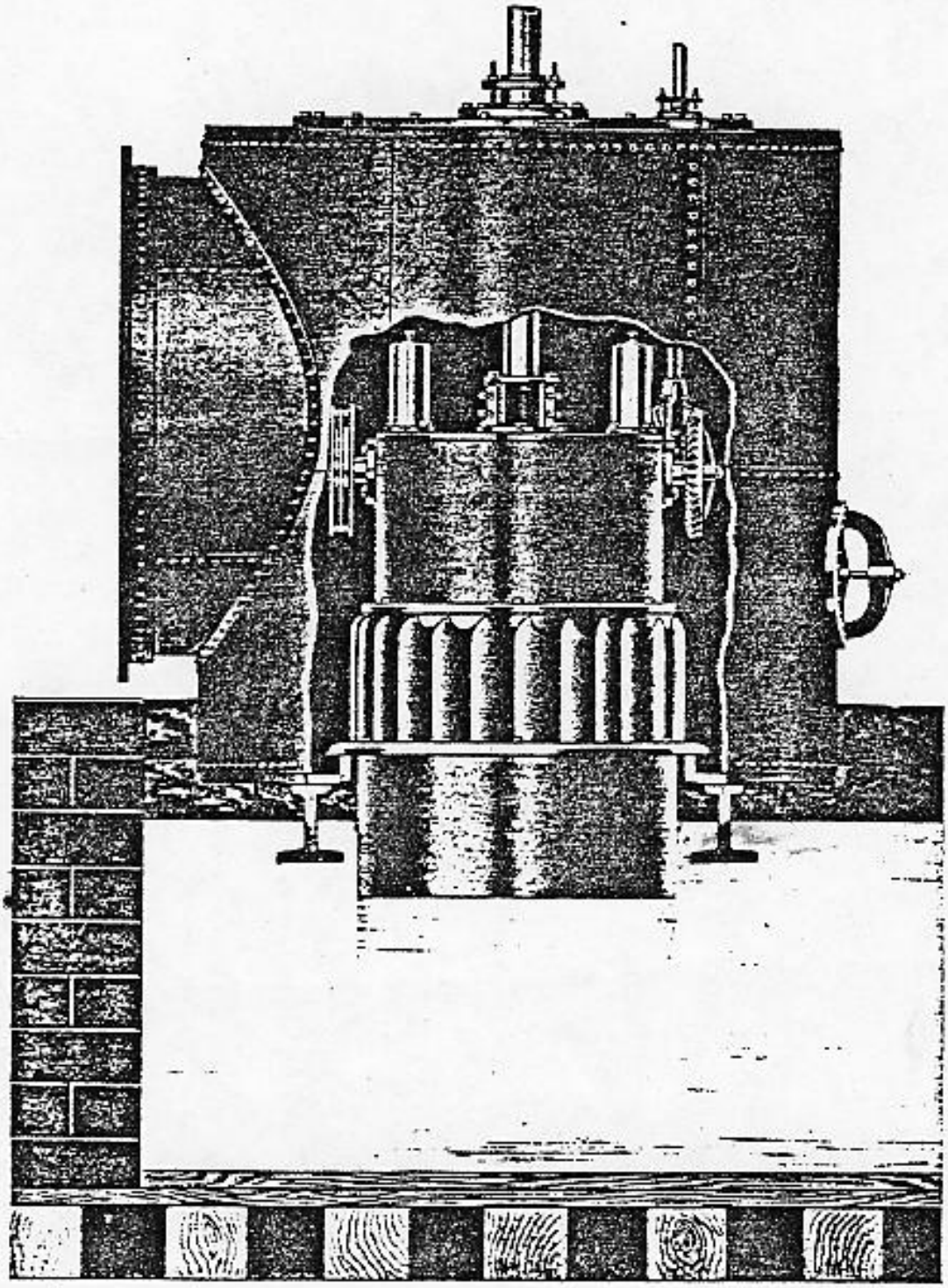


Plate No. 3

Vertical Cylinder Gate Hercules Turbine in Steel Case

# STEEL CASES FOR TURBINES

Although the expense of steel is as a rule considerably greater than wood, the results obtained by the use of steel cases and penstocks are much better than would be possible with wood on account of their durability and freedom from leakage. We therefore strongly recommend their use, especially for wheels under high heads.

Plate No. 3 represents a HERCULES Turbine in a steel case. The case is made with two cast iron heads, and a plate steel shell, and is provided with a cover, so that the wheel may be taken out entire. The cover is fitted with stuffing boxes for both wheel and gate shafts, and a manhole affords easy access to the wheel. The bearing surfaces of the heads are nicely turned, insuring tight joints, and all holes for rivets are accurately spaced and drilled to prevent any undue strain in riveting.

Such a case is fitted with a mouthpiece for feeder connection, and when ordered, a cast iron flange is furnished to connect with steel, or wood feeder.

The draft-tube in this plate is shown of regular length, but it could be extended to any desired length not exceeding 24 feet.

For convenience in shipping and erecting at the mill, the heads of the larger cases are made clamp, the two sections being planed together.

Where two wheels of the same, or different diameters are to be used, their cases may be connected in the center with one common feeder, or if desired, they may be placed in cases provided with separate feeders, as shown in plate No. 4.

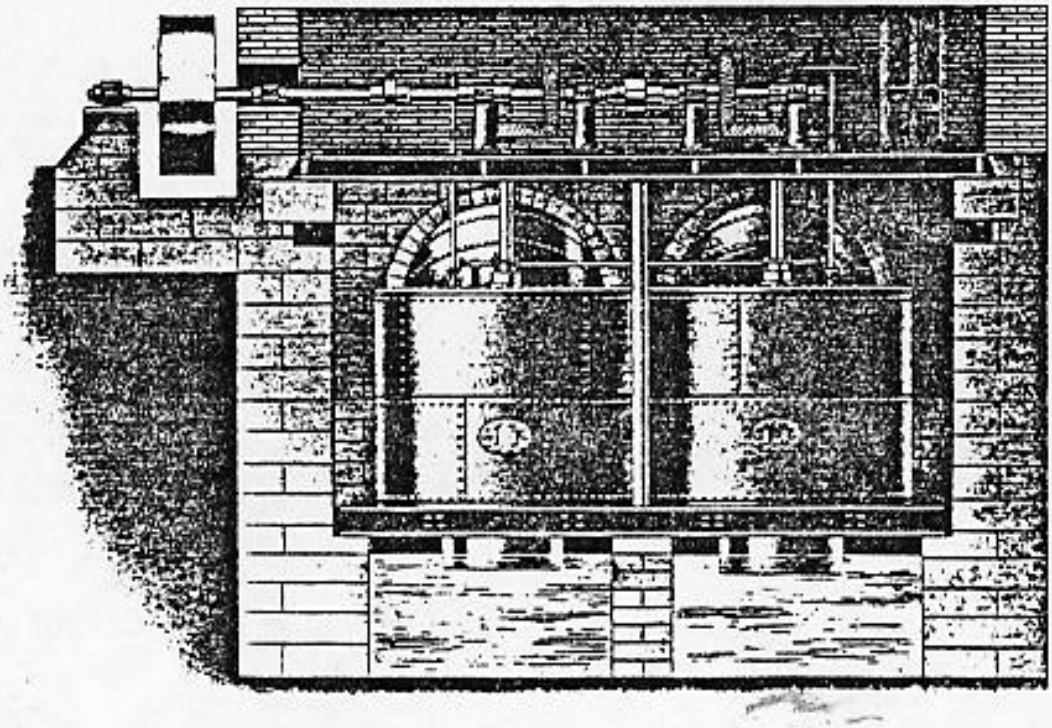


Plate No. 4

Two Vertical Cylinder Gate Hercules Turbines in two steel cases with separate feeders

# HORIZONTAL TURBINES

When conditions do not compel the use of vertical wheels, the important advantages possessed by horizontal wheels lead us to recommend this form of installation.

There are three principal arrangements for horizontal wheels:

*First* — The single wheel discharging its water through a quarter-turn and draft-tube. See plate No. 5.

*Second* — A pair of wheels of the same or different diameters in the same case, each wheel discharging its water through a separate quarter-turn and draft-tube. See plate No. 6.

*Third* — A pair of wheels of the same or different diameters in the same case, discharging their water through a common center case and draft-tube. See plate No. 7.

Numerous as are the different arrangements, they are all modifications of the three mentioned above.

For developing a given power, a pair of smaller wheels have, in most cases, a distinct advantage over a single large wheel. The end thrusts are balanced, thus avoiding loss of power by step friction. The number of revolutions per minute is increased, so that pulleys of smaller diameter will produce suitable belt speed and, in some cases, lessen the liability of back water damaging the belts.

We recommend the use of several wheels on one shaft where large power and quick revolutions are required. With this arrangement, pulp grinders or generators may be connected direct to the wheel shaft, thereby saving the loss due to the transmission of power through belts or gears.

Where steel cases are used, they are constructed with heavy cast iron heads, the shell being made of plate steel. The heads are fitted with removable covers, which permit any part of the wheels to be taken out. Such cases are supported by cast iron brackets which are cast on the head, or riveted to the shell, the brackets resting on beams which are supported by masonry.

Bearings used to support the wheel shaft outside the case are made ring-oiling and are supported by heavy cast iron stands which are connected with the case. Bearings to support the wheel shaft inside the case, also steps and thrust bearings are all of approved design and are capable of easy adjustment in case of wear.

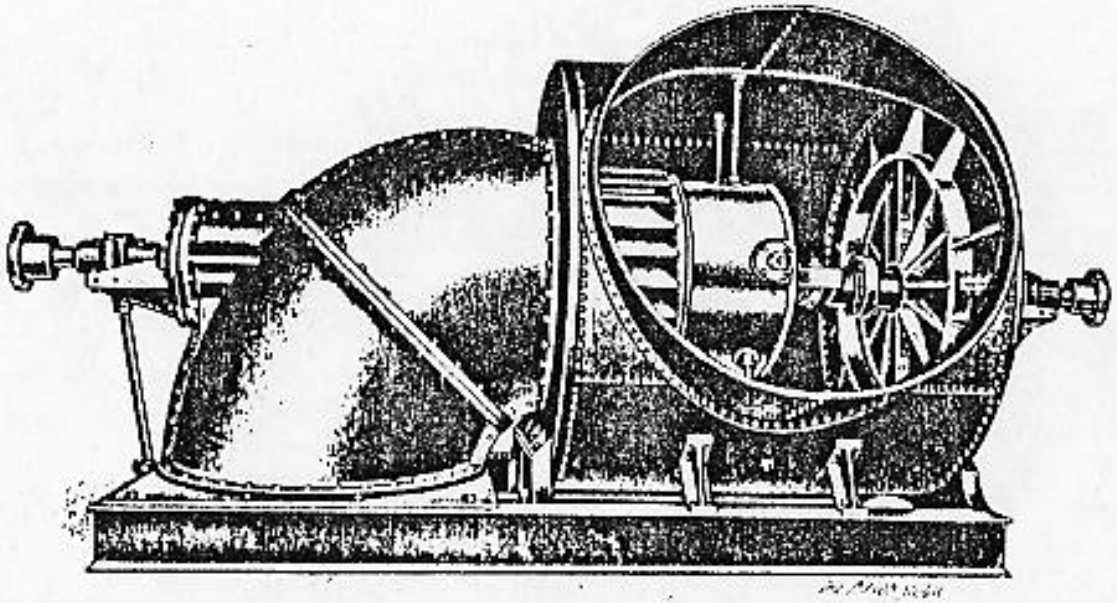


Plate No. 5

Single Horizontal Cylinder Gate Hercules Turbine in steel case with cast iron quarter-turn. Draft tube of cast iron, or with steel extension

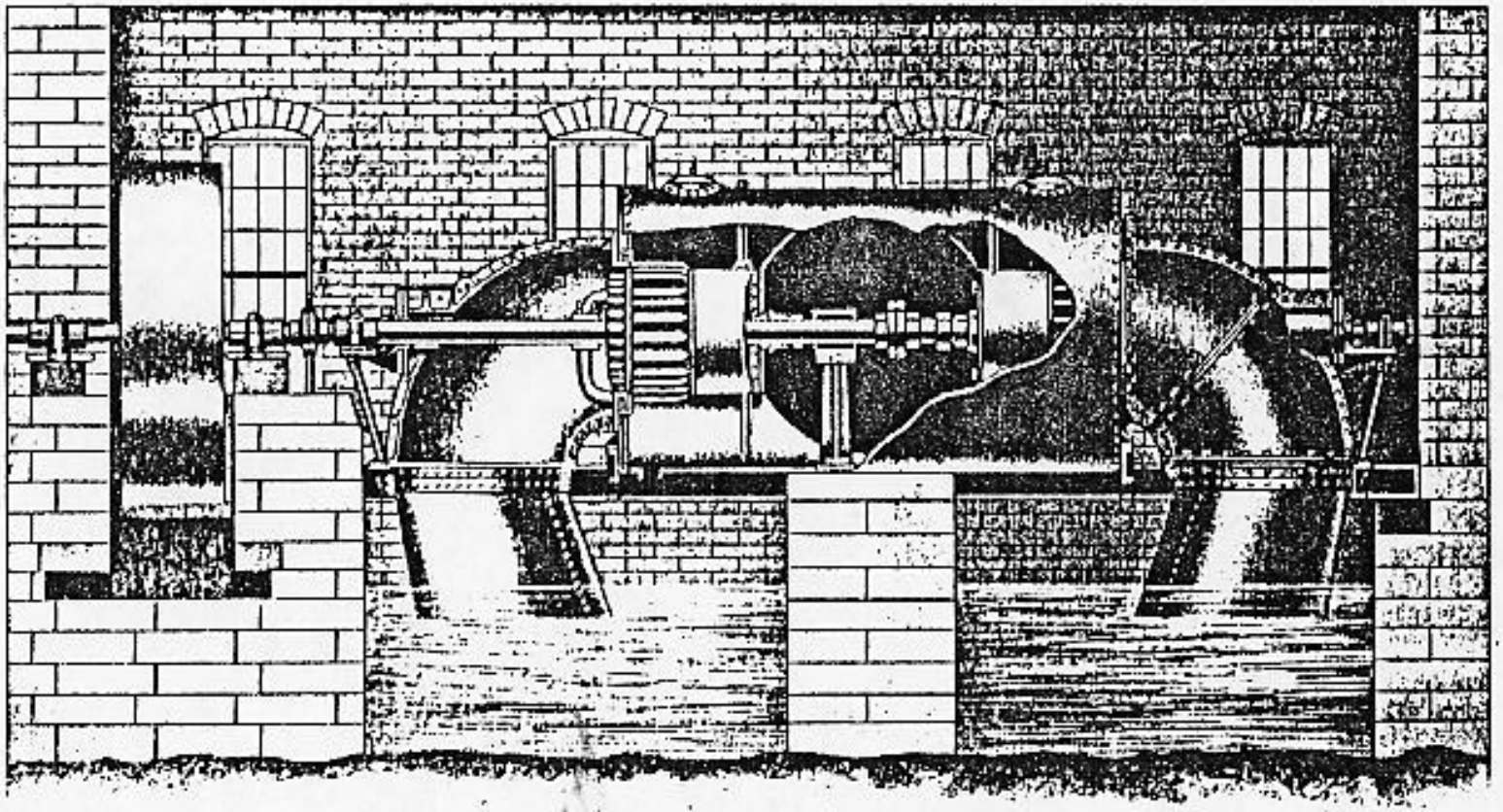


Plate No. 6

A pair of Horizontal Cylinder Gate Hercules Turbines in one steel case, each Turbine discharging its water through a separate quarter-turn and draft-tube

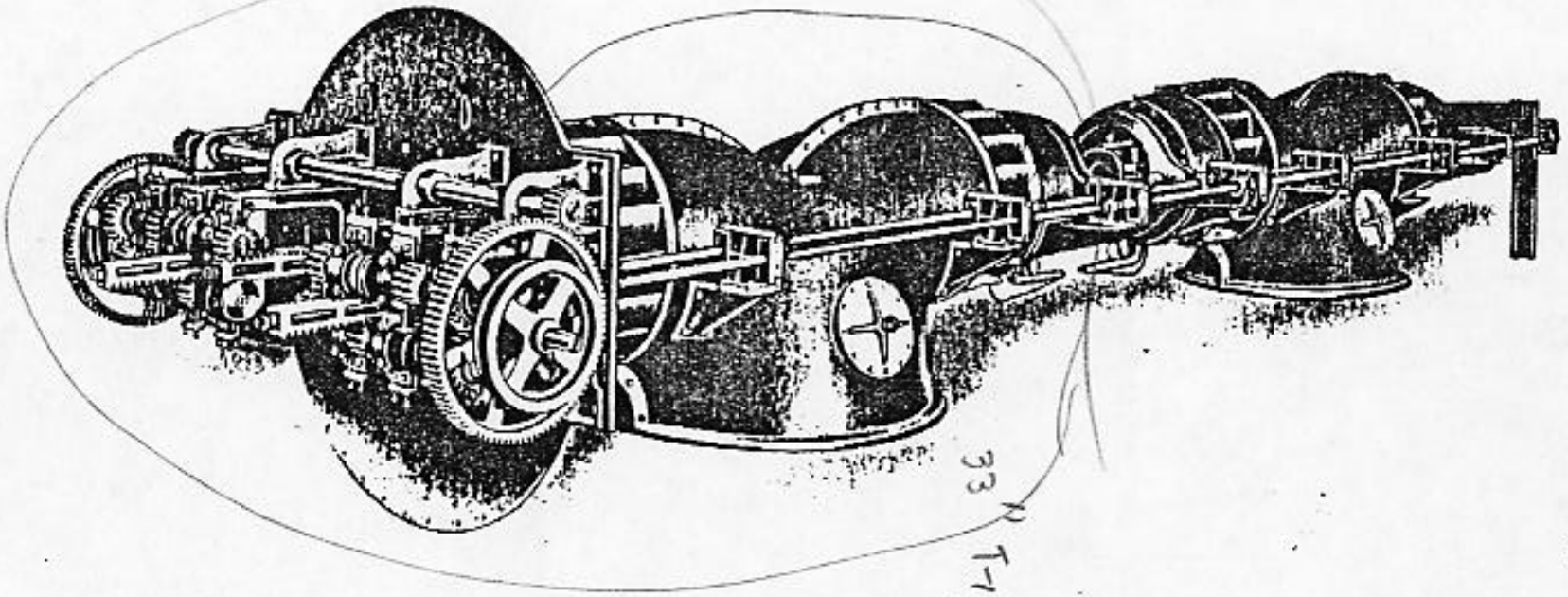


Plate No. 7

Two pairs Cylinder Gate Hercules Turbines to be set in masonry flume, each pair discharging through a common center-case and draft-tube

# USEFUL INFORMATION

To find the Theoretical Horse Power due to a given quantity of water under a given head, multiply the cubic feet discharged per second by 62⅓ and the product by the head in feet. This product divided by 550 will give the required Horse Power.

The Actual Horse Power developed by a wheel depends entirely upon its efficiency as found by test, and is such a percentage of the Theoretical Horse Power.

The Percentage at which wheel makers table their wheels can easily be found by dividing the Horse Power, as shown in the tables for a given head, by the Theoretical Horse Power due to the same quantity of water under the same head.

## FOR WHEELS OF THE SAME DIAMETER UNDER DIFFERENT HEADS.

The Horse Power varies as the square roots of the cubes of the heads.

The Cubic Feet discharged per second vary as the square roots of the heads.

The Revolutions vary as the square roots of the heads.

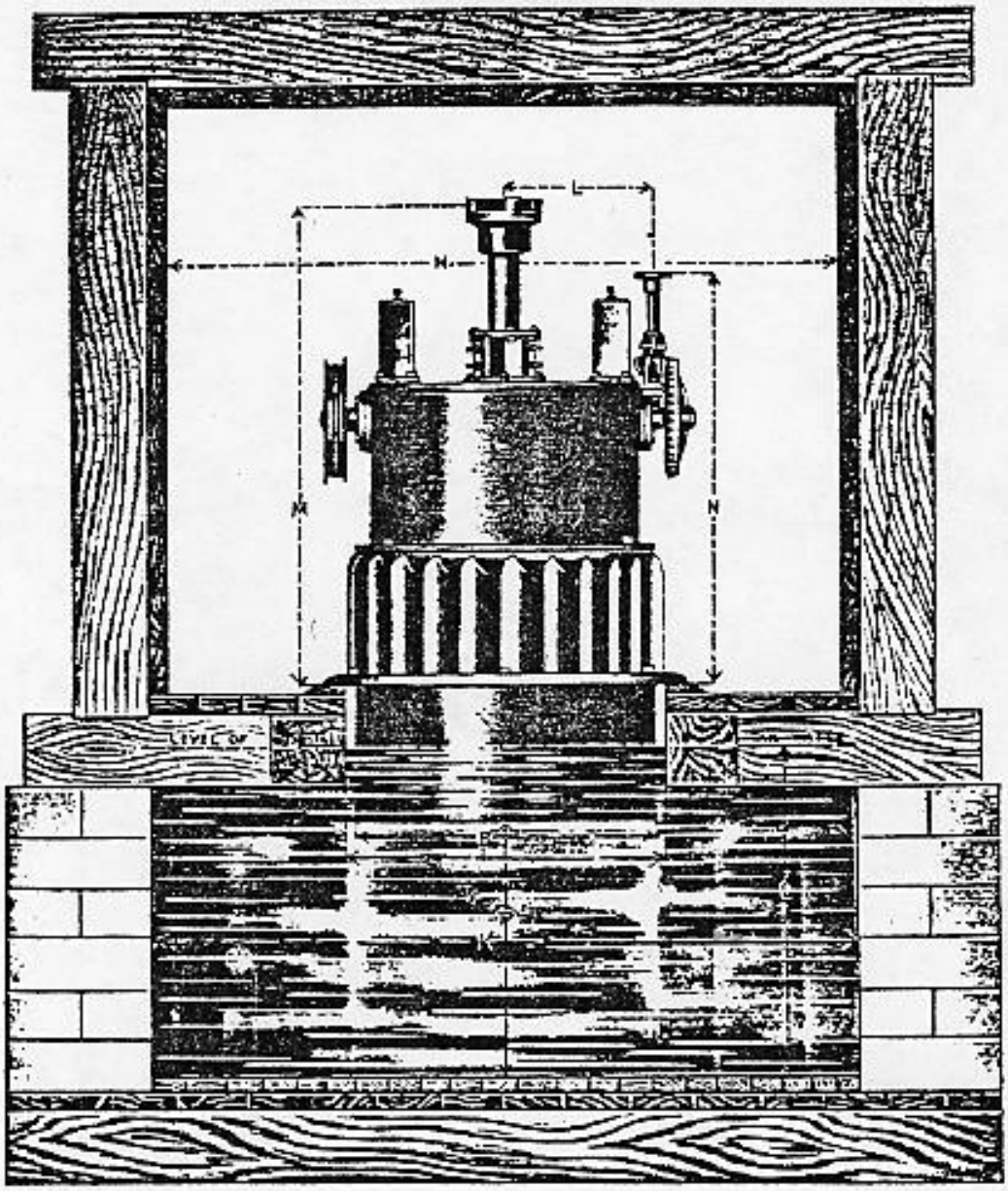



Plate No. 8

## Table of Dimensions

These Dimensions are for a head of 20 feet and may be varied for a greater or less head.

| Diam. of Wheel | B | H | I | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|---|
| | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. |
| 9 | 1 – 4¼ | 2 – 3 | 1 – 5¾ | 3 – 0 | | 1 – 11¼ | | 1 – 1½ | 0 – 9¼ |
| 12 | 1 – 8¼ | 3 – 0 | 1 – 9¾ | 4 – 0 | 0 – 9¾ | 2 – 11⅜ | 3 – 0¼ | 1 – 6 | 1 – 0¼ |
| 15 | 1 – 10 | 3 – 9 | 1 – 11½ | 5 – 0 | 0 – 11⅜ | 3 – 5⅜ | 3 – 9½ | 1 – 10½ | 1 – 6 |
| 18 | 2 – 2⅛ | 4 – 6 | 2 – 3⅝ | 6 – 0 | 1 – 0⅞ | 3 – 8⅜ | 4 – 0¾ | 2 – 3 | 1 – 8¾ |
| 21 | 2 – 5⅜ | 5 – 3 | 2 – 6⅜ | 7 – 0 | 1 – 2½ | 4 – 2⅛ | 4 – 3¾ | 2 – 7½ | 2 – 0½ |
| 24 | 2 – 9⅝ | 6 – 0 | 2 – 11⅛ | 8 – 0 | 1 – 4⅜ | 4 – 7⅛ | 4 – 7⅛ | 3 – 0 | 2 – 4⅜ |
| 27 | 3 – 1¼ | 6 – 9 | 3 – 2¾ | 9 – 0 | 1 – 5⅞ | 4 – 10⅛ | 4 – 9⅛ | 3 – 4½ | 2 – 8 |
| 30 | 3 – 5⅛ | 7 – 6 | 3 – 6¾ | 10 – 0 | 1 – 8⅛ | 5 – 3⅜ | 5 – 1⅛ | 3 – 9 | 3 – 0 |
| 33 | 3 – 10¼ | 8 – 3 | 3 – 11¾ | 11 – 0 | 1 – 9⅞ | 6 – 1¾ | 5 – 6 | 4 – 1½ | 3 – 3½ |
| 36 | 4 – 0⅜ | 9 – 0 | 4 – 1⅜ | 12 – 0 | 1 – 11⅞ | 6 – 6 | 5 – 6⅛ | 4 – 6 | 3 – 7 |
| 39 | 4 – 6¼ | 9 – 9 | 4 – 7¾ | 13 – 0 | 2 – 2⅛ | 6 – 7⅜ | 5 – 10½ | 4 – 10½ | 3 – 10½ |
| 42 | 4 – 10⅜ | 10 – 6 | 4 – 11⅜ | 14 – 0 | 2 – 3½ | 6 – 10¼ | 6 – 2⅝ | 5 – 3 | 4 – 1¼ |
| 45 | 5 – 3¼ | 11 – 3 | 5 – 5¼ | 15 – 0 | 2 – 5⅛ | 7 – 0⅜ | 6 – 5⅛ | 5 – 7½ | 4 – 5¾ |
| 48 | 5 – 5⅛ | 12 – 0 | 5 – 6¾ | 16 – 0 | 2 – 7⅝ | 7 – 2¼ | 6 – 6¾ | 6 – 0 | 4 – 0½ |
| 51 | 6 – 0⅜ | 12 – 9 | 6 – 1⅜ | 17 – 0 | 2 – 10⅛ | 8 – 7½ | 7 – 2⅛ | 6 – 4½ | 4 – 10½ |
| 54 | 6 – 6⅜ | 13 – 6 | 6 – 7⅜ | 18 – 0 | 2 – 10⅞ | 8 – 7⅝ | 7 – 5⅛ | 6 – 9 | 5 – 3 |
| 57 | 6 – 10 | 14 – 3 | 6 – 11½ | 19 – 0 | 2 – 11⅝ | 8 – 11 | 7 – 8½ | 7 – 1½ | 5 – 8½ |
| 60 | 7 – 4 | 15 – 0 | 7 – 5½ | 20 – 0 | 3 – 1⅞ | 8 – 11 | 7 – 11 | 7 – 6 | 5 – 11 |

HOLYOKE, MASSACHUSETTS

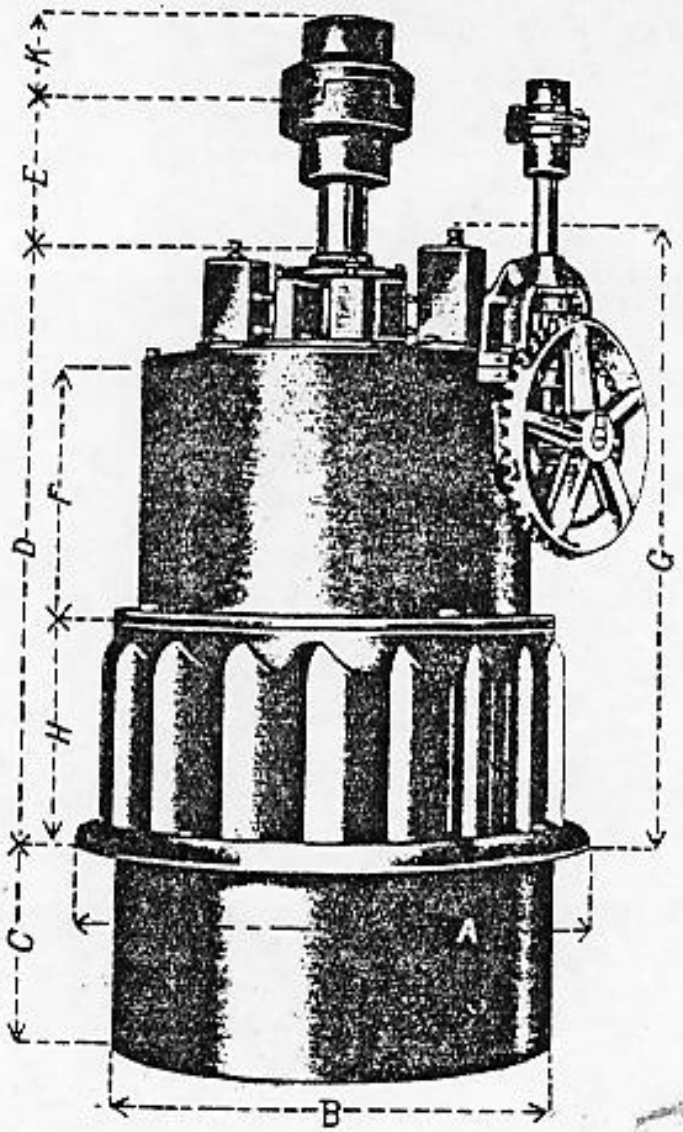



Plate No. 9

# Table of Dimensions

Type A. See Plate No. 9

| Diam. of Wheel | Diam. of Shaft | Length of Shaft from Deck of Flume | Whole Length of Shaft | A | B | C | D | E | F | G | H | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ins. | Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ins. |
| 9 | 1¾ | 1 – 11¼ | 2 – 3 5/16 | 1 – 10¾ | 1 – 4¼ | 0 – 8½ | 1 – 4 | 0 – 7¼ | 0 – 4 5/16 | | 0 – 7 1/16 | 3 1/2 |
| 12 | 2 3/16 | 2 – 11 5/16 | 3 – 2 | 2 – 0¾ | 1 – 8¼ | 0 – 11 5/8 | 2 – 0⅜ | 0 – 10 3/16 | 0 – 10 5/8 | 2 – 0 5/8 | 0 – 9¾ | 4 |
| 15 | 2 1/16 | 3 – 5 5/8 | 3 – 7 1/8 | 2 – 4¼ | 1 – 10 | 0 — 11 | 2 – 8 1/4 | 0 – 8 1/32 | 1 – 3 | 2 – 8 1/16 | 1 – 0¼ | 4 1/16 |
| 18 | 2 15/16 | 3 – 8 3/8 | 3 – 11 | 2 – 8¼ | 2 – 2 1/16 | 1 – 0½ | 2 – 11¾ | 0 – 9 1/8 | 1 – 4 1/8 | 3 – 0 1/8 | 1 – 1 3/8 | 4 1/2 |
| 21 | 3 5/16 | 4 – 2 1/16 | 4 – 4¼ | 3 – 0⅛ | 2 – 5 1/8 | 1 – 2 | 3 – 3 1/2 | 0 – 10 1/8 | 1 – 6 3/8 | 3 – 4¾ | 1 – 3 1/8 | 5 1/8 |
| 24 | 3 1/16 | 4 – 7 1/16 | 4 – 10 1/8 | 3 – 4 | 2 – 9 5/8 | 1 – 3¼ | 3 – 7¼ | 1 – 0 1/16 | 1 – 7 1/8 | 3 – 9 1/8 | 1 – 4 1/8 | 5 1/8 |
| 27 | 3 13/16 | 4 – 10 1/16 | 5 – 1 1/16 | 3 – 7½ | 3 – 1¼ | 1 – 5 | 3 – 10 | 1 – 0 1/16 | 1 – 8 1/16 | 4 – 0¾ | 1 – 5 1/8 | 6 1/16 |
| 30 | 3 15/16 | 5 – 3 1/8 | 5 – 7 1/8 | 3 – 11¼ | 3 – 5 1/16 | 1 – 6 | 4 – 2½ | 1 – 1 1/8 | 1 – 11 1/16 | 4 – 6 1/8 | 1 – 7 1/16 | 6 1/16 |
| 33 | 4 1/16 | 6 – 1¾ | 6 – 8 1/16 | 4 – 7 | 3 – 10¼ | 1 – 10 | 4 – 7¼ | 1 – 6½ | 2 – 0¾ | 4 – 10½ | 1 – 9¼ | 7¼ |
| 36 | 4 7/16 | 6 – 6 | 6 – 9 | 4 – 10 | 4 – 0 1/16 | 1 – 10 | 4 – 9 1/16 | 1 – 8 1/16 | 2 – 1 1/4 | 5 – 2 1/16 | 1 – 10 1/8 | 7 1/8 |
| 39 | 5 1/16 | 6 – 7 3/16 | 7 – 0¼ | 5 – 3 | 4 – 6¼ | 2 – 0 | 5 – 2¼ | 1 – 5 1/8 | 2 – 3¼ | 5 – 7¼ | 2 – 0¼ | 8 1/16 |
| 42 | 5 7/16 | 6 – 10¼ | 7 – 7 1/16 | 5 – 7½ | 4 – 10 1/16 | 2 – 3½ | 5 – 9¼ | 1 – 1 | 2 – 4¾ | 6 – 1 1/16 | 2 – 2 1/8 | 8 1/16 |
| 45 | 5 13/16 | 7 – 0 3/16 | 7 – 10 1/16 | 6 – 0½ | 5 – 3¼ | 2 – 3½ | 5 – 11 1/8 | 1 – 1 1/16 | 2 – 4 1/8 | 6 – 5 1/16 | 2 – 5½ | 8 1/16 |
| 48 | 6 1/16 | 7 – 2¾ | 8 – 1 | 6 – 2¼ | 5 – 5 1/16 | 2 – 5 | 6 – 1 1/16 | 1 – 1 1/8 | 2 – 6 1/8 | 6 – 8 | 2 – 5 1/8 | 8 1/16 |
| 51 | 7¼ | 8 – 7½ | 9 – 4 1/16 | 6 – 11 | 6 – 0 1/16 | 3 – 0 | 6 – 5 1/8 | 2 – 1 5/8 | 2 – 7 5/8 | 7 – 0 1/8 | 2 – 8½ | 11 |
| 54 | 7½ | 8 – 7 5/8 | 9 – 4¼ | 7 – 4 | 6 – 6 1/8 | 3 – 0 | 6 – 8 3/8 | 1 – 10¾ | 2 – 10 5/8 | 7 – 5 1/8 | 2 – 8½ | 11 |
| 57 | 8 | 8 – 11 | 9 – 10 | 7 – 10 | 6 – 10 | 3 – 2 | 7 – 1 3/8 | 1 – 9 1/8 | 2 – 11¼ | 7 – 11 3/8 | 2 – 11¼ | 12 |
| 60 | 8 | 8 – 11 | 9 – 10 | 8 – 4 | 7 – 4 | 3 – 2 | 7 – 4 1/8 | 1 – 0 5/8 | 3 – 0½ | 8 – 2 1/8 | 3 – 0½ | 12 |

## Table of Dimensions

Type B. See Plate No. 9

| Diam. of Wheel | Diam. of Shaft | Length of Shaft from Deck of Flume | Whole Length of Shaft | A | B | C | D | E | F | G | H | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ins. | Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ins. |
| 15 | $2\frac{4}{16}$ | 3 – 5⅝ | 3 – 9⅜ | 2 – 4¼ | 1 – 10 | 1 – 1 | 2 – 8⅛ | 0 – 8⅛ | 1 – 3 | 2 – $8\frac{3}{16}$ | 0 – $11\frac{5}{16}$ | 4⅜ |
| 18 | $2\frac{7}{16}$ | 3 – 8⅜ | 4 – $0\frac{5}{16}$ | 2 – 8¼ | 2 – $2\frac{3}{16}$ | 1 – 2 | 2 – 11⅜ | 0 – 9 | 1 – 4⅜ | 3 – 0½ | 1 – 1½ | 4⅜ |
| 21 | $3\frac{3}{16}$ | 4 – $2\frac{5}{16}$ | 4 – $7\frac{5}{16}$ | 3 – 0⅛ | 2 – 5⅜ | 1 – 4 | 3 – $3\frac{1}{2}$ | 0 – $10\frac{1}{2}$ | 1 – 5⅜ | 3 – 4⅞ | 1 – 3½ | 5½ |
| 24 | $3\frac{4}{16}$ | 4 – $7\frac{5}{16}$ | 5 – $1\frac{5}{16}$ | 3 – 4 | 2 – 9⅝ | 1 – 6 | 3 – 7⅝ | 0 – $11\frac{1}{2}$ | 1 – 7⅛ | 3 – $10\frac{1}{16}$ | 1 – $5\frac{5}{16}$ | 5½ |
| 27 | $3\frac{12}{16}$ | 4 – $10\frac{3}{16}$ | 5 – 6⅜ | 3 – 7½ | 3 – 1¼ | 1 – 10 | 3 – $10\frac{3}{16}$ | 1 – 0 | 1 – 8⅜ | 4 – 0½ | 1 – 6 | $6\frac{7}{16}$ |
| 30 | $3\frac{9}{16}$ | 5 – 3⅝ | 6 – 0⅝ | 3 – $11\frac{1}{4}$ | 3 – $5\frac{3}{16}$ | 2 – 0 | 4 – 2¼ | 1 – 0⅜ | 1 – $11\frac{1}{16}$ | 4 – 6⅜ | 1 – $7\frac{5}{16}$ | $6\frac{7}{16}$ |
| 33 | 4⅝ | 6 – 1¼ | 7 – $1\frac{3}{16}$ | 4 – 7 | 3 – 10¼ | 2 – 2 | 4 – 7½ | 1 – $6\frac{1}{16}$ | 2 – 0¾ | 4 – 10½ | 1 – 9½ | $7\frac{7}{16}$ |
| 36 | 4⅞ | 6 – 6 | 7 – 7⅝ | 4 – 10 | 4 – 0⅜ | 2 – 4 | 4 – 9½ | 1 – $8\frac{5}{16}$ | 2 – 1½ | 5 – 2½ | 1 – 10⅝ | $8\frac{5}{16}$ |
| 39 | 5⅛ | 6 – 7⅜ | 7 – 7¼ | 5 – 3 | 4 – 6¼ | 2 – 6 | 5 – 2½ | 1 – 5⅜ | 2 – 3¼ | 5 – 8 | 2 – 0⅝ | $8\frac{9}{16}$ |
| 42 | 5⅜ | 6 – 10¼ | 7 – $11\frac{1}{2}$ | 5 – 7⅝ | 4 – $10\frac{3}{16}$ | 2 – 8 | 5 – 0½ | 1 – 0¾ | 2 – 4¼ | 6 – 1⅜ | 2 – 3⅛ | $8\frac{9}{16}$ |
| 45 | 5⅝ | 7 – 0⅛ | 8 – 3¼ | 6 – 0⅝ | 5 – 3¼ | 3 – 0 | 6 – $0\frac{1}{16}$ | 1 – $0\frac{1}{2}$ | 2 – $4\frac{1}{2}$ | 6 – $5\frac{5}{16}$ | 2 – 5¼ | $8\frac{9}{16}$ |
| 48 | 6⅛ | 7 – 2¾ | 8 – 6⅜ | 6 – 2¼ | 5 – $5\frac{3}{16}$ | 3 – 2 | 6 – 1¾ | 1 – 1 | 2 – 6⅜ | 6 – 8⅛ | 2 – 5⅝ | $8\frac{9}{16}$ |
| 51 | 7⅛ | 8 – 7⅛ | 10 – 0¼ | 6 – 11 | 6 – 0⅜ | 3 – 4 | 6 – 6⅛ | 2 – 1⅜ | 2 – 7⅜ | 7 – 0⅜ | 2 – 8¼ | $10\frac{3}{16}$ |
| 54 | 7⅝ | 8 – 7⅜ | 10 – 2⅜ | 7 – 4 | 6 – 6⅛ | 3 – 6 | 6 – 9⅛ | 1 – 10½ | 2 – 10⅝ | 7 – 5⅝ | 2 – 8¼ | $10\frac{3}{16}$ |
| 57 | 8 | 8 – 11 | 10 – 6⅝ | 7 – 10 | 6 – 10 | 3 – 10½ | 7 – 2⅛ | 1 – 8⅞ | 2 – 11¼ | 8 – 0⅛ | 2 – 11½ | $11\frac{3}{16}$ |
| 60 | 8 | 8 – 11 | 10 – 8¼ | 8 – 4 | 7 – 4 | 4 – 0¼ | 7 – 4⅝ | 1 – 6⅜ | 3 – 0½ | 8 – 2⅝ | 3 – 0¼ | $11\frac{3}{16}$ |

## Table of Dimensions

Type C. See Plate No. 9

| Diam. of Wheel | Diam. of Shaft | Length of Shaft from Deck of Flume | Whole Length of Shaft | A | B | C | D | E | F | G | H | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ins. | Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ft. Ins. | Ins. |
| 15 | $2\frac{4}{16}$ | 3 – 5⅝ | 3 – 9⅞ | 2 – 8¾ | 2 – 3¾ | 1 – 1½ | 2 – 8¾ | 0 – 8⅞ | 1 – 3 | 2 – 8½ | 1 – $0\frac{5}{16}$ | 4⅞ |
| 18 | $2\frac{9}{16}$ | 3 – 8⅞ | 4 – 1¼ | 2 – 10½ | 2 – 7¾ | 1 – 2⅞ | 2 – 11⅞ | 0 – 9 | 1 – 4⅜ | 3 – 0½ | 1 – 1½ | 4⅞ |
| 21 | $3\frac{3}{16}$ | 4 – 2⅝ | 4 – $8\frac{1}{16}$ | 3 – 7 | 3 – 0⅞ | 1 – $4\frac{5}{16}$ | 3 – $3\frac{3}{4}$ | 0 – $10\frac{1}{2}$ | 1 – 5⅛ | 3 – 4⅞ | 1 – $3\frac{9}{16}$ | 5⅛ |
| 24 | $3\frac{4}{16}$ | 4 – $7\frac{8}{16}$ | 5 – 1⅛ | 4 – 2 | 3 – 7¼ | 1 – 6⅛ | 3 – 7⅝ | 0 – $11\frac{1}{2}$ | 1 – 7¾ | 3 – $10\frac{1}{16}$ | 1 – $4\frac{1}{16}$ | 5⅛ |
| 27 | $3\frac{1}{16}$ | 4 – $10\frac{3}{16}$ | 5 – 7⅛ | 4 – 7½ | 4 – 0½ | 1 – 10¾ | 3 – 10⅛ | 1 – $0\frac{1}{16}$ | 1 – 7⅞ | 4 – 2⅜ | 1 – $6\frac{7}{16}$ | $6\frac{7}{16}$ |
| 30 | $3\frac{9}{16}$ | 5 – 3⅝ | 6 – 1⅛ | 5 – 1½ | 4 – 6½ | 2 – $1\frac{3}{16}$ | 4 – 3¼ | 1 – 0⅜ | 1 – 10¾ | 4 – 8⅞ | 1 – 8⅛ | $6\frac{7}{16}$ |
| 33 | 4⅛ | 6 – 1¾ | 7 – $1\frac{3}{16}$ | 5 – 6 | 4 – 11 | 2 – 2 | 4 – 7⅛ | 1 – $6\frac{1}{16}$ | 2 – 0 | 5 – $1\frac{7}{16}$ | 1 – $10\frac{7}{16}$ | $7\frac{7}{16}$ |
| 36 | 4⅜ | 6 – 6 | 7 – 7⅝ | 5 – 10 | 5 – 3¼ | 2 – 4 | 4 – 10⅛ | 1 – 7⅜ | 2 – 1¼ | 5 – 5¼ | 1 – 11⅜ | $8\frac{1}{16}$ |
| 39 | 5⅜ | 6 – 7⅞ | 7 – 8¾ | 6 – 5 | 5 – 8¼ | 2 – 7½ | 5 – 2½ | 1 – 5⅜ | 2 – 2¼ | 5 – 8 | 2 – 1½ | $8\frac{9}{16}$ |
| 42 | 5⅞ | 6 – $10\frac{1}{4}$ | 8 – 1¼ | 6 – 11 | 6 – 2¼ | 2 – 0½ | 5 – 9½ | 1 – 0¾ | 2 – 4¾ | 6 – 2 | 2 – 3⅛ | $8\frac{9}{16}$ |
| 45 | 5⅞ | 7 – 0⅞ | 8 – 5⅝ | 7 – 5 | 6 – 8¾ | 3 – 1⅞ | 6 – 0¾ | 1 – 0⅛ | 2 – 6 | 6 – 7⅛ | 2 – 5¼ | $8\frac{9}{16}$ |
| 48 | 6⅜ | 7 – 4½ | 8 – 0⅞ | 7 – 8 | 6 – $11\frac{1}{4}$ | 3 – 3¼ | 6 – 3⅛ | 1 – 1⅛ | 2 – 7⅛ | 7 – 0¼ | 2 – 6⅝ | 8⅛ |
| 51 | 7½ | 8 – 7½ | 10 – 2⅛ | 8 – 4 | 7 – 5¼ | 3 – 0⅛ | 6 – 9⅜ | 1 – 10⅛ | 2 – 9⅜ | 7 – 0⅛ | 2 – 10¼ | 10⅛ |
| 54 | 7½ | 8 – 8⅜ | 10 – 4¾ | 8 – 9 | 7 – 10¼ | 3 – 7⅝ | 7 – 0⅝ | 1 – 7¾ | 2 – 11⅛ | 7 – 10⅝ | 2 – 11¾ | 10⅛ |

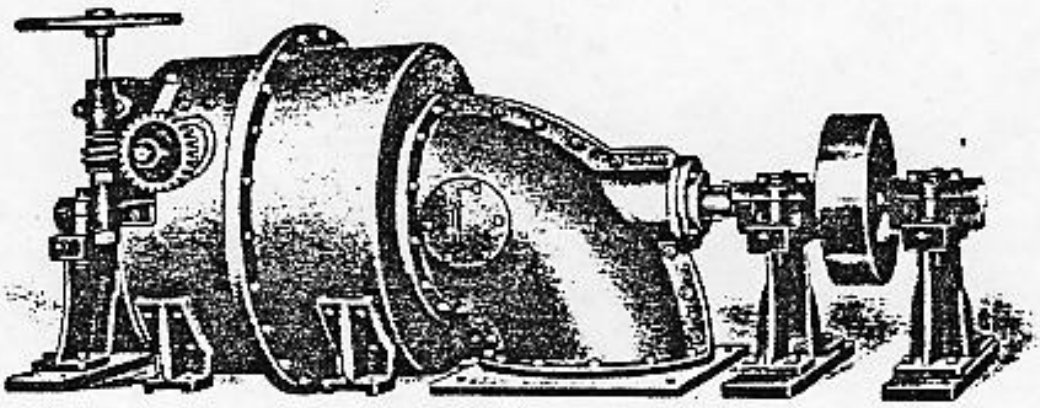


Plate No. 10

Small Horizontal Hercules Turbine, in cast iron case, discharging through a cast iron quarter-turn and fed through a penstock which enters case on back side and does not show in the cut. Can be made to take penstock at any angle. We have made a great number of such turbines

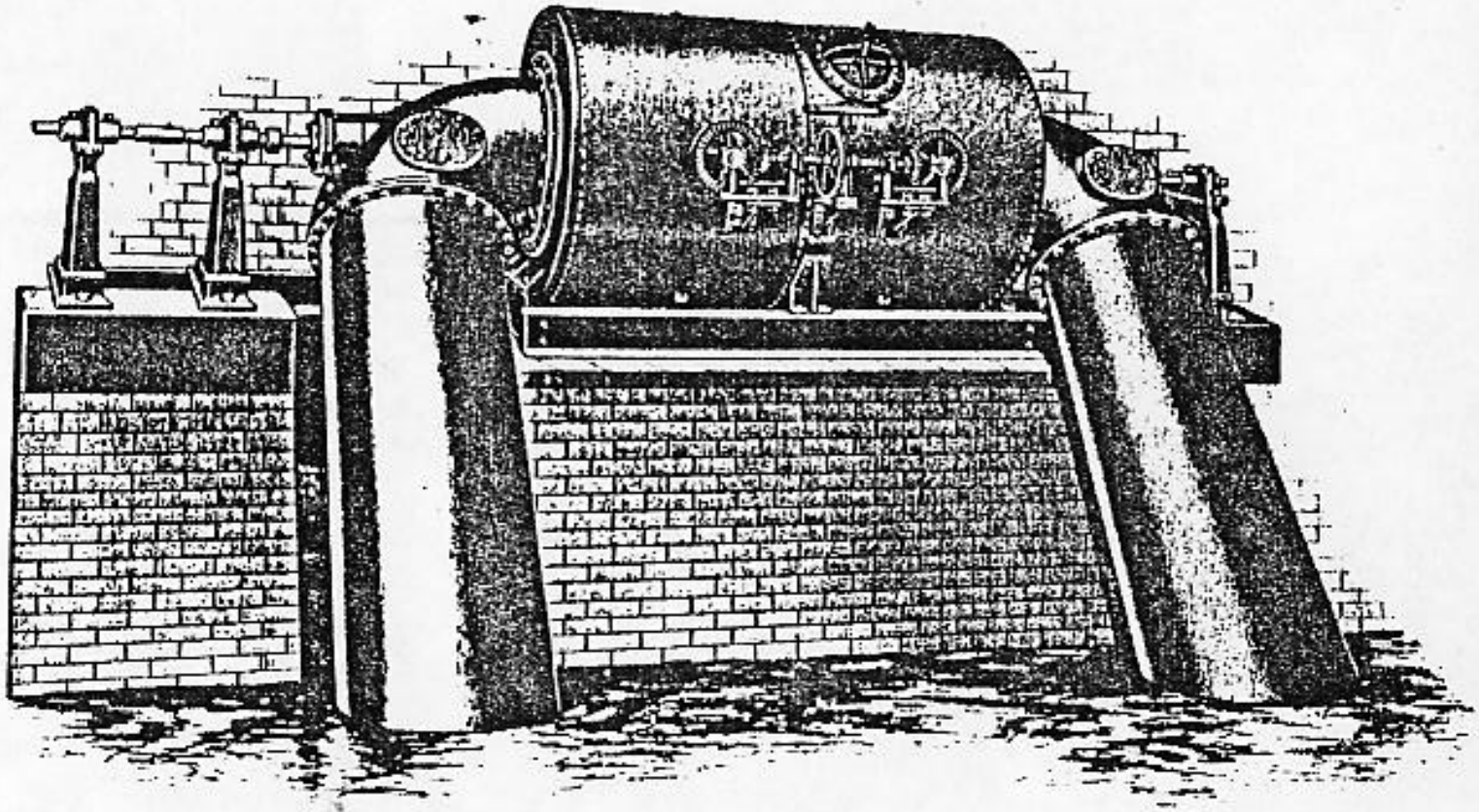


Plate No. 11

A pair of Hercules Turbines in steel case discharging through separate quarter-turns, and draft-tubes 24 feet long

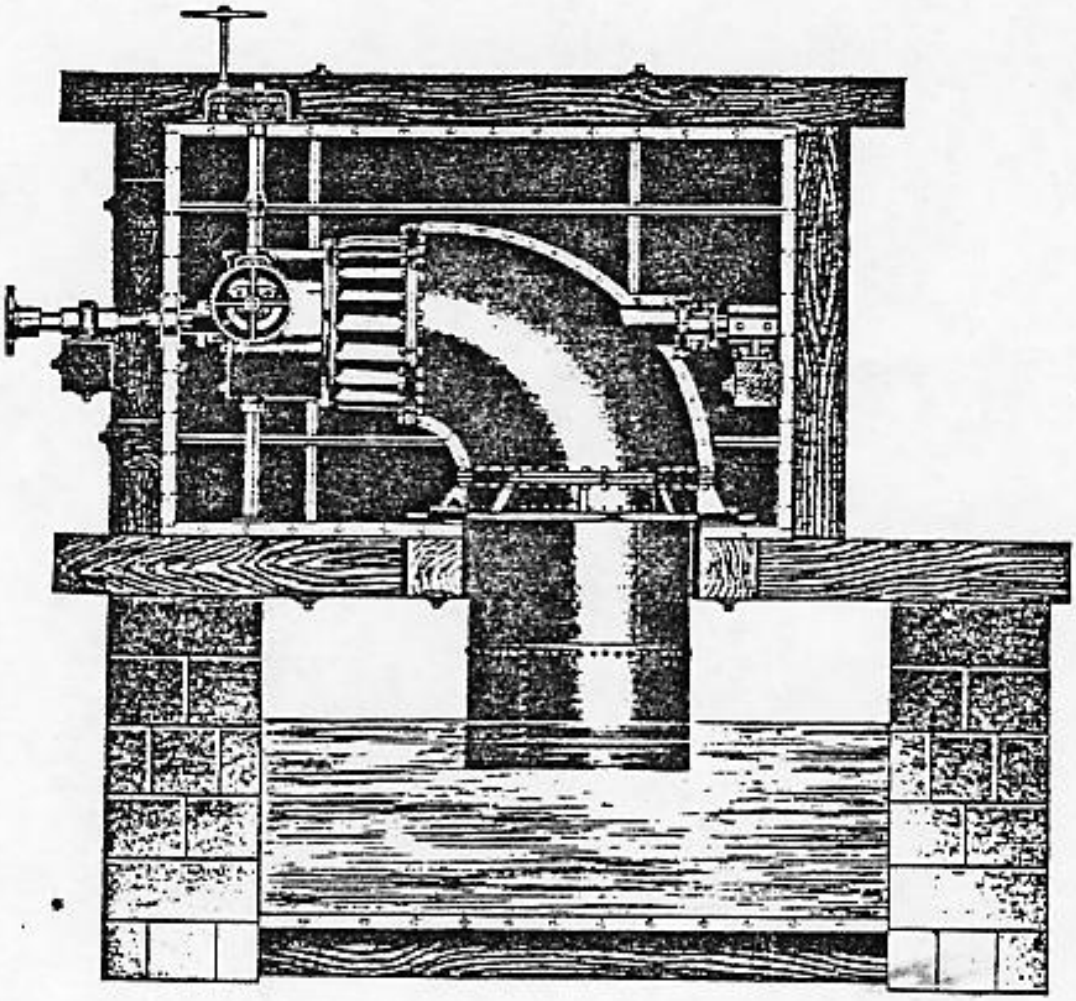


Plate No. 12

Cylinder Gate Hercules Turbine on cast iron quarter-turn and steel draft-tube, in wood flume. This arrangement has been used many times to replace vertical wheels without any material changes in the construction of the flume.

# THE HERCULES TURBINE

## Table of Type "A" Wheels

$N_S = 45$ $D_S = 1.55$ $P = 2.26$

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | Horse Power | .6 | 1.0 | 1.4 | 1.8 | 2.3 | 2.8 | 3.4 | 3.9 | 4.6 | 5.2 |
| | Cubic Feet | 2.40 | 2.77 | 3.10 | 3.40 | 3.67 | 3.92 | 4.16 | 4.39 | 4.60 | 4.81 |
| | Revolutions | 224 | 258 | 289 | 316 | 342 | 365 | 388 | 409 | 429 | 448 |
| 12 | Horse Power | 1.1 | 1.7 | 2.4 | 3.2 | 4.0 | 4.9 | 5.8 | 6.8 | 7.9 | 9.0 |
| | Cubic Feet | 4.13 | 4.78 | 5.33 | 5.85 | 6.31 | 6.75 | 7.16 | 7.55 | 7.91 | 8.26 |
| | Revolutions | 168 | 194 | 216 | 238 | 256 | 274 | 291 | 306 | 322 | 336 |
| 15 | Horse Power | 1.8 | 2.8 | 3.9 | 5.1 | 6.5 | 7.9 | 9.4 | 11.0 | 12.7 | 14.5 |
| | Cubic Feet | 6.66 | 7.70 | 8.61 | 9.45 | 10.20 | 10.90 | 11.56 | 12.18 | 12.78 | 13.35 |
| | Revolutions | 134 | 155 | 173 | 190 | 205 | 219 | 233 | 245 | 257 | 269 |
| 18 | Horse Power | 2.5 | 3.9 | 5.4 | 7.2 | 9.0 | 11.0 | 13.1 | 15.4 | 17.7 | 20.2 |
| | Cubic Feet | 9.31 | 10.75 | 12.01 | 13.18 | 14.23 | 15.20 | 16.13 | 17.00 | 17.83 | 18.63 |
| | Revolutions | 112 | 129 | 145 | 158 | 171 | 183 | 194 | 205 | 215 | 224 |
| 21 | Horse Power | 3.5 | 5.5 | 7.6 | 10.0 | 12.7 | 15.5 | 18.5 | 21.7 | 25.0 | 28.5 |
| | Cubic Feet | 13.11 | 15.15 | 16.91 | 18.55 | 20.03 | 21.41 | 22.71 | 23.95 | 25.11 | 26.23 |
| | Revolutions | 96 | 111 | 124 | 136 | 147 | 157 | 166 | 175 | 184 | 192 |
| 24 | Horse Power | 4.4 | 6.8 | 9.4 | 12.4 | 15.7 | 19.2 | 22.9 | 26.8 | 30.9 | 35.2 |
| | Cubic Feet | 16.20 | 18.71 | 20.91 | 22.91 | 24.75 | 26.46 | 28.06 | 29.58 | 31.03 | 32.41 |
| | Revolutions | 83 | 96 | 107 | 118 | 128 | 136 | 145 | 153 | 161 | 168 |
| 27 | Horse Power | 5.8 | 9.0 | 12.6 | 16.6 | 20.9 | 25.5 | 30.5 | 35.7 | 41.2 | 47.0 |
| | Cubic Feet | 21.60 | 24.95 | 27.86 | 30.56 | 33.00 | 35.28 | 37.43 | 39.45 | 41.38 | 43.21 |
| | Revolutions | 75 | 86 | 96 | 106 | 114 | 122 | 129 | 136 | 143 | 149 |
| 30 | Horse Power | 6.9 | 10.7 | 14.9 | 19.6 | 24.6 | 30.2 | 36.1 | 42.3 | 48.8 | 55.5 |
| | Cubic Feet | 25.56 | 29.51 | 32.98 | 36.16 | 39.05 | 41.73 | 44.28 | 46.66 | 48.95 | 51.11 |
| | Revolutions | 67 | 78 | 87 | 95 | 103 | 110 | 116 | 123 | 129 | 134 |
| 33 | Horse Power | 8.8 | 13.5 | 18.9 | 24.8 | 31.3 | 38.2 | 45.6 | 53.4 | 61.6 | 70.2 |
| | Cubic Feet | 32.31 | 37.31 | 41.68 | 45.71 | 49.36 | 52.76 | 55.96 | 59.00 | 61.88 | 64.61 |
| | Revolutions | 61 | 70 | 79 | 86 | 93 | 100 | 106 | 111 | 117 | 122 |
| 36 | Horse Power | 9.9 | 15.3 | 21.3 | 28.1 | 35.4 | 43.2 | 51.6 | 60.5 | 69.8 | 79.5 |
| | Cubic Feet | 36.55 | 42.21 | 47.16 | 51.71 | 55.85 | 59.68 | 63.31 | 66.75 | 70.01 | 73.11 |
| | Revolutions | 56 | 65 | 72 | 79 | 86 | 91 | 97 | 102 | 107 | 112 |
| 30 | Horse Power | 12.1 | 18.8 | 26.2 | 34.5 | 43.5 | 53.2 | 63.5 | 74.3 | 85.8 | 97.7 |
| | Cubic Feet | 44.95 | 51.90 | 57.98 | 63.58 | 68.66 | 73.40 | 77.86 | 82.06 | 86.08 | 89.90 |
| | Revolutions | 52 | 60 | 68 | 73 | 79 | 84 | 89 | 94 | 99 | 103 |
| 42 | Horse Power | 14.5 | 22.4 | 31.3 | 41.1 | 51.8 | 63.3 | 75.6 | 88.5 | 102.1 | 116.4 |
| | Cubic Feet | 53.53 | 61.81 | 69.06 | 75.73 | 81.76 | 87.41 | 92.73 | 97.73 | 102.5 | 107.0 |
| | Revolutions | 48 | 55 | 62 | 68 | 73 | 78 | 83 | 88 | 92 | 96 |
| 45 | Horse Power | 16.3 | 25.1 | 35.1 | 46.2 | 58.2 | 71.1 | 84.8 | 99.4 | 114.7 | 130.6 |
| | Cubic Feet | 60.10 | 69.40 | 77.53 | 85.01 | 91.80 | 98.11 | 104.1 | 109.7 | 115.1 | 120.2 |
| | Revolutions | 45 | 52 | 58 | 63 | 68 | 73 | 78 | 82 | 86 | 90 |
| 48 | Horse Power | 18.0 | 27.7 | 38.7 | 50.9 | 64.2 | 78.4 | 93.6 | 109.6 | 126.4 | 144.0 |
| | Cubic Feet | 66.26 | 76.51 | 85.50 | 93.75 | 101.2 | 108.2 | 114.8 | 121.0 | 126.9 | 132.5 |
| | Revolutions | 42 | 48 | 54 | 59 | 64 | 69 | 73 | 77 | 80 | 84 |
| 51 | Horse Power | 20.3 | 31.3 | 43.7 | 57.5 | 72.5 | 88.6 | 105.7 | 123.8 | 142.8 | 162.7 |
| | Cubic Feet | 74.85 | 86.43 | 96.56 | 105.9 | 114.3 | 122.2 | 129.6 | 136.6 | 143.3 | 149.7 |
| | Revolutions | 39 | 45 | 51 | 56 | 60 | 65 | 69 | 72 | 75 | 79 |
| 54 | Horse Power | 23.5 | 36.2 | 50.5 | 66.5 | 83.8 | 102.4 | 122.2 | 143.1 | 165.1 | 188.1 |
| | Cubic Feet | 86.51 | 98.25 | 111.6 | 122.4 | 132.2 | 141.3 | 149.9 | 158.0 | 165.7 | 173.0 |
| | Revolutions | 37 | 43 | 48 | 52 | 57 | 61 | 65 | 68 | 71 | 75 |
| 57 | Horse Power | 25.4 | 39.1 | 54.6 | 71.9 | 90.5 | 110.6 | 132.0 | 154.6 | 178.4 | 203.2 |
| | Cubic Feet | 93.46 | 107.9 | 120.6 | 132.2 | 142.8 | 152.6 | 161.9 | 170.6 | 179.0 | 186.9 |
| | Revolutions | 35 | 40 | 45 | 50 | 54 | 57 | 61 | 64 | 68 | 71 |
| 60 | Horse Power | 28.1 | 43.3 | 60.5 | 79.6 | 100.3 | 122.6 | 146.3 | 171.3 | 197.7 | 225.2 |
| | Cubic Feet | 103.6 | 119.6 | 133.6 | 146.5 | 158.3 | 169.1 | 179.4 | 189.1 | 198.4 | 207.2 |
| | Revolutions | 33 | 38 | 43 | 47 | 51 | 54 | 58 | 61 | 64 | 67 |

# THE HERCULES TURBINE

Corresponds to P122

## Table of Type "A" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 9 | Horse Power | 5.9 | 6.6 | 7.3 | 8.0 | 8.8 | 9.6 | 10.4 | 11.2 | 12.1 | 12.9 |
| | Cubic Feet | 5.00 | 5.19 | 5.37 | 5.55 | 5.72 | 5.88 | 6.05 | 6.20 | 6.35 | 6.50 |
| | Revolutions | 466 | 483 | 501 | 517 | 533 | 549 | 564 | 578 | 593 | 607 |
| 12 | Horse Power | 10.1 | 11.3 | 12.5 | 13.8 | 15.1 | 16.5 | 17.9 | 19.3 | 20.8 | 22.3 |
| | Cubic Feet | 8.61 | 8.93 | 9.25 | 9.55 | 9.85 | 10.13 | 10.41 | 10.68 | 10.95 | 11.20 |
| | Revolutions | 350 | 363 | 376 | 388 | 400 | 412 | 423 | 434 | 444 | 455 |
| 15 | Horse Power | 16.3 | 18.3 | 20.2 | 22.3 | 24.4 | 26.6 | 28.9 | 31.2 | 33.6 | 36.0 |
| | Cubic Feet | 13.90 | 14.41 | 14.91 | 15.41 | 15.88 | 16.35 | 16.80 | 17.23 | 17.66 | 18.06 |
| | Revolutions | 280 | 290 | 300 | 310 | 320 | 329 | 338 | 347 | 356 | 364 |
| 18 | Horse Power | 22.8 | 25.5 | 28.3 | 31.2 | 34.1 | 37.2 | 40.3 | 43.6 | 46.8 | 50.2 |
| | Cubic Feet | 19.38 | 20.11 | 20.83 | 21.51 | 22.16 | 22.81 | 23.43 | 24.05 | 24.63 | 25.21 |
| | Revolutions | 233 | 242 | 251 | 259 | 267 | 275 | 282 | 289 | 297 | 303 |
| 21 | Horse Power | 32.1 | 35.9 | 39.8 | 43.9 | 48.1 | 52.4 | 56.8 | 61.4 | 66.0 | 70.8 |
| | Cubic Feet | 27.31 | 28.33 | 29.33 | 30.30 | 31.23 | 32.13 | 33.01 | 33.88 | 34.70 | 35.51 |
| | Revolutions | 200 | 207 | 215 | 222 | 229 | 235 | 242 | 248 | 254 | 260 |
| 24 | Horse Power | 39.7 | 44.3 | 49.2 | 54.2 | 59.4 | 64.7 | 70.2 | 75.8 | 81.5 | 87.4 |
| | Cubic Feet | 33.73 | 35.00 | 36.23 | 37.41 | 38.56 | 39.70 | 40.78 | 41.83 | 42.86 | 43.88 |
| | Revolutions | 175 | 181 | 188 | 194 | 200 | 206 | 212 | 217 | 223 | 228 |
| 27 | Horse Power | 52.9 | 59.2 | 65.6 | 72.3 | 79.2 | 86.3 | 93.6 | 101.1 | 108.7 | 116.6 |
| | Cubic Feet | 44.98 | 46.68 | 48.31 | 49.90 | 51.43 | 52.93 | 54.38 | 55.80 | 57.16 | 58.50 |
| | Revolutions | 155 | 161 | 167 | 172 | 178 | 183 | 188 | 193 | 198 | 202 |
| 30 | Horse Power | 62.6 | 70.0 | 77.6 | 85.5 | 93.7 | 102.1 | 110.7 | 119.5 | 128.6 | 137.9 |
| | Cubic Feet | 53.21 | 55.21 | 57.15 | 59.03 | 60.85 | 62.61 | 64.33 | 66.00 | 67.63 | 69.21 |
| | Revolutions | 140 | 145 | 150 | 155 | 160 | 165 | 169 | 174 | 178 | 182 |
| 33 | Horse Power | 79.2 | 88.5 | 98.1 | 108.1 | 118.4 | 129.1 | 140.0 | 151.2 | 162.6 | 174.4 |
| | Cubic Feet | 67.28 | 69.81 | 72.25 | 74.63 | 76.93 | 79.16 | 81.33 | 83.45 | 85.48 | 87.50 |
| | Revolutions | 127 | 132 | 137 | 141 | 145 | 150 | 154 | 158 | 162 | 165 |
| 36 | Horse Power | 89.6 | 100.1 | 111.1 | 122.3 | 134.0 | 146.0 | 158.4 | 171.0 | 184.0 | 197.2 |
| | Cubic Feet | 76.11 | 78.98 | 81.75 | 84.43 | 87.03 | 89.56 | 92.01 | 94.40 | 96.71 | 98.98 |
| | Revolutions | 117 | 121 | 125 | 129 | 133 | 137 | 140 | 144 | 148 | 152 |
| 39 | Horse Power | 110.2 | 123.1 | 136.6 | 150.4 | 164.8 | 179.5 | 194.7 | 210.3 | 226.2 | 242.6 |
| | Cubic Feet | 93.58 | 97.11 | 100.5 | 103.8 | 107.0 | 110.1 | 113.1 | 116.1 | 118.9 | 121.7 |
| | Revolutions | 107 | 112 | 116 | 120 | 124 | 127 | 130 | 133 | 137 | 140 |
| 42 | Horse Power | 131.2 | 146.7 | 162.6 | 179.2 | 196.3 | 213.8 | 231.9 | 250.5 | 269.4 | 288.9 |
| | Cubic Feet | 111.5 | 115.7 | 119.7 | 123.6 | 127.4 | 131.1 | 134.7 | 138.2 | 141.6 | 144.9 |
| | Revolutions | 100 | 104 | 107 | 111 | 114 | 118 | 121 | 124 | 127 | 130 |
| 45 | Horse Power | 147.3 | 164.6 | 182.6 | 201.1 | 220.3 | 240.0 | 260.3 | 281.1 | 302.4 | 324.3 |
| | Cubic Feet | 125.1 | 129.8 | 134.4 | 138.8 | 143.1 | 147.2 | 151.2 | 155.2 | 159.0 | 162.7 |
| | Revolutions | 93 | 97 | 100 | 103 | 107 | 110 | 113 | 116 | 119 | 121 |
| 48 | Horse Power | 162.5 | 181.5 | 201.3 | 221.8 | 242.9 | 264.7 | 287.1 | 310.0 | 333.5 | 357.6 |
| | Cubic Feet | 137.9 | 143.1 | 148.2 | 153.0 | 157.7 | 162.3 | 166.8 | 171.1 | 175.3 | 179.4 |
| | Revolutions | 87 | 91 | 94 | 97 | 100 | 103 | 106 | 108 | 111 | 114 |
| 51 | Horse Power | 183.5 | 205.1 | 227.4 | 250.5 | 274.4 | 299.0 | 324.3 | 350.2 | 376.7 | 403.9 |
| | Cubic Feet | 155.8 | 161.7 | 167.4 | 172.8 | 178.2 | 183.4 | 188.4 | 193.3 | 198.0 | 202.6 |
| | Revolutions | 82 | 86 | 88 | 91 | 94 | 97 | 100 | 102 | 104 | 107 |
| 54 | Horse Power | 212.1 | 237.1 | 262.9 | 289.6 | 317.2 | 345.7 | 374.8 | 404.8 | 435.5 | 466.9 |
| | Cubic Feet | 180.1 | 186.9 | 193.5 | 199.8 | 206.0 | 212.0 | 217.8 | 223.4 | 228.9 | 234.3 |
| | Revolutions | 78 | 81 | 83 | 86 | 89 | 91 | 94 | 96 | 99 | 101 |
| 57 | Horse Power | 229.2 | 256.1 | 284.0 | 312.9 | 342.7 | 373.4 | 404.9 | 437.3 | 470.5 | 504.4 |
| | Cubic Feet | 194.6 | 201.9 | 209.0 | 215.8 | 222.5 | 229.0 | 235.2 | 241.4 | 247.3 | 253.1 |
| | Revolutions | 74 | 76 | 79 | 82 | 84 | 87 | 89 | 91 | 94 | 96 |
| 60 | Horse Power | 254.0 | 283.8 | 314.8 | 346.8 | 379.8 | 413.9 | 448.8 | 484.7 | 521.5 | 559.0 |
| | Cubic Feet | 215.7 | 223.8 | 231.6 | 239.3 | 246.6 | 253.8 | 260.7 | 267.5 | 274.1 | 280.5 |
| | Revolutions | 70 | 72 | 75 | 78 | 80 | 82 | 85 | 87 | 89 | 91 |

# THE HERCULES TURBINE

## Table of Type "A" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 9 | Horse Power | 13.8 | 14.7 | 15.7 | 16.6 | 17.6 | 18.6 | 19.6 | 20.6 | 21.6 | 22.7 |
| | Cubic Feet | 6.65 | 6.78 | 6.93 | 7.06 | 7.20 | 7.33 | 7.46 | 7.58 | 7.71 | 7.83 |
| | Revolutions | 620 | 634 | 647 | 660 | 672 | 684 | 696 | 708 | 720 | 732 |
| 12 | Horse Power | 23.8 | 25.4 | 27.0 | 28.7 | 30.3 | 32.0 | 33.8 | 35.5 | 37.3 | 39.1 |
| | Cubic Feet | 11.45 | 11.70 | 11.95 | 12.18 | 12.41 | 12.63 | 12.86 | 13.08 | 13.30 | 13.51 |
| | Revolutions | 465 | 475 | 485 | 494 | 504 | 514 | 523 | 532 | 540 | 548 |
| 15 | Horse Power | 38.4 | 41.0 | 43.6 | 46.2 | 48.9 | 51.7 | 54.5 | 57.3 | 60.2 | 63.2 |
| | Cubic Feet | 18.48 | 18.88 | 19.26 | 19.65 | 20.01 | 20.40 | 20.75 | 21.11 | 21.45 | 21.80 |
| | Revolutions | 372 | 380 | 388 | 396 | 403 | 411 | 418 | 425 | 432 | 439 |
| 18 | Horse Power | 53.7 | 57.2 | 60.8 | 64.5 | 68.3 | 72.1 | 76.1 | 80.0 | 84.0 | 88.1 |
| | Cubic Feet | 25.78 | 26.35 | 26.88 | 27.41 | 27.93 | 28.45 | 28.96 | 29.45 | 29.93 | 30.41 |
| | Revolutions | 310 | 317 | 324 | 330 | 336 | 342 | 348 | 354 | 360 | 366 |
| 21 | Horse Power | 75.6 | 80.6 | 85.7 | 90.9 | 96.2 | 101.6 | 107.1 | 112.7 | 118.4 | 124.2 |
| | Cubic Feet | 36.31 | 37.10 | 37.86 | 38.61 | 39.35 | 40.08 | 40.78 | 41.48 | 42.16 | 42.85 |
| | Revolutions | 266 | 271 | 277 | 283 | 288 | 293 | 298 | 304 | 309 | 313 |
| 24 | Horse Power | 93.4 | 99.6 | 105.9 | 112.3 | 118.8 | 125.5 | 132.3 | 139.3 | 146.2 | 153.4 |
| | Cubic Feet | 44.86 | 45.83 | 46.78 | 47.70 | 48.58 | 49.50 | 50.38 | 51.25 | 52.08 | 52.91 |
| | Revolutions | 233 | 238 | 243 | 248 | 253 | 258 | 262 | 267 | 271 | 275 |
| 27 | Horse Power | 124.6 | 132.8 | 141.3 | 149.8 | 158.5 | 167.4 | 176.5 | 185.7 | 195.0 | 204.5 |
| | Cubic Feet | 59.81 | 61.11 | 62.38 | 63.60 | 64.81 | 66.01 | 67.18 | 68.33 | 69.45 | 70.56 |
| | Revolutions | 207 | 211 | 215 | 220 | 224 | 228 | 232 | 236 | 240 | 244 |
| 30 | Horse Power | 147.4 | 157.2 | 167.1 | 177.2 | 187.5 | 198.1 | 208.7 | 219.7 | 230.7 | 242.0 |
| | Cubic Feet | 70.76 | 72.30 | 73.80 | 75.25 | 76.68 | 78.10 | 79.45 | 80.83 | 82.16 | 83.48 |
| | Revolutions | 186 | 190 | 194 | 198 | 202 | 205 | 209 | 212 | 216 | 220 |
| 33 | Horse Power | 180.4 | 198.7 | 211.2 | 224.0 | 237.1 | 250.4 | 263.9 | 277.7 | 291.7 | 306.0 |
| | Cubic Feet | 89.46 | 91.40 | 93.28 | 95.11 | 96.93 | 98.73 | 100.5 | 102.2 | 103.9 | 105.5 |
| | Revolutions | 169 | 173 | 176 | 180 | 183 | 187 | 190 | 193 | 196 | 200 |
| 36 | Horse Power | 210.9 | 224.8 | 239.0 | 253.5 | 268.2 | 283.3 | 298.6 | 314.2 | 330.0 | 346.2 |
| | Cubic Feet | 101.2 | 103.4 | 105.5 | 107.6 | 109.7 | 111.7 | 113.7 | 115.6 | 117.5 | 119.4 |
| | Revolutions | 155 | 158 | 162 | 165 | 168 | 171 | 174 | 177 | 180 | 183 |
| 39 | Horse Power | 259.3 | 276.4 | 293.9 | 311.6 | 329.8 | 348.3 | 367.2 | 386.4 | 405.8 | 425.6 |
| | Cubic Feet | 124.5 | 127.1 | 129.8 | 132.3 | 134.8 | 137.3 | 139.8 | 142.1 | 144.5 | 146.8 |
| | Revolutions | 143 | 140 | 149 | 152 | 155 | 158 | 161 | 164 | 166 | 169 |
| 42 | Horse Power | 308.8 | 329.2 | 350.0 | 371.2 | 392.8 | 414.9 | 437.3 | 460.2 | 483.3 | 506.9 |
| | Cubic Feet | 148.2 | 151.4 | 154.5 | 157.6 | 160.6 | 163.6 | 166.5 | 169.3 | 172.1 | 174.9 |
| | Revolutions | 133 | 136 | 139 | 141 | 144 | 147 | 149 | 152 | 154 | 157 |
| 45 | Horse Power | 346.7 | 369.6 | 392.9 | 416.7 | 441.0 | 465.7 | 490.9 | 516.5 | 542.5 | 569.0 |
| | Cubic Feet | 166.4 | 170.0 | 173.5 | 176.9 | 180.3 | 183.6 | 186.8 | 190.0 | 193.1 | 196.3 |
| | Revolutions | 124 | 127 | 129 | 132 | 135 | 137 | 139 | 142 | 144 | 146 |
| 48 | Horse Power | 382.3 | 407.5 | 433.3 | 459.5 | 486.3 | 513.6 | 541.3 | 569.6 | 598.2 | 627.5 |
| | Cubic Feet | 183.5 | 187.4 | 191.3 | 195.1 | 198.8 | 202.5 | 206.0 | 209.6 | 213.0 | 216.4 |
| | Revolutions | 116 | 119 | 122 | 124 | 126 | 128 | 131 | 133 | 135 | 137 |
| 51 | Horse Power | 431.8 | 460.3 | 489.4 | 519.0 | 549.2 | 580.1 | 611.5 | 643.4 | 675.8 | 708.8 |
| | Cubic Feet | 207.2 | 211.7 | 216.1 | 220.3 | 224.5 | 228.7 | 232.7 | 236.6 | 240.6 | 244.5 |
| | Revolutions | 109 | 112 | 114 | 116 | 118 | 120 | 123 | 125 | 127 | 129 |
| 54 | Horse Power | 499.2 | 532.1 | 565.7 | 599.9 | 634.9 | 670.6 | 706.8 | 743.7 | 781.1 | 819.3 |
| | Cubic Feet | 239.6 | 244.7 | 249.8 | 254.7 | 259.6 | 264.4 | 269.0 | 273.6 | 278.1 | 282.6 |
| | Revolutions | 103 | 106 | 108 | 110 | 112 | 114 | 116 | 118 | 120 | 122 |
| 57 | Horse Power | 539.2 | 574.8 | 611.1 | 648.1 | 685.9 | 724.4 | 763.6 | 803.4 | 843.8 | 885.1 |
| | Cubic Feet | 258.8 | 264.4 | 269.8 | 275.1 | 280.4 | 285.6 | 290.6 | 295.5 | 300.4 | 305.3 |
| | Revolutions | 98 | 100 | 102 | 104 | 106 | 108 | 110 | 112 | 114 | 116 |
| 60 | Horse Power | 597.7 | 637.1 | 677.4 | 718.3 | 760.2 | 802.9 | 846.3 | 890.5 | 935.3 | 981.0 |
| | Cubic Feet | 286.8 | 293.0 | 299.1 | 305.0 | 310.8 | 316.5 | 322.1 | 327.6 | 333.0 | 338.4 |
| | Revolutions | 93 | 95 | 97 | 99 | 101 | 103 | 105 | 107 | 108 | 110 |

# THE HERCULES TURBINE

## Table of Type "A" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 |
| 9 | Horse Power | 23.8 | 24.9 | 26.0 | 27.1 | 28.2 | 29.4 | 30.5 | 31.7 | 32.9 |
| | Cubic Feet | 7.96 | 8.08 | 8.20 | 8.31 | 8.43 | 8.55 | 8.65 | 8.76 | 8.88 |
| | Revolutions | 743 | 754 | 765 | 776 | 787 | 797 | 808 | 818 | 827 |
| 12 | Horse Power | 41.0 | 42.9 | 44.8 | 46.7 | 48.7 | 50.6 | 52.7 | 54.7 | 56.7 |
| | Cubic Feet | 13.71 | 13.93 | 14.13 | 14.33 | 14.53 | 14.71 | 14.91 | 15.10 | 15.29 |
| | Revolutions | 557 | 566 | 574 | 582 | 590 | 598 | 606 | 614 | 621 |
| 15 | Horse Power | 66.1 | 69.2 | 72.3 | 75.4 | 78.5 | 81.7 | 85.0 | 88.3 | 91.6 |
| | Cubic Feet | 22.13 | 22.46 | 22.80 | 23.11 | 23.43 | 23.75 | 24.06 | 24.36 | 24.67 |
| | Revolutions | 446 | 452 | 459 | 466 | 472 | 478 | 484 | 490 | 496 |
| 18 | Horse Power | 92.3 | 96.6 | 100.8 | 105.2 | 109.6 | 114.1 | 118.6 | 123.2 | 127.9 |
| | Cubic Feet | 30.88 | 31.36 | 31.81 | 32.26 | 32.70 | 33.15 | 33.58 | 34.00 | 34.44 |
| | Revolutions | 372 | 377 | 383 | 388 | 394 | 399 | 404 | 409 | 414 |
| 21 | Horse Power | 130.1 | 136.0 | 142.1 | 148.2 | 154.4 | 160.7 | 167.1 | 173.5 | 180.1 |
| | Cubic Feet | 43.51 | 44.16 | 44.81 | 45.45 | 46.06 | 46.68 | 47.30 | 47.90 | 48.50 |
| | Revolutions | 318 | 323 | 328 | 333 | 337 | 342 | 346 | 350 | 355 |
| 24 | Horse Power | 160.7 | 168.0 | 175.5 | 183.0 | 190.7 | 198.5 | 206.4 | 214.4 | 222.4 |
| | Cubic Feet | 53.75 | 54.55 | 55.35 | 56.13 | 56.90 | 57.66 | 58.43 | 59.16 | 59.89 |
| | Revolutions | 280 | 284 | 288 | 292 | 296 | 300 | 304 | 308 | 311 |
| 27 | Horse Power | 214.2 | 224.1 | 234.0 | 244.1 | 254.3 | 264.7 | 275.3 | 285.9 | 296.7 |
| | Cubic Feet | 71.66 | 72.75 | 73.81 | 74.85 | 75.88 | 76.90 | 77.91 | 78.90 | 79.88 |
| | Revolutions | 248 | 251 | 255 | 259 | 262 | 266 | 269 | 272 | 275 |
| 30 | Horse Power | 253.4 | 265.1 | 276.8 | 288.8 | 300.9 | 313.2 | 325.7 | 338.2 | 351.0 |
| | Cubic Feet | 84.78 | 86.06 | 87.31 | 88.55 | 89.76 | 90.98 | 92.18 | 93.33 | 94.50 |
| | Revolutions | 223 | 226 | 230 | 233 | 236 | 239 | 242 | 245 | 248 |
| 33 | Horse Power | 320.4 | 335.1 | 350.0 | 365.0 | 380.3 | 395.9 | 411.7 | 427.5 | 443.8 |
| | Cubic Feet | 107.1 | 108.8 | 110.4 | 111.9 | 113.4 | 115.0 | 116.5 | 118.0 | 119.4 |
| | Revolutions | 203 | 206 | 209 | 212 | 214 | 217 | 220 | 223 | 226 |
| 36 | Horse Power | 362.5 | 379.2 | 396.0 | 413.0 | 430.3 | 447.9 | 465.8 | 483.7 | 502.0 |
| | Cubic Feet | 121.2 | 123.1 | 124.9 | 126.6 | 128.4 | 130.1 | 131.8 | 133.5 | 135.1 |
| | Revolutions | 186 | 189 | 191 | 194 | 197 | 199 | 202 | 205 | 207 |
| 39 | Horse Power | 445.7 | 466.2 | 486.9 | 507.8 | 529.1 | 550.8 | 572.7 | 594.8 | 617.3 |
| | Cubic Feet | 149.1 | 151.3 | 153.5 | 155.7 | 157.8 | 160.0 | 162.1 | 164.1 | 166.2 |
| | Revolutions | 171 | 174 | 177 | 179 | 182 | 184 | 186 | 189 | 192 |
| 42 | Horse Power | 530.8 | 555.2 | 579.9 | 604.9 | 630.2 | 656.0 | 682.1 | 708.4 | 735.1 |
| | Cubic Feet | 177.6 | 180.2 | 182.9 | 185.5 | 188.0 | 190.5 | 193.0 | 195.5 | 197.9 |
| | Revolutions | 159 | 162 | 164 | 166 | 169 | 171 | 173 | 175 | 178 |
| 45 | Horse Power | 595.9 | 623.2 | 650.9 | 679.0 | 707.4 | 736.4 | 765.6 | 795.2 | 825.2 |
| | Cubic Feet | 199.3 | 202.3 | 205.3 | 208.2 | 211.0 | 213.9 | 216.7 | 219.4 | 222.1 |
| | Revolutions | 149 | 151 | 153 | 155 | 157 | 159 | 161 | 163 | 165 |
| 48 | Horse Power | 657.1 | 687.3 | 717.8 | 748.7 | 780.1 | 812.0 | 844.3 | 876.9 | 910.1 |
| | Cubic Feet | 219.8 | 223.1 | 226.4 | 229.6 | 232.7 | 235.8 | 238.9 | 241.9 | 245.0 |
| | Revolutions | 139 | 141 | 144 | 146 | 148 | 150 | 152 | 153 | 155 |
| 51 | Horse Power | 742.2 | 776.3 | 810.8 | 845.8 | 881.2 | 917.2 | 953.7 | 990.5 | 1028 |
| | Cubic Feet | 248.3 | 252.0 | 255.7 | 259.3 | 262.9 | 266.4 | 269.9 | 273.3 | 276.7 |
| | Revolutions | 131 | 133 | 135 | 137 | 139 | 141 | 143 | 144 | 146 |
| 54 | Horse Power | 857.9 | 897.4 | 937.2 | 977.6 | 1018 | 1060 | 1102 | 1145 | 1188 |
| | Cubic Feet | 286.9 | 291.3 | 295.6 | 299.7 | 303.8 | 307.9 | 312.0 | 315.9 | 319.9 |
| | Revolutions | 124 | 126 | 128 | 130 | 131 | 133 | 135 | 136 | 138 |
| 57 | Horse Power | 926.9 | 969.4 | 1012 | 1056 | 1100 | 1145 | 1191 | 1237 | 1283 |
| | Cubic Feet | 310.0 | 314.7 | 319.3 | 323.8 | 328.2 | 332.7 | 337.0 | 341.3 | 345.6 |
| | Revolutions | 118 | 120 | 121 | 123 | 125 | 126 | 128 | 130 | 131 |
| 60 | Horse Power | 1027 | 1074 | 1122 | 1170 | 1219 | 1269 | 1320 | 1370 | 1422 |
| | Cubic Feet | 343.6 | 348.8 | 353.9 | 358.9 | 363.8 | 368.7 | 373.6 | 378.3 | 383.0 |
| | Revolutions | 112 | 114 | 115 | 117 | 118 | 120 | 122 | 123 | 125 |

# THE HERCULES TURBINE

## Table of Type "A" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 9 | Horse Power | 34.2 | 35.4 | 36.6 | 37.9 | 39.2 | 40.5 | 41.8 | 43.1 | 44.4 |
| | Cubic Feet | 8.99 | 9.10 | 9.20 | 9.30 | 9.41 | 9.51 | 9.61 | 9.71 | 9.80 |
| | Revolutions | 837 | 847 | 857 | 867 | 877 | 886 | 895 | 905 | 915 |
| 12 | Horse Power | 58.8 | 60.9 | 63.1 | 65.3 | 67.4 | 69.7 | 71.9 | 74.1 | 76.4 |
| | Cubic Feet | 15.47 | 15.65 | 15.84 | 16.02 | 16.19 | 16.37 | 16.54 | 16.71 | 16.88 |
| | Revolutions | 628 | 636 | 643 | 651 | 658 | 665 | 672 | 679 | 686 |
| 15 | Horse Power | 95.0 | 98.4 | 101.9 | 105.4 | 108.9 | 112.5 | 116.1 | 119.8 | 123.4 |
| | Cubic Feet | 24.98 | 25.27 | 25.56 | 25.85 | 26.14 | 26.42 | 26.70 | 26.98 | 27.25 |
| | Revolutions | 502 | 508 | 514 | 520 | 526 | 531 | 537 | 542 | 548 |
| 18 | Horse Power | 132.6 | 137.4 | 142.2 | 147.1 | 152.0 | 157.0 | 162.0 | 167.1 | 172.3 |
| | Cubic Feet | 34.86 | 35.27 | 35.68 | 36.08 | 36.48 | 36.88 | 37.27 | 37.66 | 38.03 |
| | Revolutions | 419 | 424 | 429 | 434 | 439 | 444 | 448 | 453 | 458 |
| 21 | Horse Power | 186.8 | 193.5 | 200.3 | 207.1 | 214.1 | 221.1 | 228.2 | 235.4 | 242.6 |
| | Cubic Feet | 49.09 | 49.67 | 50.25 | 50 81 | 51.38 | 51.93 | 52.48 | 53.02 | 53.56 |
| | Revolutions | 360 | 364 | 368 | 372 | 376 | 380 | 384 | 388 | 392 |
| 24 | Horse Power | 230.6 | 238.9 | 247.3 | 255.8 | 264.4 | 273.0 | 281.8 | 290.7 | 299.6 |
| | Cubic Feet | 60.62 | 61.34 | 62.04 | 62.75 | 63.44 | 64.13 | 64.83 | 65.48 | 66.14 |
| | Revolutions | 314 | 318 | 322 | 325 | 329 | 332 | 336 | 339 | 343 |
| 27 | Horse Power | 307.6 | 318.6 | 329.8 | 341.1 | 352.6 | 364.1 | 375.8 | 387.6 | 399.5 |
| | Cubic Feet | 80.84 | 81.80 | 82.75 | 83.68 | 84.61 | 85.52 | 86.43 | 87.32 | 88.21 |
| | Revolutions | 279 | 282 | 285 | 288 | 292 | 295 | 298 | 301 | 304 |
| 30 | Horse Power | 363.9 | 377.0 | 390.2 | 403.5 | 417.1 | 430.8 | 444.6 | 458.6 | 472.7 |
| | Cubic Feet | 95.64 | 96.77 | 97.89 | 99.00 | 100.1 | 101.2 | 102.2 | 103.3 | 104.3 |
| | Revolutions | 251 | 254 | 257 | 260 | 263 | 266 | 268 | 271 | 274 |
| 33 | Horse Power | 460.1 | 476.6 | 493.3 | 510.3 | 527.4 | 544.7 | 562.2 | 579.8 | 597.6 |
| | Cubic Feet | 120.9 | 122.3 | 123.7 | 125.1 | 126.5 | 127.9 | 129.3 | 130.6 | 131.9 |
| | Revolutions | 229 | 231 | 234 | 237 | 239 | 242 | 244 | 247 | 249 |
| 36 | Horse Power | 520.5 | 539.2 | 558.1 | 577.2 | 596.6 | 616.2 | 635.9 | 655.9 | 676.1 |
| | Cubic Feet | 136.8 | 138.4 | 140.0 | 141.6 | 143.2 | 144.7 | 146.2 | 147.7 | 149.2 |
| | Revolutions | 209 | 211 | 214 | 216 | 219 | 221 | 223 | 225 | 228 |
| 39 | Horse Power | 640.0 | 663.0 | 686.2 | 709.8 | 733.6 | 757.6 | 781.9 | 806.5 | 831.3 |
| | Cubic Feet | 168.2 | 170.2 | 172.1 | 174.1 | 176.0 | 177.9 | 179.8 | 181.7 | 183.5 |
| | Revolutions | 194 | 197 | 199 | 201 | 203 | 205 | 208 | 210 | 212 |
| 42 | Horse Power | 762.2 | 789.6 | 817.2 | 845.3 | 873.7 | 902.3 | 931.2 | 960.5 | 990.0 |
| | Cubic Feet | 200.3 | 202.7 | 205.0 | 207.3 | 209.6 | 211.9 | 214.1 | 216.3 | 218.5 |
| | Revolutions | 180 | 182 | 184 | 186 | 188 | 190 | 192 | 194 | 196 |
| 45 | Horse Power | 855.6 | 886.3 | 917.4 | 948.8 | 980.7 | 1012 | 1045 | 1078 | 1111 |
| | Cubic Feet | 224.8 | 227.5 | 230.1 | 232.7 | 235.3 | 237.9 | 240.4 | 242.9 | 245.3 |
| | Revolutions | 167 | 169 | 171 | 173 | 175 | 177 | 178 | 180 | 182 |
| 48 | Horse Power | 943.5 | 977.4 | 1011 | 1046 | 1081 | 1117 | 1152 | 1189 | 1225 |
| | Cubic Feet | 248.0 | 250.9 | 253.8 | 256.7 | 259.5 | 262.3 | 265.1 | 267.8 | 270.6 |
| | Revolutions | 157 | 159 | 161 | 163 | 164 | 166 | 168 | 170 | 171 |
| 51 | Horse Power | 1065 | 1104 | 1142 | 1181 | 1221 | 1261 | 1302 | 1343 | 1384 |
| | Cubic Feet | 280.0 | 283.4 | 286.6 | 289.9 | 293.1 | 296.3 | 299.4 | 302.5 | 305.6 |
| | Revolutions | 147 | 149 | 151 | 153 | 154 | 156 | 158 | 159 | 161 |
| 54 | Horse Power | 1232 | 1276 | 1321 | 1366 | 1412 | 1458 | 1505 | 1552 | 1600 |
| | Cubic Feet | 323.8 | 327.6 | 331.4 | 335.1 | 338.8 | 342.5 | 346.1 | 349.7 | 353.2 |
| | Revolutions | 139 | 141 | 143 | 144 | 146 | 147 | 149 | 150 | 152 |
| 57 | Horse Power | 1330 | 1378 | 1427 | 1475 | 1525 | 1575 | 1626 | 1677 | 1728 |
| | Cubic Feet | 349.7 | 353.9 | 358.0 | 362.0 | 366.0 | 370.0 | 373.9 | 377.8 | 381.6 |
| | Revolutions | 133 | 134 | 136 | 137 | 139 | 140 | 142 | 143 | 145 |
| 60 | Horse Power | 1475 | 1528 | 1581 | 1635 | 1690 | 1746 | 1802 | 1858 | 1915 |
| | Cubic Feet | 387.6 | 392.2 | 396.8 | 401.2 | 405.7 | 410.0 | 414.4 | 418.7 | 423.9 |
| | Revolutions | 126 | 128 | 129 | 131 | 132 | 134 | 135 | 136 | 137 |

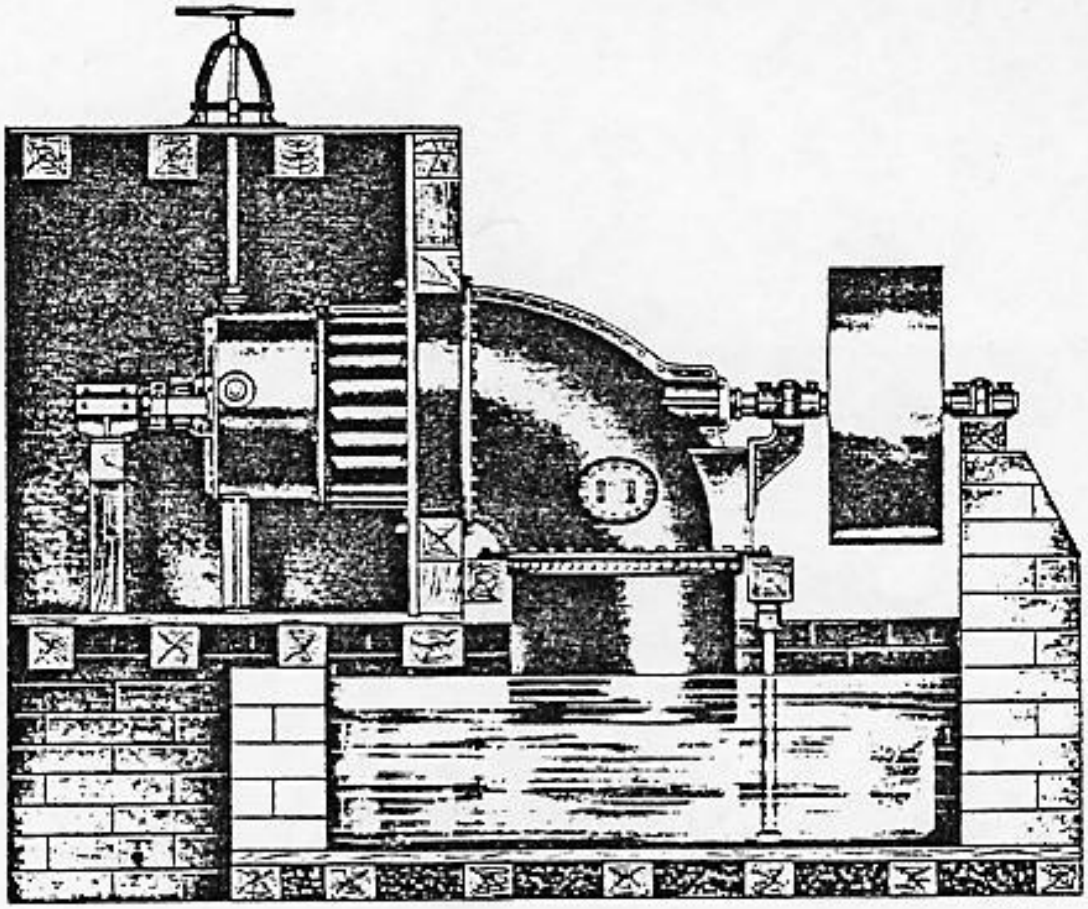


**Plate No. 13**

Cylinder Gate Hercules Turbine on cast iron quarter-turn and steel draft tube, in wood flume of simple construction

$N_s = 55$

$D_s = 1.41$

# THE HERCULES TURBINE

## Table of Type "B" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 15 | Horse Power | 2.1 | 3.3 | 4.6 | 6.1 | 7.7 | 9.4 | 11.2 | 13.1 | 15.1 | 17.2 |
| | Cubic Feet | 7.93 | 9.15 | 10.23 | 11.23 | 12.10 | 12.95 | 13.73 | 14.46 | 15.18 | 15.85 |
| | Revolutions | 143 | 165 | 185 | 203 | 219 | 234 | 248 | 262 | 274 | 287 |
| 18 | Horse Power | 3.0 | 4.8 | 6.4 | 8.5 | 10.7 | 13.1 | 15.6 | 18.3 | 21.1 | 24.1 |
| | Cubic Feet | 11.16 | 12.90 | 14.41 | 15.80 | 17.06 | 18.25 | 19.35 | 20.40 | 21.41 | 22.36 |
| | Revolutions | 122 | 141 | 158 | 173 | 187 | 200 | 212 | 223 | 234 | 245 |
| 21 | Horse Power | 4.1 | 6.3 | 8.9 | 11.7 | 14.7 | 18.0 | 21.5 | 25.1 | 29.0 | 33.1 |
| | Cubic Feet | 15.11 | 17.46 | 19.51 | 21.38 | 23.10 | 24.68 | 26.18 | 27.61 | 28.96 | 30.25 |
| | Revolutions | 106 | 123 | 137 | 150 | 162 | 173 | 184 | 194 | 203 | 212 |
| 24 | Horse Power | 5.3 | 8.2 | 11.5 | 15.2 | 19.1 | 23.4 | 27.9 | 32.7 | 37.7 | 42.9 |
| | Cubic Feet | 19.73 | 22.78 | 25.46 | 27.90 | 30.13 | 32.21 | 34.18 | 36.03 | 37.78 | 39.46 |
| | Revolutions | 93 | 107 | 120 | 131 | 142 | 152 | 161 | 170 | 178 | 186 |
| 27 | Horse Power | 7.0 | 10.8 | 15.1 | 19.9 | 25.1 | 30.7 | 36.6 | 42.9 | 49.5 | 56.4 |
| | Cubic Feet | 25.58 | 29.55 | 33.03 | 36.18 | 39.08 | 41.78 | 44.31 | 46.71 | 49.00 | 51.18 |
| | Revolutions | 81 | 94 | 105 | 115 | 124 | 132 | 140 | 148 | 155 | 162 |
| 30 | Horse Power | 8.3 | 12.9 | 18.0 | 23.6 | 29.8 | 36.4 | 43.5 | 50.9 | 58.9 | 66.9 |
| | Cubic Feet | 31.13 | 35.95 | 40.18 | 44.01 | 47.55 | 50.83 | 53.91 | 56.83 | 59.60 | 62.25 |
| | Revolutions | 74 | 85 | 95 | 104 | 112 | 120 | 127 | 134 | 141 | 147 |
| 33 | Horse Power | 10.0 | 15.5 | 21.6 | 28.5 | 35.9 | 43.8 | 52.3 | 61.3 | 70.7 | 80.6 |
| | Cubic Feet | 36.88 | 42.58 | 47.61 | 52.16 | 56.33 | 60.23 | 63.88 | 67.33 | 70.63 | 73.76 |
| | Revolutions | 69 | 80 | 90 | 98 | 106 | 113 | 120 | 127 | 133 | 139 |
| 36 | Horse Power | 12.1 | 18.6 | 26.1 | 34.2 | 43.1 | 52.7 | 62.9 | 73.7 | 85.0 | 96.8 |
| | Cubic Feet | 44.51 | 51.40 | 57.48 | 62.96 | 68.00 | 72.70 | 77.11 | 81.28 | 85.25 | 89.03 |
| | Revolutions | 60 | 69 | 77 | 84 | 91 | 97 | 104 | 109 | 114 | 119 |
| 39 | Horse Power | 13.9 | 21.4 | 29.9 | 39.3 | 49.5 | 60.5 | 72.2 | 84.6 | 97.6 | 111.3 |
| | Cubic Feet | 51.08 | 58.98 | 65.95 | 72.25 | 78.03 | 83.41 | 88.48 | 93.26 | 97.81 | 102.1 |
| | Revolutions | 57 | 66 | 73 | 80 | 87 | 93 | 98 | 104 | 109 | 114 |
| 42 | Horse Power | 16.4 | 25.3 | 35.4 | 46.5 | 58.6 | 71.7 | 85.5 | 100.2 | 115.6 | 131.7 |
| | Cubic Feet | 60.48 | 69.83 | 78.06 | 85.51 | 92.38 | 98.75 | 104.7 | 110.4 | 115.8 | 120.9 |
| | Revolutions | 53 | 61 | 68 | 75 | 81 | 86 | 92 | 97 | 101 | 106 |
| 45 | Horse Power | 18.5 | 28.5 | 39.9 | 52.5 | 66.2 | 80.9 | 96.5 | 113.0 | 130.4 | 148.6 |
| | Cubic Feet | 68.11 | 78.65 | 87.93 | 96.33 | 104.0 | 111.2 | 118.0 | 124.3 | 130.4 | 136.2 |
| | Revolutions | 49 | 57 | 64 | 70 | 75 | 80 | 85 | 90 | 94 | 98 |
| 48 | Horse Power | 21.7 | 33.4 | 46.7 | 61.5 | 77.4 | 94.6 | 112.9 | 132.3 | 152.6 | 173.9 |
| | Cubic Feet | 79.10 | 91.35 | 102.1 | 111.8 | 120.8 | 129.1 | 137.0 | 144.4 | 151.4 | 158.2 |
| | Revolutions | 44 | 51 | 57 | 63 | 68 | 73 | 77 | 81 | 85 | 89 |
| 51 | Horse Power | 26.0 | 40.0 | 56.0 | 73.6 | 92.7 | 113.3 | 135.2 | 158.3 | 182.7 | 208.1 |
| | Cubic Feet | 91.55 | 105.7 | 118.2 | 129.8 | 139.8 | 149.3 | 158.6 | 167.1 | 175.3 | 183.1 |
| | Revolutions | 41 | 48 | 54 | 59 | 63 | 68 | 72 | 76 | 79 | 83 |
| 54 | Horse Power | 29.5 | 45.4 | 63.5 | 83.4 | 105.2 | 128.5 | 153.3 | 179.6 | 207.2 | 236.1 |
| | Cubic Feet | 104.5 | 120.7 | 134.9 | 147.8 | 159.6 | 170.7 | 181.0 | 190.8 | 200.1 | 209.0 |
| | Revolutions | 41 | 47 | 53 | 58 | 63 | 67 | 71 | 75 | 79 | 82 |

# THE HERCULES TURBINE

## Table of Type "B" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 15 | Horse Power | 19.4 | 21.7 | 24.1 | 26.5 | 29.1 | 31.7 | 34.4 | 37.1 | 39.9 | 42.8 |
| | Cubic Feet | 16.50 | 17.11 | 17.73 | 18.30 | 18.86 | 19.41 | 19.95 | 20.46 | 20.96 | 21.46 |
| | Revolutions | 298 | 309 | 320 | 331 | 341 | 351 | 361 | 370 | 379 | 388 |
| 18 | Horse Power | 27.2 | 30.4 | 33.7 | 37.1 | 40.6 | 44.3 | 48.0 | 51.9 | 55.8 | 59.8 |
| | Cubic Feet | 23.26 | 24.13 | 24.98 | 25.80 | 26.60 | 27.36 | 28.11 | 28.85 | 29.56 | 30.25 |
| | Revolutions | 255 | 264 | 274 | 283 | 291 | 300 | 308 | 316 | 324 | 331 |
| 21 | Horse Power | 37.3 | 41.7 | 46.2 | 50.9 | 55.8 | 60.8 | 65.9 | 71.2 | 76.6 | 82.1 |
| | Cubic Feet | 31.48 | 32.66 | 33.81 | 34.93 | 36.00 | 37.05 | 38.06 | 39.05 | 40.01 | 40.95 |
| | Revolutions | 221 | 229 | 237 | 245 | 253 | 260 | 267 | 274 | 281 | 287 |
| 24 | Horse Power | 48.4 | 54.1 | 60.0 | 66.1 | 72.4 | 78.9 | 85.6 | 92.4 | 99.5 | 106.7 |
| | Cubic Feet | 41.06 | 42.63 | 44.11 | 45.56 | 46.96 | 48.33 | 49.66 | 50.95 | 52.21 | 53.43 |
| | Revolutions | 193 | 201 | 208 | 215 | 221 | 228 | 234 | 240 | 246 | 252 |
| 27 | Horse Power | 63.6 | 71.0 | 78.8 | 86.8 | 95.1 | 103.6 | 112.4 | 121.3 | 130.6 | 140.0 |
| | Cubic Feet | 53.26 | 55.28 | 57.21 | 59.10 | 60.91 | 62.68 | 64.40 | 66.06 | 67.70 | 69.28 |
| | Revolutions | 169 | 175 | 181 | 187 | 193 | 199 | 204 | 209 | 215 | 220 |
| 30 | Horse Power | 75.5 | 84.3 | 93.5 | 103.0 | 112.9 | 123.0 | 133.4 | 144.0 | 155.0 | 166.2 |
| | Cubic Feet | 64.80 | 67.23 | 69.60 | 71.88 | 74.10 | 76.25 | 78.31 | 80.36 | 82.35 | 84.28 |
| | Revolutions | 153 | 159 | 164 | 170 | 175 | 180 | 185 | 190 | 194 | 199 |
| 33 | Horse Power | 90.8 | 101.5 | 112.6 | 124.0 | 135.9 | 148.0 | 160.5 | 173.4 | 186.5 | 200.0 |
| | Cubic Feet | 76.78 | 79.68 | 82.46 | 85.18 | 87.80 | 90.35 | 92.81 | 95.23 | 97.58 | 99.68 |
| | Revolutions | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 179 | 184 | 188 |
| 36 | Horse Power | 109.2 | 122.1 | 135.4 | 149.1 | 163.3 | 177.9 | 193.0 | 208.4 | 224.2 | 240.5 |
| | Cubic Feet | 92.68 | 96.16 | 99.55 | 101.1 | 106.0 | 109.0 | 112.0 | 114.9 | 117.8 | 120.5 |
| | Revolutions | 124 | 129 | 133 | 137 | 142 | 146 | 150 | 154 | 157 | 161 |
| 39 | Horse Power | 125.4 | 140.2 | 155.5 | 171.3 | 187.6 | 204.4 | 221.6 | 239.4 | 257.5 | 276.1 |
| | Cubic Feet | 106.3 | 110.3 | 114.2 | 117.9 | 121.6 | 125.1 | 128.5 | 131.9 | 135.1 | 138.3 |
| | Revolutions | 118 | 123 | 127 | 131 | 135 | 139 | 143 | 147 | 150 | 154 |
| 42 | Horse Power | 148.5 | 165.9 | 184.0 | 202.7 | 222.8 | 241.9 | 262.4 | 283.4 | 304.9 | 326.9 |
| | Cubic Feet | 125.9 | 130.6 | 135.2 | 139.6 | 144.0 | 148.1 | 152.2 | 156.3 | 160.0 | 163.8 |
| | Revolutions | 110 | 114 | 118 | 122 | 126 | 130 | 133 | 137 | 140 | 143 |
| 45 | Horse Power | 167.5 | 187.2 | 207.7 | 228.8 | 250.6 | 273.0 | 296.1 | 319.7 | 344.0 | 368.9 |
| | Cubic Feet | 141.8 | 147.1 | 152.3 | 157.3 | 162.1 | 166.8 | 171.4 | 175.9 | 180.2 | 184.4 |
| | Revolutions | 102 | 106 | 110 | 114 | 117 | 120 | 124 | 127 | 130 | 133 |
| 48 | Horse Power | 196.1 | 219.1 | 243.0 | 267.7 | 293.2 | 319.5 | 346.5 | 374.2 | 402.6 | 431.7 |
| | Cubic Feet | 164.6 | 170.9 | 176.9 | 182.7 | 188.3 | 193.7 | 199.0 | 204.2 | 209.3 | 214.2 |
| | Revolutions | 93 | 96 | 99 | 103 | 106 | 109 | 112 | 115 | 118 | 120 |
| 51 | Horse Power | 234.7 | 262.3 | 290.9 | 320.5 | 351.0 | 382.4 | 414.7 | 447.9 | 481.9 | 516.7 |
| | Cubic Feet | 190.6 | 197.8 | 204.7 | 211.4 | 217.9 | 224.2 | 230.4 | 236.4 | 242.2 | 247.9 |
| | Revolutions | 86 | 90 | 93 | 96 | 99 | 102 | 104 | 107 | 110 | 112 |
| 54 | Horse Power | 266.2 | 297.5 | 329.9 | 363.5 | 398.1 | 433.7 | 470.3 | 508.0 | 546.5 | 586.0 |
| | Cubic Feet | 217.6 | 225.8 | 233.7 | 241.4 | 248.8 | 256.0 | 263.0 | 269.9 | 276.5 | 283.0 |
| | Revolutions | 85 | 89 | 92 | 95 | 98 | 101 | 103 | 106 | 109 | 111 |

# THE HERCULES TURBINE

## Table of Type "B" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 15 | Horse Power | 45.8 | 48.8 | 51.9 | 55.0 | 58.2 | 61.5 | 64.8 | 68.2 | 71.7 | 75.2 |
| | Cubic Feet | 21.95 | 22.41 | 22.88 | 23.33 | 23.78 | 24.21 | 24.65 | 25.06 | 25.48 | 25.88 |
| | Revolutions | 397 | 405 | 414 | 422 | 430 | 438 | 446 | 453 | 461 | 468 |
| 18 | Horse Power | 64.0 | 68.2 | 72.5 | 76.9 | 81.4 | 85.9 | 90.6 | 95.3 | 100.1 | 105.0 |
| | Cubic Feet | 30.93 | 31.60 | 32.25 | 32.90 | 33.51 | 34.13 | 34.73 | 35.33 | 35.91 | 36.50 |
| | Revolutions | 338 | 346 | 353 | 360 | 367 | 374 | 381 | 387 | 393 | 400 |
| 21 | Horse Power | 87.8 | 93.6 | 99.5 | 105.5 | 111.7 | 118.0 | 124.3 | 130.8 | 137.4 | 144.1 |
| | Cubic Feet | 41.88 | 42.78 | 43.66 | 44.51 | 45.36 | 46.20 | 47.01 | 47.83 | 48.61 | 49.40 |
| | Revolutions | 294 | 300 | 306 | 312 | 318 | 324 | 330 | 336 | 341 | 347 |
| 24 | Horse Power | 114.0 | 121.5 | 129.2 | 137.0 | 145.0 | 153.2 | 161.4 | 169.9 | 178.4 | 187.1 |
| | Cubic Feet | 54.63 | 55.81 | 56.96 | 58.10 | 59.20 | 60.28 | 61.31 | 62.40 | 63.43 | 64.45 |
| | Revolutions | 257 | 263 | 268 | 274 | 279 | 284 | 289 | 294 | 299 | 304 |
| 27 | Horse Power | 149.6 | 159.5 | 169.6 | 179.9 | 190.3 | 201.0 | 211.9 | 222.9 | 234.2 | 245.6 |
| | Cubic Feet | 70.85 | 72.36 | 73.86 | 75.33 | 76.76 | 78.16 | 79.55 | 80.91 | 82.25 | 83.56 |
| | Revolutions | 224 | 229 | 234 | 239 | 243 | 248 | 252 | 256 | 261 | 265 |
| 30 | Horse Power | 177.6 | 189.3 | 201.3 | 214.0 | 225.9 | 238.6 | 251.5 | 264.6 | 278.0 | 291.5 |
| | Cubic Feet | 86.18 | 88.03 | 89.85 | 91.63 | 93.38 | 95.10 | 96.78 | 98.43 | 100.0 | 101.6 |
| | Revolutions | 203 | 208 | 212 | 216 | 221 | 225 | 228 | 232 | 236 | 240 |
| 33 | Horse Power | 213.8 | 227.9 | 242.3 | 257.0 | 272.0 | 287.2 | 302.7 | 318.5 | 334.6 | 350.8 |
| | Cubic Feet | 102.1 | 104.3 | 106.4 | 108.6 | 110.6 | 112.7 | 114.7 | 116.6 | 118.5 | 120.4 |
| | Revolutions | 192 | 196 | 200 | 204 | 208 | 212 | 216 | 220 | 223 | 227 |
| 36 | Horse Power | 257.0 | 274.0 | 291.3 | 308.9 | 326.9 | 345.3 | 363.9 | 382.9 | 402.2 | 421.9 |
| | Cubic Feet | 123.2 | 125.9 | 128.5 | 131.0 | 133.5 | 136.0 | 138.4 | 140.8 | 143.1 | 145.4 |
| | Revolutions | 165 | 168 | 172 | 175 | 179 | 182 | 185 | 188 | 191 | 194 |
| 39 | Horse Power | 295.2 | 314.6 | 334.5 | 354.8 | 375.5 | 396.5 | 417.9 | 439.7 | 461.9 | 484.5 |
| | Cubic Feet | 141.4 | 144.5 | 147.5 | 150.4 | 153.2 | 156.1 | 158.8 | 161.5 | 164.2 | 166.8 |
| | Revolutions | 157 | 161 | 164 | 167 | 171 | 174 | 177 | 180 | 183 | 186 |
| 42 | Horse Power | 349.5 | 372.5 | 396.0 | 420.0 | 444.5 | 469.4 | 494.8 | 520.6 | 546.9 | 573.5 |
| | Cubic Feet | 167.4 | 171.0 | 174.7 | 178.0 | 181.4 | 184.7 | 188.0 | 191.2 | 194.4 | 197.5 |
| | Revolutions | 146 | 150 | 153 | 157 | 160 | 162 | 164 | 167 | 170 | 173 |
| 45 | Horse Power | 394.3 | 420.3 | 446.9 | 474.0 | 501.6 | 529.7 | 558.3 | 587.4 | 617.1 | 647.2 |
| | Cubic Feet | 188.6 | 192.6 | 196.6 | 200.5 | 204.3 | 208.1 | 211.8 | 215.4 | 218.9 | 222.4 |
| | Revolutions | 136 | 139 | 142 | 145 | 148 | 150 | 153 | 155 | 158 | 161 |
| 48 | Horse Power | 461.4 | 491.9 | 522.9 | 554.6 | 586.9 | 619.8 | 653.3 | 687.4 | 722.1 | 757.3 |
| | Cubic Feet | 219.0 | 223.7 | 228.3 | 232.8 | 238.8 | 241.6 | 245.9 | 250.1 | 254.2 | 258.3 |
| | Revolutions | 123 | 126 | 128 | 131 | 133 | 136 | 138 | 141 | 143 | 145 |
| 51 | Horse Power | 552.4 | 588.8 | 626.0 | 663.9 | 702.6 | 741.9 | 782.0 | 822.8 | 864.3 | 906.5 |
| | Cubic Feet | 253.5 | 258.9 | 264.3 | 269.5 | 274.6 | 279.7 | 284.6 | 289.5 | 294.3 | 299.0 |
| | Revolutions | 115 | 117 | 120 | 122 | 124 | 127 | 129 | 131 | 133 | 135 |
| 54 | Horse Power | 626.4 | 667.7 | 709.9 | 752.9 | 796.8 | 841.5 | 886.9 | 933.2 | 980.3 | 1028 |
| | Cubic Feet | 289.4 | 295.6 | 301.7 | 307.7 | 313.6 | 319.3 | 325.0 | 330.5 | 336.0 | 341.3 |
| | Revolutions | 114 | 116 | 118 | 121 | 123 | 125 | 128 | 130 | 132 | 134 |

# THE HERCULES TURBINE

## Table of Type "B" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 |
| 15 | Horse Power | 78.7 | 82.3 | 86.0 | 89.7 | 93.4 | 97.3 | 101.1 | 105.0 | 109.0 |
| | Cubic Feet | 26.28 | 26.68 | 27.08 | 27.46 | 27.83 | 28.21 | 28.58 | 28.96 | 29.29 |
| | Revolutions | 475 | 482 | 489 | 496 | 503 | 510 | 517 | 523 | 530 |
| 18 | Horse Power | 110.0 | 115.0 | 120.1 | 125.3 | 130.6 | 135.9 | 141.3 | 146.8 | 152.3 |
| | Cubic Feet | 37.06 | 37.61 | 38.16 | 38.70 | 39.23 | 39.76 | 40.28 | 40.80 | 41.30 |
| | Revolutions | 406 | 412 | 418 | 424 | 430 | 436 | 441 | 447 | 452 |
| 21 | Horse Power | 150.9 | 157.8 | 164.9 | 172.0 | 179.2 | 186.5 | 193.9 | 201.4 | 209.1 |
| | Cubic Feet | 50.16 | 50.91 | 51.66 | 52.40 | 53.11 | 53.83 | 54.53 | 55.23 | 55.92 |
| | Revolutions | 352 | 357 | 362 | 368 | 373 | 378 | 383 | 387 | 392 |
| 24 | Horse Power | 196.0 | 204.9 | 214.1 | 223.3 | 232.7 | 242.2 | 251.8 | 261.5 | 271.4 |
| | Cubic Feet | 65.45 | 66.43 | 67.40 | 68.35 | 69.30 | 70.23 | 71.15 | 72.05 | 72.94 |
| | Revolutions | 308 | 313 | 317 | 322 | 326 | 331 | 335 | 339 | 344 |
| 27 | Horse Power | 257.2 | 269.0 | 280.9 | 293.1 | 305.4 | 317.8 | 330.5 | 343.3 | 356.2 |
| | Cubic Feet | 84.86 | 86.13 | 87.40 | 88.63 | 89.86 | 91.06 | 92.25 | 93.43 | 94.61 |
| | Revolutions | 269 | 273 | 277 | 281 | 285 | 289 | 292 | 296 | 299 |
| 30 | Horse Power | 305.3 | 319.4 | 333.5 | 347.9 | 362.5 | 377.3 | 392.2 | 407.4 | 422.8 |
| | Cubic Feet | 103.2 | 104.8 | 106.3 | 107.8 | 109.3 | 110.8 | 112.2 | 113.6 | 115.1 |
| | Revolutions | 244 | 247 | 251 | 255 | 258 | 262 | 265 | 268 | 272 |
| 33 | Horse Power | 367.5 | 384.3 | 401.4 | 418.8 | 436.3 | 454.1 | 472.2 | 490.4 | 508.9 |
| | Cubic Feet | 122.3 | 124.1 | 126.0 | 127.7 | 129.5 | 131.2 | 133.0 | 134.7 | 136.3 |
| | Revolutions | 230 | 234 | 237 | 241 | 244 | 247 | 250 | 253 | 256 |
| 36 | Horse Power | 441.8 | 462.0 | 482.6 | 503.4 | 524.5 | 545.9 | 567.6 | 589.6 | 611.8 |
| | Cubic Feet | 147.6 | 149.9 | 152.1 | 154.2 | 156.3 | 158.4 | 160.5 | 162.5 | 164.6 |
| | Revolutions | 197 | 200 | 203 | 206 | 209 | 212 | 215 | 217 | 220 |
| 39 | Horse Power | 507.3 | 530.6 | 554.2 | 578.1 | 602.3 | 626.9 | 651.8 | 677.1 | 702.6 |
| | Cubic Feet | 169.4 | 172.0 | 174.5 | 176.9 | 179.4 | 181.8 | 184.2 | 186.5 | 188.8 |
| | Revolutions | 189 | 191 | 194 | 197 | 200 | 202 | 205 | 207 | 210 |
| 42 | Horse Power | 600.6 | 628.1 | 656.0 | 684.4 | 713.1 | 742.2 | 771.7 | 801.5 | 831.8 |
| | Cubic Feet | 200.6 | 203.6 | 206.6 | 209.5 | 212.4 | 215.2 | 218.0 | 220.8 | 223.6 |
| | Revolutions | 175 | 178 | 181 | 183 | 186 | 188 | 191 | 193 | 195 |
| 45 | Horse Power | 677.7 | 708.8 | 740.3 | 772.2 | 804.6 | 837.5 | 870.7 | 904.4 | 938.6 |
| | Cubic Feet | 225.9 | 229.3 | 232.6 | 235.9 | 239.2 | 242.4 | 245.6 | 248.7 | 251.8 |
| | Revolutions | 163 | 166 | 168 | 170 | 173 | 175 | 177 | 179 | 182 |
| 48 | Horse Power | 793.1 | 829.4 | 866.2 | 903.6 | 941.5 | 980.0 | 1019 | 1058 | 1098 |
| | Cubic Feet | 262.3 | 266.3 | 270.2 | 274.0 | 277.8 | 281.5 | 285.2 | 288.8 | 292.4 |
| | Revolutions | 147 | 150 | 152 | 154 | 156 | 158 | 160 | 162 | 165 |
| 51 | Horse Power | 949.3 | 992.8 | 1037 | 1081 | 1127 | 1173 | 1219 | 1267 | 1314 |
| | Cubic Feet | 303.6 | 308.2 | 312.7 | 317.1 | 321.5 | 325.8 | 330.0 | 334.3 | 338.4 |
| | Revolutions | 138 | 140 | 142 | 144 | 146 | 148 | 150 | 152 | 154 |
| 54 | Horse Power | 1076 | 1126 | 1176 | 1226 | 1278 | 1330 | 1383 | 1436 | 1491 |
| | Cubic Feet | 346.6 | 351.9 | 357.0 | 362.1 | 367.0 | 372.0 | 376.8 | 381.6 | 386.4 |
| | Revolutions | 136 | 138 | 140 | 142 | 144 | 146 | 148 | 150 | 152 |

# THE HERCULES TURBINE

## Table of Type "B" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 15 | Horse Power | 113.0 | 117.1 | 121.2 | 125.3 | 129.5 | 133.8 | 138.1 | 142.4 | 146.8 |
| | Cubic Feet | 29.65 | 30.00 | 30.35 | 30.69 | 31.03 | 31.36 | 31.70 | 32.02 | 32.35 |
| | Revolutions | 536 | 543 | 549 | 555 | 561 | 567 | 573 | 579 | 585 |
| 18 | Horse Power | 157.9 | 163.6 | 169.3 | 175.1 | 181.0 | 186.9 | 192.9 | 199.0 | 205.1 |
| | Cubic Feet | 41.80 | 42.29 | 42.76 | 43.27 | 43.75 | 44.22 | 44.69 | 45.15 | 45.61 |
| | Revolutions | 458 | 463 | 469 | 474 | 479 | 484 | 490 | 495 | 500 |
| 21 | Horse Power | 216.7 | 224.5 | 232.4 | 240.4 | 248.4 | 256.6 | 264.8 | 273.1 | 281.5 |
| | Cubic Feet | 56.60 | 57.28 | 57.93 | 58.58 | 59.23 | 59.87 | 60.51 | 61.13 | 61.75 |
| | Revolutions | 397 | 402 | 406 | 411 | 415 | 420 | 424 | 429 | 433 |
| 24 | Horse Power | 281.4 | 291.5 | 301.7 | 312.1 | 322.5 | 333.1 | 343.8 | 354.6 | 365.5 |
| | Cubic Feet | 73.83 | 74.70 | 75.56 | 76.42 | 77.26 | 78.10 | 78.92 | 79.74 | 80.55 |
| | Revolutions | 348 | 352 | 356 | 360 | 364 | 368 | 372 | 376 | 380 |
| 27 | Horse Power | 369.3 | 382.6 | 396.0 | 409.6 | 423.3 | 437.2 | 451.2 | 465.4 | 479.7 |
| | Cubic Feet | 95.75 | 96.89 | 98.01 | 99.11 | 100.2 | 101.3 | 102.3 | 103.4 | 104.5 |
| | Revolutions | 303 | 306 | 310 | 313 | 317 | 320 | 324 | 327 | 330 |
| 30 | Horse Power | 438.4 | 454.1 | 470.1 | 486.2 | 502.5 | 518.9 | 535.6 | 552.4 | 569.4 |
| | Cubic Feet | 116.4 | 117.8 | 119.2 | 120.5 | 121.9 | 123.2 | 124.5 | 125.8 | 127.1 |
| | Revolutions | 275 | 279 | 282 | 285 | 288 | 291 | 294 | 297 | 300 |
| 33 | Horse Power | 527.7 | 546.6 | 565.8 | 585.2 | 604.8 | 624.7 | 644.7 | 665.0 | 685.4 |
| | Cubic Feet | 138.0 | 139.6 | 141.2 | 142.8 | 144.4 | 146.0 | 147.5 | 149.0 | 150.6 |
| | Revolutions | 259 | 262 | 265 | 268 | 271 | 274 | 277 | 280 | 283 |
| 36 | Horse Power | 634.3 | 657.1 | 680.2 | 703.5 | 727.1 | 750.9 | 775.0 | 799.3 | 823.9 |
| | Cubic Feet | 166.6 | 168.5 | 170.5 | 172.4 | 174.3 | 176.2 | 178.0 | 179.9 | 181.7 |
| | Revolutions | 223 | 226 | 228 | 231 | 234 | 236 | 239 | 241 | 244 |
| 39 | Horse Power | 728.4 | 754.6 | 781.1 | 807.9 | 835.0 | 862.4 | 890.0 | 918.0 | 946.2 |
| | Cubic Feet | 191.1 | 193.4 | 195.6 | 197.8 | 200.0 | 202.2 | 204.3 | 206.4 | 208.5 |
| | Revolutions | 212 | 215 | 217 | 219 | 222 | 224 | 227 | 229 | 231 |
| 42 | Horse Power | 862.4 | 893.3 | 924.7 | 956.4 | 988.5 | 1020 | 1053 | 1086 | 1120 |
| | Cubic Feet | 226.3 | 228.9 | 231.6 | 234.2 | 236.8 | 239.4 | 241.9 | 244.4 | 246.9 |
| | Revolutions | 196 | 200 | 202 | 204 | 207 | 209 | 211 | 213 | 215 |
| 45 | Horse Power | 973.1 | 1008 | 1043 | 1079 | 1115 | 1152 | 1189 | 1226 | 1264 |
| | Cubic Feet | 254.8 | 257.9 | 260.8 | 263.8 | 266.7 | 269.6 | 272.4 | 275.3 | 278.0 |
| | Revolutions | 184 | 187 | 189 | 191 | 193 | 195 | 197 | 199 | 201 |
| 48 | Horse Power | 1138 | 1179 | 1221 | 1262 | 1305 | 1348 | 1391 | 1435 | 1479 |
| | Cubic Feet | 293.9 | 299.4 | 302.9 | 306.3 | 309.7 | 313.1 | 316.4 | 319.7 | 322.9 |
| | Revolutions | 167 | 169 | 171 | 173 | 175 | 177 | 178 | 180 | 182 |
| 51 | Horse Power | 1363 | 1412 | 1461 | 1511 | 1562 | 1613 | 1665 | 1717 | 1770 |
| | Cubic Feet | 342.5 | 346.6 | 350.6 | 354.6 | 358.5 | 362.4 | 366.2 | 370.0 | 373.7 |
| | Revolutions | 156 | 157 | 159 | 161 | 163 | 165 | 166 | 168 | 170 |
| 54 | Horse Power | 1546 | 1601 | 1657 | 1714 | 1772 | 1830 | 1888 | 1948 | 2008 |
| | Cubic Feet | 391.0 | 395.7 | 400.2 | 404.8 | 409.3 | 413.7 | 418.1 | 422.4 | 426.7 |
| | Revolutions | 154 | 156 | 157 | 159 | 161 | 163 | 164 | 166 | 168 |

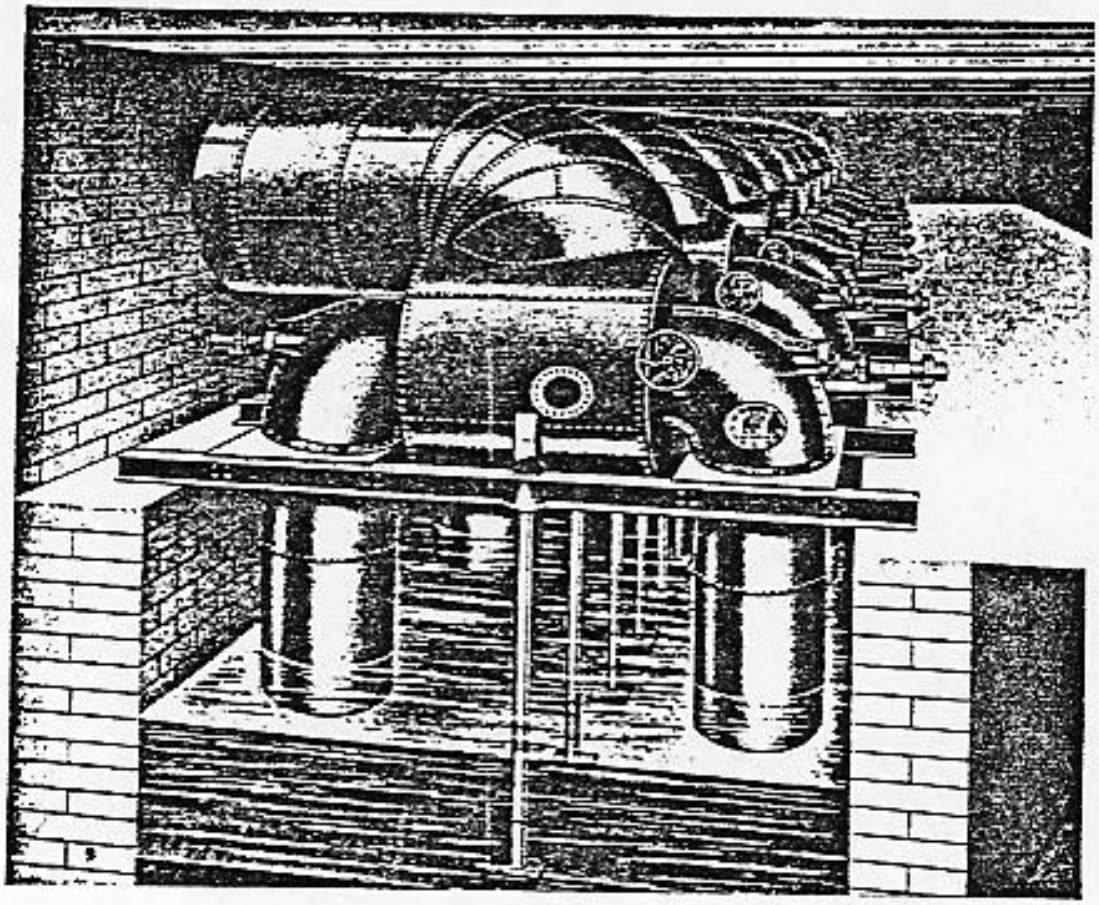


Plate No. 14

Eight units in wood grinder room, being part of installation in one mill of forty-two Hercules Turbines

$N_S = 67$

$D_S = 1.30$

# THE HERCULES TURBINE

## Table of Type "C" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | Horse Power | 2.6 | 4.1 | 5.7 | 7.5 | 9.5 | 11.6 | 13.9 | 16.3 | 18.8 | 21.4 |
| | Cubic Feet | 9.75 | 11.25 | 12.58 | 13.78 | 14.90 | 15.91 | 16.88 | 17.80 | 18.66 | 19.50 |
| | Revolutions | 182 | 210 | 235 | 258 | 278 | 297 | 316 | 333 | 349 | 364 |
| 18 | Horse Power | 3.8 | 5.9 | 8.3 | 10.9 | 13.8 | 16.9 | 20.1 | 23.6 | 27.2 | 31.0 |
| | Cubic Feet | 13.65 | 15.76 | 17.63 | 19.30 | 20.85 | 22.30 | 23.65 | 24.93 | 26.15 | 27.31 |
| | Revolutions | 144 | 166 | 186 | 203 | 220 | 235 | 249 | 263 | 275 | 288 |
| 21 | Horse Power | 5.0 | 7.7 | 10.8 | 14.3 | 18.0 | 22.0 | 26.2 | 30.7 | 35.4 | 40.4 |
| | Cubic Feet | 17.65 | 20.38 | 22.80 | 24.96 | 26.96 | 28.83 | 30.58 | 32.23 | 33.80 | 35.31 |
| | Revolutions | 125 | 144 | 161 | 177 | 191 | 204 | 217 | 228 | 240 | 250 |
| 24 | Horse Power | 6.6 | 10.2 | 14.3 | 18.8 | 23.6 | 28.9 | 34.5 | 40.4 | 46.6 | 53.1 |
| | Cubic Feet | 23.90 | 27.60 | 30.86 | 33.81 | 36.51 | 39.03 | 41.41 | 43.65 | 45.78 | 47.81 |
| | Revolutions | 108 | 125 | 140 | 154 | 166 | 177 | 188 | 199 | 208 | 217 |
| 27 | Horse Power | 8.3 | 12.7 | 17.7 | 23.3 | 29.4 | 35.9 | 42.8 | 50.2 | 57.9 | 65.9 |
| | Cubic Feet | 29.50 | 34.00 | 38.08 | 41.73 | 45.06 | 48.18 | 51.10 | 53.86 | 56.50 | 59.01 |
| | Revolutions | 105 | 121 | 136 | 149 | 161 | 172 | 182 | 192 | 202 | 211 |
| 30 | Horse Power | 10.7 | 16.6 | 23.2 | 30.5 | 38.4 | 46.9 | 56.0 | 65.6 | 75.7 | 86.2 |
| | Cubic Feet | 37.65 | 43.46 | 48.60 | 53.25 | 57.50 | 61.48 | 65.21 | 68.73 | 72.10 | 75.30 |
| | Revolutions | 88 | 102 | 113 | 124 | 134 | 144 | 152 | 161 | 169 | 176 |
| 33 | Horse Power | 11.9 | 18.4 | 25.8 | 33.9 | 42.7 | 52.2 | 62.2 | 73.0 | 84.1 | 95.9 |
| | Cubic Feet | 42.61 | 49.20 | 55.01 | 60.26 | 65.08 | 69.58 | 73.80 | 77.80 | 81.60 | 85.21 |
| | Revolutions | 83 | 95 | 107 | 117 | 126 | 135 | 143 | 151 | 158 | 165 |
| 36 | Horse Power | 14.5 | 22.3 | 31.2 | 41.0 | 51.7 | 63.1 | 75.3 | 88.2 | 101.8 | 116.0 |
| | Cubic Feet | 50.75 | 58.60 | 65.51 | 71.76 | 77.51 | 82.86 | 87.90 | 92.65 | 97.16 | 101.5 |
| | Revolutions | 70 | 81 | 91 | 100 | 108 | 115 | 122 | 129 | 135 | 141 |
| 39 | Horse Power | 17.5 | 26.9 | 37.7 | 49.5 | 62.4 | 76.3 | 91.0 | 106.6 | 123.0 | 140.1 |
| | Cubic Feet | 61.30 | 70.80 | 79.21 | 86.78 | 93.73 | 100.2 | 106.3 | 112.0 | 117.5 | 122.7 |
| | Revolutions | 68 | 78 | 87 | 96 | 104 | 111 | 118 | 124 | 130 | 136 |
| 42 | Horse Power | 20.3 | 31.3 | 43.7 | 57.5 | 72.4 | 88.5 | 105.6 | 123.7 | 142.8 | 162.6 |
| | Cubic Feet | 72.25 | 83.43 | 93.28 | 102.2 | 110.4 | 118.0 | 125.1 | 131.9 | 138.4 | 144.5 |
| | Revolutions | 62 | 72 | 80 | 88 | 95 | 102 | 108 | 114 | 120 | 125 |
| 45 | Horse Power | 21.9 | 33.7 | 47.1 | 62.0 | 78.1 | 95.4 | 113.9 | 133.4 | 153.9 | 175.4 |
| | Cubic Feet | 77.66 | 91.78 | 102.6 | 112.4 | 121.4 | 129.8 | 137.7 | 145.1 | 152.2 | 158.9 |
| | Revolutions | 57 | 66 | 74 | 81 | 87 | 93 | 99 | 104 | 109 | 114 |
| 48 | Horse Power | 25.9 | 39.9 | 55.8 | 73.4 | 92.5 | 113.0 | 134.9 | 158.0 | 182.2 | 207.7 |
| | Cubic Feet | 91.51 | 105.7 | 118.1 | 129.4 | 139.8 | 149.4 | 158.5 | 167.1 | 175.2 | 183.0 |
| | Revolutions | 51 | 59 | 66 | 72 | 78 | 83 | 88 | 93 | 98 | 102 |
| 51 | Horse Power | 29.2 | 45.0 | 62.9 | 82.8 | 104.3 | 127.4 | 152.1 | 178.1 | 205.5 | 234.1 |
| | Cubic Feet | 104.6 | 120.8 | 135.1 | 148.0 | 159.8 | 170.9 | 181.2 | 191.1 | 200.4 | 209.3 |
| | Revolutions | 49 | 56 | 63 | 69 | 74 | 80 | 84 | 89 | 93 | 98 |
| 54 | Horse Power | 32.8 | 50.5 | 70.6 | 92.8 | 116.9 | 142.9 | 170.5 | 199.7 | 230.4 | 262.5 |
| | Cubic Feet | 117.7 | 135.9 | 151.9 | 166.4 | 179.7 | 192.1 | 203.8 | 214.8 | 224.3 | 235.3 |
| | Revolutions | 46 | 53 | 59 | 65 | 70 | 75 | 80 | 84 | 88 | 92 |

# THE HERCULES TURBINE

## Table of Type "C" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 15 | Horse Power | 24.1 | 26.9 | 29.9 | 32.9 | 36.1 | 39.3 | 42.6 | 46.0 | 49.5 | 53.1 |
| | Cubic Feet | 20.30 | 21.06 | 21.80 | 22.51 | 23.20 | 23.88 | 24.53 | 25.16 | 25.80 | 26.40 |
| | Revolutions | 379 | 394 | 407 | 421 | 434 | 446 | 459 | 471 | 482 | 494 |
| 18 | Horse Power | 35.0 | 39.1 | 43.3 | 47.7 | 52.3 | 57.0 | 61.8 | 66.7 | 71.8 | 77.0 |
| | Cubic Feet | 28.41 | 29.50 | 30.53 | 31.53 | 32.50 | 33.45 | 34.36 | 35.25 | 36.13 | 36.96 |
| | Revolutions | 300 | 311 | 322 | 332 | 343 | 353 | 362 | 372 | 381 | 390 |
| 21 | Horse Power | 45.6 | 50.9 | 56.5 | 62.2 | 68.1 | 74.2 | 80.5 | 87.0 | 93.6 | 100.3 |
| | Cubic Feet | 36.75 | 38.13 | 39.46 | 40.76 | 42.03 | 43.25 | 44.43 | 45.58 | 46.71 | 47.81 |
| | Revolutions | 261 | 270 | 280 | 289 | 298 | 307 | 315 | 323 | 331 | 339 |
| 24 | Horse Power | 59.9 | 67.0 | 74.3 | 81.8 | 89.6 | 97.6 | 105.9 | 114.4 | 123.1 | 132.0 |
| | Cubic Feet | 49.78 | 51.65 | 53.46 | 55.23 | 56.93 | 58.58 | 60.18 | 61.75 | 63.26 | 64.76 |
| | Revolutions | 226 | 235 | 243 | 251 | 259 | 266 | 274 | 281 | 288 | 295 |
| 27 | Horse Power | 74.4 | 83.1 | 92.2 | 101.5 | 111.2 | 121.2 | 131.4 | 141.9 | 152.7 | 163.7 |
| | Cubic Feet | 61.41 | 63.73 | 65.98 | 68.13 | 70.23 | 72.26 | 74.25 | 76.18 | 78.06 | 79.90 |
| | Revolutions | 219 | 227 | 236 | 243 | 251 | 258 | 265 | 272 | 279 | 285 |
| 30 | Horse Power | 97.2 | 108.6 | 120.5 | 132.7 | 145.4 | 158.4 | 171.8 | 185.5 | 199.6 | 214.0 |
| | Cubic Feet | 78.38 | 81.33 | 84.18 | 86.95 | 89.63 | 92.21 | 94.75 | 97.21 | 99.61 | 101.9 |
| | Revolutions | 183 | 190 | 197 | 203 | 210 | 216 | 222 | 227 | 233 | 239 |
| 33 | Horse Power | 108.1 | 120.8 | 134.0 | 147.6 | 161.6 | 176.1 | 191.0 | 206.3 | 221.9 | 238.0 |
| | Cubic Feet | 88.70 | 92.06 | 95.28 | 98.41 | 101.4 | 104.4 | 107.2 | 110.0 | 112.7 | 115.4 |
| | Revolutions | 172 | 179 | 185 | 191 | 197 | 203 | 208 | 214 | 219 | 224 |
| 36 | Horse Power | 130.8 | 146.2 | 162.1 | 178.6 | 195.6 | 213.2 | 231.1 | 249.6 | 268.6 | 288.0 |
| | Cubic Feet | 105.6 | 109.6 | 113.6 | 117.2 | 120.8 | 124.3 | 127.7 | 131.0 | 134.3 | 137.4 |
| | Revolutions | 147 | 153 | 158 | 163 | 168 | 173 | 178 | 182 | 187 | 191 |
| 39 | Horse Power | 158.0 | 176.6 | 195.9 | 215.8 | 236.3 | 257.5 | 279.2 | 301.6 | 324.5 | 347.9 |
| | Cubic Feet | 127.7 | 132.6 | 137.2 | 141.7 | 146.1 | 150.3 | 154.4 | 158.4 | 162.4 | 166.2 |
| | Revolutions | 141 | 147 | 152 | 157 | 162 | 166 | 171 | 175 | 180 | 184 |
| 42 | Horse Power | 183.4 | 204.9 | 227.3 | 250.4 | 274.2 | 298.8 | 324.0 | 349.9 | 376.5 | 403.7 |
| | Cubic Feet | 150.4 | 156.1 | 161.6 | 166.9 | 172.0 | 177.0 | 181.8 | 186.6 | 191.2 | 195.7 |
| | Revolutions | 130 | 135 | 140 | 144 | 149 | 153 | 157 | 161 | 165 | 169 |
| 45 | Horse Power | 197.7 | 221.0 | 245.1 | 270.0 | 295.7 | 322.2 | 349.4 | 377.4 | 406.0 | 435.4 |
| | Cubic Feet | 165.4 | 171.7 | 177.7 | 183.5 | 189.2 | 194.7 | 200.0 | 205.2 | 210.3 | 215.2 |
| | Revolutions | 119 | 123 | 128 | 132 | 136 | 140 | 144 | 148 | 151 | 155 |
| 48 | Horse Power | 234.2 | 261.7 | 290.2 | 319.7 | 350.2 | 381.5 | 413.8 | 446.9 | 480.8 | 515.5 |
| | Cubic Feet | 190.5 | 197.7 | 204.6 | 211.3 | 217.8 | 224.1 | 230.3 | 236.3 | 242.1 | 247.8 |
| | Revolutions | 106 | 110 | 114 | 118 | 122 | 125 | 129 | 132 | 135 | 138 |
| 51 | Horse Power | 264.0 | 295.1 | 327.2 | 360.5 | 394.8 | 430.2 | 466.5 | 503.8 | 542.1 | 581.3 |
| | Cubic Feet | 217.8 | 226.1 | 234.0 | 241.7 | 249.1 | 256.3 | 263.3 | 270.2 | 276.9 | 283.4 |
| | Revolutions | 102 | 105 | 109 | 113 | 116 | 120 | 123 | 126 | 129 | 132 |
| 54 | Horse Power | 296.0 | 330.8 | 366.9 | 404.2 | 442.6 | 482.3 | 523.0 | 564.8 | 607.8 | 651.7 |
| | Cubic Feet | 244.9 | 254.2 | 263.1 | 271.6 | 280.1 | 288.2 | 296.1 | 303.8 | 311.3 | 318.7 |
| | Revolutions | 96 | 100 | 103 | 107 | 110 | 113 | 116 | 119 | 122 | 125 |

# THE HERCULES TURBINE

## Table of Type "C" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 15 | Horse Power | 56.8 | 60.5 | 64.4 | 68.3 | 72.2 | 76.3 | 80.4 | 84.6 | 88.9 | 93.2 |
| | Cubic Feet | 27.00 | 27.58 | 28.15 | 28.70 | 29.25 | 29.78 | 30.31 | 30.83 | 31.35 | 31.85 |
| | Revolutions | 505 | 515 | 526 | 537 | 547 | 557 | 567 | 576 | 586 | 595 |
| 18 | Horse Power | 82.3 | 87.7 | 93.3 | 98.9 | 104.7 | 110.6 | 116.6 | 122.6 | 128.8 | 135.1 |
| | Cubic Feet | 37.80 | 38.61 | 39.41 | 40.20 | 40.96 | 41.71 | 42.45 | 43.18 | 43.88 | 44.60 |
| | Revolutions | 399 | 407 | 416 | 424 | 432 | 440 | 448 | 455 | 463 | 470 |
| 21 | Horse Power | 107.2 | 114.3 | 121.5 | 128.9 | 136.4 | 144.1 | 151.9 | 159.8 | 167.8 | 176.0 |
| | Cubic Feet | 48.88 | 49.93 | 50.96 | 51.98 | 52.96 | 53.93 | 54.90 | 55.83 | 56.75 | 57.66 |
| | Revolutions | 347 | 354 | 362 | 369 | 376 | 383 | 389 | 396 | 403 | 409 |
| 24 | Horse Power | 141.1 | 150.4 | 159.8 | 169.5 | 179.4 | 189.5 | 199.7 | 210.1 | 220.7 | 231.5 |
| | Cubic Feet | 66.21 | 67.63 | 69.03 | 70.40 | 71.73 | 73.06 | 74.35 | 75.60 | 76.88 | 78.10 |
| | Revolutions | 301 | 308 | 314 | 320 | 327 | 332 | 338 | 344 | 350 | 356 |
| 27 | Horse Power | 175.0 | 186.6 | 198.3 | 210.4 | 222.6 | 235.1 | 247.8 | 260.7 | 273.9 | 287.2 |
| | Cubic Feet | 81.70 | 83.45 | 85.18 | 86.80 | 88.51 | 90.13 | 91.73 | 93.30 | 94.85 | 96.36 |
| | Revolutions | 292 | 298 | 304 | 310 | 316 | 322 | 328 | 333 | 339 | 344 |
| 30 | Horse Power | 228.8 | 243.9 | 259.3 | 275.0 | 291.0 | 307.4 | 324.0 | 340.9 | 358.0 | 375.5 |
| | Cubic Feet | 104.2 | 106.5 | 108.7 | 110.8 | 112.9 | 115.0 | 117.1 | 119.1 | 121.0 | 122.9 |
| | Revolutions | 244 | 249 | 254 | 259 | 264 | 269 | 274 | 279 | 283 | 288 |
| 33 | Horse Power | 254.4 | 271.2 | 288.3 | 305.8 | 323.6 | 341.7 | 360.2 | 379.0 | 398.1 | 417.5 |
| | Cubic Feet | 118.0 | 120.5 | 123.0 | 125.4 | 127.8 | 130.2 | 132.5 | 134.7 | 137.0 | 139.1 |
| | Revolutions | 229 | 234 | 239 | 244 | 248 | 253 | 257 | 262 | 266 | 270 |
| 36 | Horse Power | 307.9 | 328.2 | 348.9 | 370.0 | 391.6 | 413.5 | 435.9 | 458.6 | 481.8 | 505.3 |
| | Cubic Feet | 140.5 | 143.5 | 146.5 | 149.4 | 152.2 | 155.0 | 157.8 | 160.5 | 163.1 | 165.7 |
| | Revolutions | 196 | 200 | 204 | 208 | 212 | 216 | 220 | 223 | 227 | 231 |
| 39 | Horse Power | 371.9 | 396.5 | 421.5 | 447.0 | 473.1 | 499.6 | 526.6 | 554.1 | 582.0 | 610.4 |
| | Cubic Feet | 169.9 | 173.6 | 177.1 | 180.6 | 184.1 | 187.5 | 190.8 | 194.0 | 197.3 | 200.4 |
| | Revolutions | 188 | 192 | 196 | 200 | 204 | 208 | 211 | 215 | 219 | 222 |
| 42 | Horse Power | 431.5 | 460.0 | 489.0 | 518.7 | 548.9 | 579.7 | 611.0 | 642.9 | 675.3 | 708.2 |
| | Cubic Feet | 200.1 | 204.4 | 208.6 | 212.7 | 216.8 | 220.7 | 224.7 | 228.5 | 232.3 | 236.0 |
| | Revolutions | 173 | 177 | 181 | 184 | 188 | 191 | 195 | 198 | 201 | 204 |
| 45 | Horse Power | 465.4 | 496.1 | 527.4 | 559.4 | 591.9 | 625.1 | 658.9 | 693.3 | 728.2 | 763.8 |
| | Cubic Feet | 220.1 | 224.8 | 229.4 | 234.0 | 238.4 | 242.8 | 247.1 | 251.3 | 255.5 | 259.6 |
| | Revolutions | 158 | 162 | 165 | 168 | 172 | 175 | 178 | 181 | 184 | 187 |
| 48 | Horse Power | 551.1 | 587.4 | 624.5 | 662.4 | 700.9 | 740.3 | 780.3 | 821.0 | 862.4 | 904.4 |
| | Cubic Feet | 253.4 | 258.8 | 264.1 | 269.4 | 274.5 | 279.6 | 284.5 | 289.4 | 294.2 | 298.9 |
| | Revolutions | 142 | 145 | 148 | 151 | 154 | 156 | 159 | 162 | 165 | 167 |
| 51 | Horse Power | 621.4 | 662.3 | 704.2 | 746.8 | 790.3 | 834.6 | 879.8 | 925.6 | 972.3 | 1019 |
| | Cubic Feet | 289.7 | 296.0 | 302.1 | 308.1 | 313.9 | 319.7 | 325.3 | 330.9 | 336.4 | 341.8 |
| | Revolutions | 135 | 138 | 141 | 144 | 147 | 149 | 152 | 155 | 157 | 160 |
| 54 | Horse Power | 696.6 | 742.5 | 789.4 | 837.2 | 886.0 | 935.7 | 986.3 | 1037 | 1090 | 1143 |
| | Cubic Feet | 325.8 | 332.8 | 339.7 | 346.4 | 353.0 | 359.5 | 365.8 | 372.1 | 378.2 | 384.3 |
| | Revolutions | 128 | 131 | 133 | 136 | 139 | 141 | 144 | 146 | 149 | 151 |

# THE HERCULES TURBINE

## Table of Type "C" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 |
| 15 | Horse Power | 97.6 | 102.1 | 106.6 | 111.2 | 116.9 | 120.6 | 125.4 | 130.3 | 135.2 |
| | Cubic Feet | 32.33 | 32.81 | 33.30 | 33.78 | 34.23 | 34.70 | 35.15 | 35.60 | 36.05 |
| | Revolutions | 605 | 614 | 623 | 631 | 640 | 649 | 657 | 666 | 674 |
| 18 | Horse Power | 141.5 | 148.0 | 154.6 | 161.2 | 168.0 | 174.9 | 181.8 | 188.9 | 196.0 |
| | Cubic Feet | 45.28 | 45.96 | 46.63 | 47.30 | 47.95 | 48.60 | 49.23 | 49.86 | 50.48 |
| | Revolutions | 478 | 485 | 492 | 499 | 506 | 512 | 519 | 526 | 532 |
| 21 | Horse Power | 184.3 | 192.8 | 201.4 | 210.0 | 218.9 | 227.8 | 236.8 | 246.0 | 255.3 |
| | Cubic Feet | 58.55 | 59.43 | 60.30 | 61.16 | 62.00 | 62.83 | 63.66 | 64.46 | 65.26 |
| | Revolutions | 416 | 422 | 428 | 434 | 440 | 446 | 452 | 457 | 463 |
| 24 | Horse Power | 242.4 | 253.5 | 264.8 | 276.2 | 287.8 | 299.6 | 311.5 | 323.5 | 335.8 |
| | Cubic Feet | 79.31 | 80.50 | 81.68 | 82.85 | 83.98 | 85.11 | 86.21 | 87.31 | 88.40 |
| | Revolutions | 361 | 366 | 372 | 377 | 382 | 387 | 392 | 397 | 402 |
| 27 | Horse Power | 300.8 | 314.6 | 328.6 | 342.8 | 357.1 | 371.6 | 386.5 | 401.5 | 416.6 |
| | Cubic Feet | 97.85 | 99.33 | 100.8 | 102.2 | 103.6 | 105.0 | 106.4 | 107.7 | 109.1 |
| | Revolutions | 350 | 355 | 360 | 365 | 370 | 375 | 380 | 385 | 390 |
| 30 | Horse Power | 393.2 | 411.3 | 429.5 | 448.1 | 466.9 | 485.9 | 505.3 | 524.8 | 544.6 |
| | Cubic Feet | 124.9 | 126.7 | 128.6 | 130.4 | 132.2 | 134.0 | 135.7 | 137.5 | 139.2 |
| | Revolutions | 292 | 297 | 301 | 305 | 309 | 314 | 318 | 322 | 326 |
| 33 | Horse Power | 437.2 | 457.3 | 477.6 | 498.2 | 519.1 | 540.3 | 561.8 | 583.5 | 605.5 |
| | Cubic Feet | 141.3 | 143.5 | 145.5 | 147.6 | 149.6 | 151.6 | 153.6 | 155.6 | 157.5 |
| | Revolutions | 275 | 279 | 283 | 287 | 291 | 295 | 299 | 302 | 306 |
| 36 | Horse Power | 529.1 | 553.4 | 578.0 | 602.9 | 628.2 | 653.8 | 679.8 | 706.1 | 732.8 |
| | Cubic Feet | 168.3 | 170.8 | 173.3 | 175.8 | 178.2 | 180.6 | 183.0 | 185.3 | 187.6 |
| | Revolutions | 234 | 238 | 241 | 245 | 248 | 251 | 255 | 258 | 261 |
| 39 | Horse Power | 639.3 | 668.5 | 698.3 | 728.4 | 759.0 | 789.9 | 821.3 | 853.1 | 885.3 |
| | Cubic Feet | 203.5 | 206.6 | 209.6 | 212.6 | 215.5 | 218.4 | 221.2 | 224.1 | 226.9 |
| | Revolutions | 226 | 229 | 232 | 236 | 239 | 242 | 245 | 248 | 251 |
| 42 | Horse Power | 741.7 | 775.7 | 810.1 | 845.1 | 880.5 | 916.5 | 952.9 | 989.8 | 1027 |
| | Cubic Feet | 239.6 | 243.2 | 246.8 | 250.3 | 253.7 | 257.1 | 260.5 | 263.8 | 267.1 |
| | Revolutions | 208 | 211 | 214 | 217 | 220 | 223 | 226 | 228 | 231 |
| 45 | Horse Power | 799.8 | 836.5 | 873.7 | 911.4 | 949.6 | 988.4 | 1027 | 1067 | 1107 |
| | Cubic Feet | 263.6 | 267.6 | 271.5 | 275.3 | 279.1 | 282.9 | 286.6 | 290.2 | 293.8 |
| | Revolutions | 190 | 193 | 195 | 198 | 201 | 204 | 206 | 209 | 212 |
| 48 | Horse Power | 947.1 | 990.5 | 1034 | 1079 | 1124 | 1170 | 1216 | 1264 | 1311 |
| | Cubic Feet | 303.5 | 308.1 | 312.6 | 317.0 | 321.4 | 325.7 | 330.0 | 334.2 | 338.3 |
| | Revolutions | 170 | 172 | 175 | 177 | 180 | 182 | 185 | 187 | 189 |
| 51 | Horse Power | 1067 | 1116 | 1166 | 1216 | 1267 | 1319 | 1372 | 1425 | 1478 |
| | Cubic Feet | 347.1 | 352.3 | 357.4 | 362.5 | 367.5 | 372.4 | 377.3 | 382.1 | 386.8 |
| | Revolutions | 162 | 165 | 167 | 169 | 172 | 174 | 176 | 178 | 181 |
| 54 | Horse Power | 1197 | 1252 | 1307 | 1364 | 1421 | 1479 | 1538 | 1597 | 1658 |
| | Cubic Feet | 390.3 | 396.1 | 401.9 | 407.6 | 413.2 | 418.8 | 424.3 | 429.7 | 435.0 |
| | Revolutions | 153 | 156 | 158 | 160 | 162 | 165 | 167 | 169 | 171 |

# THE HERCULES TURBINE

## Table of Type "C" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 15 | Horse Power | 140.2 | 145.2 | 150.3 | 155.5 | 160.7 | 165.9 | 171.3 | 176.6 | 182.1 |
| | Cubic Feet | 36.48 | 36.91 | 37.33 | 37.76 | 38.18 | 38.60 | 39.00 | 39.40 | 39.80 |
| | Revolutions | 682 | 690 | 698 | 706 | 714 | 722 | 729 | 737 | 744 |
| 18 | Horse Power | 203.2 | 210.5 | 217.9 | 225.4 | 232.9 | 240.5 | 248.3 | 256.1 | 263.9 |
| | Cubic Feet | 51.08 | 51.70 | 52.30 | 52.88 | 53.46 | 54.05 | 54.61 | 55.18 | 55.75 |
| | Revolutions | 539 | 545 | 551 | 558 | 564 | 570 | 576 | 582 | 588 |
| 21 | Horse Power | 264.7 | 274.2 | 283.8 | 293.6 | 303.4 | 313.4 | 323.4 | 333.6 | 343.8 |
| | Cubic Feet | 66.06 | 66.85 | 67.61 | 68.38 | 69.13 | 69.88 | 70.61 | 71.35 | 72.08 |
| | Revolutions | 469 | 474 | 480 | 485 | 491 | 496 | 501 | 506 | 511 |
| 24 | Horse Power | 348.1 | 360.6 | 373.3 | 386.1 | 399.0 | 412.1 | 425.3 | 438.7 | 452.2 |
| | Cubic Feet | 89.48 | 90.53 | 91.58 | 92.61 | 93.65 | 94.65 | 95.65 | 96.65 | 97.63 |
| | Revolutions | 407 | 412 | 417 | 422 | 426 | 431 | 435 | 440 | 444 |
| 27 | Horse Power | 431.9 | 447.5 | 463.2 | 479.0 | 495.1 | 511.3 | 527.7 | 544.3 | 561.1 |
| | Cubic Feet | 110.4 | 111.7 | 113.0 | 114.3 | 115.5 | 116.8 | 118.0 | 119.2 | 120.5 |
| | Revolutions | 394 | 399 | 404 | 408 | 413 | 417 | 422 | 426 | 430 |
| 30 | Horse Power | 564.7 | 584.9 | 605.5 | 626.2 | 647.2 | 668.5 | 689.9 | 711.6 | 733.5 |
| | Cubic Feet | 140.9 | 142.5 | 144.2 | 145.8 | 147.4 | 149.0 | 150.6 | 152.1 | 153.7 |
| | Revolutions | 330 | 334 | 338 | 341 | 345 | 349 | 353 | 356 | 360 |
| 33 | Horse Power | 627.8 | 650.4 | 673.2 | 696.3 | 719.6 | 743.2 | 767.1 | 791.2 | 815.5 |
| | Cubic Feet | 159.4 | 161.3 | 163.2 | 165.0 | 166.9 | 168.7 | 170.4 | 172.2 | 174.0 |
| | Revolutions | 310 | 313 | 317 | 321 | 324 | 328 | 331 | 335 | 338 |
| 36 | Horse Power | 759.8 | 787.1 | 814.7 | 842.6 | 870.9 | 899.4 | 928.3 | 957.4 | 986.9 |
| | Cubic Feet | 189.9 | 192.1 | 194.3 | 196.5 | 198.7 | 200.9 | 203.0 | 205.1 | 207.2 |
| | Revolutions | 264 | 268 | 271 | 274 | 277 | 280 | 283 | 286 | 288 |
| 39 | Horse Power | 917.9 | 950.9 | 984.2 | 1018 | 1052 | 1086 | 1121 | 1156 | 1192 |
| | Cubic Feet | 229.6 | 232.3 | 235.0 | 237.7 | 240.3 | 242.9 | 245.5 | 248.0 | 250.5 |
| | Revolutions | 254 | 257 | 260 | 263 | 266 | 269 | 272 | 275 | 278 |
| 42 | Horse Power | 1064 | 1103 | 1141 | 1181 | 1220 | 1260 | 1301 | 1342 | 1383 |
| | Cubic Feet | 270.3 | 273.6 | 276.7 | 279.8 | 282.9 | 286.0 | 289.0 | 292.0 | 295.0 |
| | Revolutions | 234 | 237 | 240 | 242 | 245 | 248 | 250 | 253 | 255 |
| 45 | Horse Power | 1148 | 1189 | 1231 | 1273 | 1316 | 1359 | 1403 | 1447 | 1491 |
| | Cubic Feet | 297.4 | 300.9 | 304.4 | 307.8 | 311.2 | 314.6 | 317.9 | 321.2 | 324.5 |
| | Revolutions | 214 | 217 | 219 | 222 | 224 | 227 | 229 | 231 | 234 |
| 48 | Horse Power | 1300 | 1408 | 1458 | 1508 | 1558 | 1609 | 1661 | 1713 | 1766 |
| | Cubic Feet | 342.4 | 346.5 | 350.5 | 354.4 | 358.3 | 362.2 | 366.0 | 369.8 | 373.6 |
| | Revolutions | 192 | 194 | 196 | 198 | 201 | 203 | 205 | 207 | 209 |
| 51 | Horse Power | 1533 | 1588 | 1644 | 1700 | 1757 | 1815 | 1873 | 1932 | 1991 |
| | Cubic Feet | 391.5 | 396.2 | 400.7 | 405.3 | 409.8 | 414.2 | 418.6 | 422.9 | 427.2 |
| | Revolutions | 183 | 185 | 187 | 189 | 191 | 194 | 196 | 198 | 200 |
| 54 | Horse Power | 1719 | 1780 | 1843 | 1906 | 1970 | 2035 | 2100 | 2166 | 2232 |
| | Cubic Feet | 440.3 | 445.5 | 450.6 | 455.7 | 460.8 | 465.8 | 470.7 | 475.6 | 480.4 |
| | Revolutions | 173 | 175 | 177 | 179 | 181 | 183 | 185 | 187 | 189 |

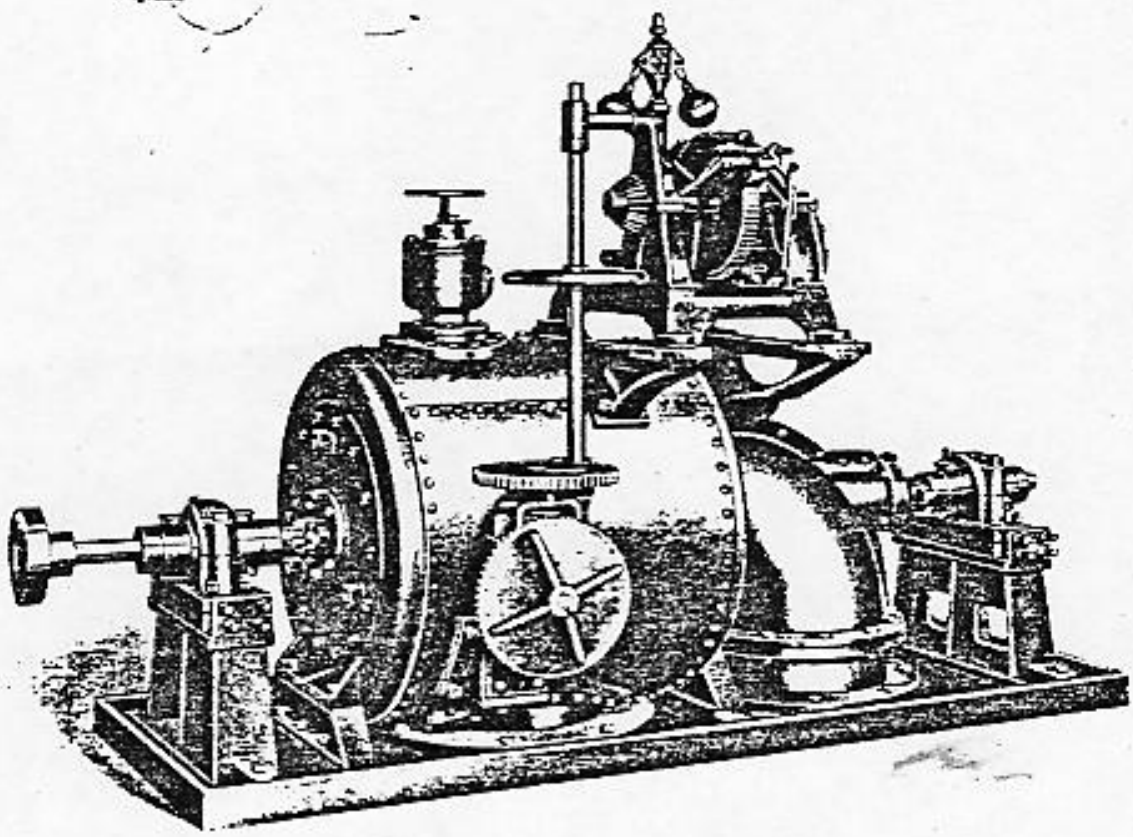


Plate No. 15

Cylinder Gate Hercules Turbine in steel case with cast iron quarter-turn, Governor attached

$N_S = 76$

$D_S = 2.3$

# THE HERCULES TURBINE

## Table of Type "D" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 15 | Horse Power | 3.5 | 5.4 | 7.6 | 10.0 | 12.6 | 15.4 | 18.4 | 21.5 | 24.8 | 28.3 |
| | Cubic Feet | 12.39 | 14.31 | 16.00 | 17.52 | 18.93 | 20.22 | 21.46 | 22.62 | 23.73 | 24.78 |
| | Revolutions | 159 | 183 | 205 | 225 | 243 | 260 | 275 | 290 | 304 | 318 |
| 18 | Horse Power | 5.0 | 7.8 | 10.9 | 14.4 | 18.1 | 22.2 | 26.4 | 31.0 | 35.7 | 40.7 |
| | Cubic Feet | 17.84 | 20.60 | 23.04 | 25.24 | 27.26 | 29.14 | 30.91 | 32.58 | 34.17 | 35.69 |
| | Revolutions | 132 | 153 | 171 | 187 | 202 | 216 | 229 | 242 | 254 | 265 |
| 21 | Horse Power | 6.9 | 10.6 | 14.9 | 19.6 | 24.7 | 30.2 | 36.0 | 42.2 | 48.7 | 55.5 |
| | Cubic Feet | 24.29 | 28.04 | 31.36 | 34.35 | 37.10 | 39.66 | 42.07 | 44.34 | 46.51 | 48.58 |
| | Revolutions | 113 | 131 | 146 | 160 | 173 | 185 | 197 | 207 | 217 | 227 |
| 24 | Horse Power | 9.0 | 13.9 | 19.5 | 25.6 | 32.3 | 39.4 | 47.0 | 55.1 | 63.6 | 72.5 |
| | Cubic Feet | 30.17 | 34.84 | 38.95 | 42.67 | 46.09 | 49.27 | 52.26 | 55.09 | 57.78 | 60.35 |
| | Revolutions | 103 | 119 | 133 | 146 | 157 | 168 | 178 | 188 | 197 | 206 |
| 27 | Horse Power | 11.9 | 18.3 | 25.6 | 33.6 | 42.4 | 51.8 | 61.8 | 72.4 | 83.6 | 95.2 |
| | Cubic Feet | 41.20 | 47.57 | 53.19 | 58.27 | 62.94 | 67.28 | 71.36 | 75.22 | 78.89 | 82.40 |
| | Revolutions | 88 | 102 | 114 | 125 | 135 | 144 | 153 | 161 | 169 | 176 |
| 30 | Horse Power | 15.2 | 23.4 | 32.8 | 43.1 | 54.3 | 66.4 | 79.2 | 92.8 | 107.0 | 122.0 |
| | Cubic Feet | 50.60 | 58.42 | 65.32 | 71.55 | 77.28 | 82.62 | 87.63 | 92.37 | 96.88 | 101.2 |
| | Revolutions | 80 | 92 | 103 | 113 | 122 | 131 | 139 | 146 | 153 | 160 |
| 33 | Horse Power | 18.2 | 28.0 | 39.1 | 51.5 | 64.9 | 79.3 | 94.6 | 110.8 | 127.8 | 145.7 |
| | Cubic Feet | 61.55 | 71.07 | 79.46 | 87.04 | 94.02 | 100.5 | 106.6 | 112.3 | 117.8 | 123.1 |
| | Revolutions | 72 | 83 | 93 | 102 | 110 | 118 | 125 | 132 | 138 | 144 |
| 36 | Horse Power | 21.4 | 32.9 | 46.0 | 60.5 | 76.2 | 93.1 | 111.1 | 130.1 | 150.1 | 171.1 |
| | Cubic Feet | 70.47 | 81.37 | 90.97 | 99.66 | 107.6 | 115.0 | 122.0 | 128.6 | 134.9 | 140.9 |
| | Revolutions | 66 | 76 | 85 | 93 | 101 | 108 | 114 | 120 | 126 | 132 |
| 39 | Horse Power | 25.1 | 38.6 | 54.0 | 71.0 | 89.4 | 109.3 | 130.4 | 152.7 | 176.2 | 200.8 |
| | Cubic Feet | 83.88 | 96.86 | 108.3 | 118.6 | 128.1 | 137.0 | 145.3 | 153.1 | 160.6 | 167.7 |
| | Revolutions | 61 | 70 | 79 | 86 | 93 | 100 | 106 | 111 | 117 | 122 |
| 42 | Horse Power | 29.1 | 44.8 | 62.6 | 82.3 | 103.7 | 126.7 | 151.3 | 177.2 | 204.4 | 232.9 |
| | Cubic Feet | 97.28 | 112.3 | 125.6 | 137.6 | 148.6 | 158.9 | 168.5 | 177.6 | 186.3 | 194.6 |
| | Revolutions | 56 | 65 | 73 | 80 | 86 | 92 | 98 | 103 | 108 | 113 |
| 45 | Horse Power | 33.4 | 51.4 | 71.9 | 94.6 | 119.1 | 145.5 | 173.6 | 203.4 | 234.6 | 267.4 |
| | Cubic Feet | 111.7 | 128.9 | 144.2 | 157.9 | 170.6 | 182.4 | 193.4 | 203.9 | 213.8 | 223.3 |
| | Revolutions | 53 | 61 | 68 | 75 | 81 | 86 | 92 | 96 | 101 | 106 |
| 48 | Horse Power | 38.0 | 58.5 | 81.8 | 107.5 | 135.5 | 165.6 | 197.6 | 231.4 | 267.0 | 304.2 |
| | Cubic Feet | 127.0 | 146.7 | 164.0 | 179.7 | 194.1 | 207.5 | 220.1 | 232.0 | 243.3 | 254.1 |
| | Revolutions | 49 | 57 | 64 | 70 | 75 | 81 | 86 | 90 | 95 | 99 |
| 51 | Horse Power | 42.9 | 66.1 | 92.3 | 121.4 | 153.0 | 186.9 | 223.0 | 261.2 | 301.4 | 343.4 |
| | Cubic Feet | 143.4 | 165.6 | 185.2 | 202.8 | 219.1 | 234.2 | 248.4 | 261.9 | 274.7 | 286.9 |
| | Revolutions | 46 | 54 | 60 | 66 | 71 | 76 | 81 | 85 | 89 | 93 |
| 54 | Horse Power | 48.1 | 74.1 | 103.5 | 136.1 | 171.5 | 209.5 | 250.1 | 292.9 | 337.9 | 385.0 |
| | Cubic Feet | 160.8 | 185.7 | 207.6 | 227.4 | 245.6 | 262.6 | 278.5 | 293.6 | 307.9 | 321.6 |
| | Revolutions | 44 | 51 | 57 | 62 | 67 | 72 | 76 | 80 | 84 | 88 |

# THE HERCULES TURBINE

## Table of Type "D" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | Horse Power | 31.9 | 35.6 | 39.5 | 43.6 | 47.7 | 52.0 | 56.4 | 60.9 | 65.5 | 70.3 |
| | Cubic Feet | 25.80 | 26.77 | 27.71 | 28.62 | 29.50 | 30.35 | 31.18 | 31.99 | 32.78 | 33.56 |
| | Revolutions | 331 | 344 | 356 | 367 | 379 | 390 | 400 | 411 | 421 | 431 |
| 18 | Horse Power | 45.9 | 51.4 | 57.0 | 62.8 | 68.7 | 74.9 | 81.2 | 87.7 | 94.4 | 101.2 |
| | Cubic Feet | 37.14 | 38.55 | 39.90 | 41.21 | 42.48 | 43.71 | 44.91 | 46.07 | 47.21 | 48.32 |
| | Revolutions | 276 | 286 | 296 | 306 | 315 | 325 | 333 | 342 | 351 | 359 |
| 21 | Horse Power | 62.6 | 69.9 | 77.5 | 85.4 | 93.6 | 101.9 | 110.5 | 119.4 | 128.5 | 137.8 |
| | Cubic Feet | 50.56 | 52.47 | 54.31 | 56.09 | 57.82 | 59.49 | 61.12 | 62.71 | 64.26 | 65.77 |
| | Revolutions | 236 | 245 | 254 | 262 | 270 | 278 | 286 | 293 | 300 | 308 |
| 24 | Horse Power | 81.7 | 91.3 | 101.3 | 111.6 | 122.2 | 133.2 | 144.4 | 156.0 | 167.8 | 179.9 |
| | Cubic Feet | 66.61 | 65.18 | 67.47 | 69.68 | 71.83 | 73.91 | 75.94 | 77.91 | 79.83 | 81.71 |
| | Revolutions | 215 | 223 | 231 | 238 | 246 | 253 | 260 | 266 | 273 | 279 |
| 27 | Horse Power | 107.4 | 120.0 | 133.1 | 146.7 | 160.6 | 175.0 | 189.8 | 205.0 | 220.5 | 236.5 |
| | Cubic Feet | 85.77 | 89.00 | 92.13 | 95.15 | 98.08 | 100.9 | 103.6 | 106.3 | 109.0 | 111.5 |
| | Revolutions | 184 | 191 | 197 | 204 | 210 | 216 | 222 | 228 | 234 | 239 |
| 30 | Horse Power | 137.5 | 153.7 | 170.4 | 187.8 | 205.7 | 224.1 | 243.0 | 262.4 | 282.4 | 302.8 |
| | Cubic Feet | 105.3 | 109.3 | 113.1 | 116.8 | 120.4 | 123.9 | 127.3 | 130.6 | 133.8 | 137.0 |
| | Revolutions | 167 | 173 | 179 | 185 | 191 | 196 | 202 | 207 | 212 | 217 |
| 33 | Horse Power | 164.2 | 183.5 | 203.6 | 224.3 | 245.6 | 267.6 | 290.2 | 313.4 | 337.2 | 361.6 |
| | Cubic Feet | 126.1 | 132.9 | 137.6 | 142.1 | 146.5 | 150.7 | 154.9 | 158.9 | 162.8 | 166.6 |
| | Revolutions | 150 | 156 | 161 | 167 | 172 | 177 | 182 | 186 | 191 | 196 |
| 36 | Horse Power | 192.9 | 215.6 | 239.1 | 263.4 | 288.5 | 314.4 | 340.9 | 368.2 | 396.1 | 424.8 |
| | Cubic Feet | 140.7 | 152.2 | 157.5 | 162.7 | 167.7 | 172.6 | 177.3 | 181.9 | 186.4 | 190.8 |
| | Revolutions | 137 | 142 | 147 | 152 | 157 | 161 | 166 | 170 | 174 | 178 |
| 39 | Horse Power | 226.4 | 253.0 | 280.6 | 309.2 | 338.6 | 368.9 | 400.1 | 432.1 | 464.9 | 498.5 |
| | Cubic Feet | 174.6 | 181.2 | 187.5 | 193.7 | 199.7 | 205.4 | 211.1 | 216.6 | 221.9 | 227.1 |
| | Revolutions | 127 | 132 | 137 | 141 | 145 | 150 | 154 | 158 | 162 | 165 |
| 42 | Horse Power | 262.6 | 293.5 | 325.5 | 358.6 | 392.7 | 427.9 | 464.0 | 501.1 | 539.2 | 578.2 |
| | Cubic Feet | 202.5 | 210.1 | 217.5 | 224.6 | 231.6 | 238.3 | 244.8 | 251.2 | 257.4 | 263.4 |
| | Revolutions | 118 | 122 | 127 | 131 | 135 | 139 | 143 | 146 | 150 | 154 |
| 45 | Horse Power | 301.5 | 336.9 | 373.6 | 411.6 | 450.8 | 491.2 | 532.7 | 575.3 | 619.0 | 663.7 |
| | Cubic Feet | 232.5 | 241.2 | 249.7 | 257.9 | 265.8 | 273.5 | 281.0 | 288.3 | 295.5 | 302.3 |
| | Revolutions | 110 | 114 | 118 | 122 | 126 | 130 | 133 | 137 | 140 | 143 |
| 48 | Horse Power | 343.0 | 383.3 | 425.1 | 468.4 | 512.9 | 558.8 | 606.1 | 654.5 | 704.3 | 755.2 |
| | Cubic Feet | 264.5 | 274.5 | 284.1 | 293.4 | 302.4 | 311.2 | 319.8 | 328.1 | 336.2 | 344.1 |
| | Revolutions | 103 | 107 | 111 | 114 | 118 | 121 | 125 | 128 | 131 | 134 |
| 51 | Horse Power | 387.2 | 432.7 | 479.9 | 528.7 | 579.1 | 630.9 | 684.2 | 738.9 | 795.1 | 852.5 |
| | Cubic Feet | 298.6 | 309.9 | 320.7 | 331.3 | 341.5 | 351.4 | 361.0 | 370.4 | 379.5 | 388.4 |
| | Revolutions | 97 | 101 | 104 | 108 | 111 | 114 | 117 | 120 | 123 | 126 |
| 54 | Horse Power | 434.1 | 485.2 | 538.1 | 592.8 | 649.2 | 707.3 | 767.0 | 828.4 | 891.3 | 955.7 |
| | Cubic Feet | 334.7 | 347.4 | 359.6 | 371.4 | 382.8 | 393.9 | 404.7 | 415.2 | 425.5 | 435.5 |
| | Revolutions | 92 | 95 | 98 | 102 | 105 | 108 | 111 | 114 | 117 | 119 |

# THE HERCULES TURBINE

## Table of Type "D" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 15 | Horse Power | 75.1 | 80.1 | 85.1 | 90.3 | 95.5 | 100.9 | 106.4 | 111.9 | 117.6 | 123.3 |
| | Cubic Feet | 34.31 | 35.05 | 35.77 | 36.48 | 37.17 | 37.86 | 38.53 | 39.18 | 39.83 | 40.47 |
| | Revolutions | 440 | 450 | 459 | 468 | 477 | 486 | 495 | 503 | 511 | 519 |
| 18 | Horse Power | 108.2 | 115.3 | 122.6 | 130.0 | 137.6 | 145.3 | 153.2 | 161.2 | 169.3 | 177.6 |
| | Cubic Feet | 49.41 | 50.47 | 51.51 | 52.53 | 53.53 | 54.52 | 55.48 | 56.43 | 57.36 | 58.28 |
| | Revolutions | 367 | 375 | 383 | 390 | 398 | 405 | 412 | 419 | 426 | 433 |
| 21 | Horse Power | 147.3 | 157.0 | 166.9 | 177.0 | 187.3 | 197.8 | 208.5 | 219.4 | 230.5 | 241.7 |
| | Cubic Feet | 67.25 | 68.70 | 70.12 | 71.50 | 72.87 | 74.20 | 75.52 | 76.81 | 78.08 | 79.33 |
| | Revolutions | 315 | 321 | 328 | 334 | 341 | 347 | 353 | 359 | 365 | 371 |
| 24 | Horse Power | 192.3 | 205.0 | 218.0 | 231.2 | 244.7 | 258.4 | 272.4 | 286.6 | 301.0 | 315.7 |
| | Cubic Feet | 83.55 | 85.34 | 87.11 | 88.83 | 90.52 | 92.18 | 93.81 | 95.42 | 97.00 | 98.55 |
| | Revolutions | 286 | 292 | 298 | 304 | 310 | 315 | 321 | 326 | 332 | 337 |
| 27 | Horse Power | 252.8 | 269.5 | 286.5 | 303.8 | 321.5 | 339.6 | 357.9 | 376.6 | 395.6 | 414.9 |
| | Cubic Feet | 114.0 | 116.5 | 118.9 | 121.3 | 123.6 | 125.8 | 128.1 | 130.3 | 132.4 | 134.5 |
| | Revolutions | 244 | 250 | 255 | 260 | 265 | 270 | 275 | 279 | 284 | 289 |
| 30 | Horse Power | 323.7 | 345.0 | 366.8 | 389.0 | 411.7 | 434.8 | 458.3 | 482.2 | 506.5 | 531.2 |
| | Cubic Feet | 140.1 | 143.1 | 146.0 | 148.9 | 151.8 | 154.5 | 157.3 | 160.0 | 162.6 | 165.2 |
| | Revolutions | 222 | 227 | 231 | 236 | 240 | 245 | 249 | 253 | 258 | 262 |
| 33 | Horse Power | 386.5 | 412.0 | 438.1 | 464.6 | 491.7 | 519.2 | 547.3 | 575.8 | 604.9 | 634.4 |
| | Cubic Feet | 170.4 | 174.1 | 177.6 | 181.2 | 184.6 | 188.0 | 191.3 | 194.6 | 197.8 | 201.0 |
| | Revolutions | 200 | 204 | 209 | 213 | 217 | 221 | 225 | 229 | 232 | 236 |
| 36 | Horse Power | 454.0 | 484.0 | 514.6 | 545.7 | 577.5 | 609.9 | 642.9 | 676.4 | 710.5 | 745.2 |
| | Cubic Feet | 195.1 | 199.3 | 203.4 | 207.4 | 211.4 | 215.3 | 219.1 | 222.8 | 226.5 | 230.1 |
| | Revolutions | 183 | 186 | 190 | 194 | 198 | 201 | 205 | 208 | 212 | 215 |
| 39 | Horse Power | 532.9 | 568.0 | 603.9 | 640.5 | 677.8 | 715.8 | 754.5 | 793.8 | 833.9 | 874.5 |
| | Cubic Feet | 232.2 | 237.2 | 242.1 | 246.9 | 251.6 | 256.2 | 260.8 | 265.2 | 269.6 | 273.9 |
| | Revolutions | 169 | 173 | 176 | 180 | 183 | 187 | 190 | 193 | 196 | 200 |
| 42 | Horse Power | 618.0 | 658.8 | 700.4 | 742.8 | 786.1 | 830.2 | 875.0 | 920.7 | 967.1 | 1014 |
| | Cubic Feet | 269.4 | 275.1 | 280.8 | 286.4 | 291.8 | 297.2 | 302.5 | 307.6 | 312.7 | 317.7 |
| | Revolutions | 157 | 160 | 164 | 167 | 170 | 173 | 176 | 179 | 182 | 185 |
| 45 | Horse Power | 709.5 | 756.2 | 804.0 | 852.7 | 902.4 | 953.0 | 1004 | 1056 | 1110 | 1164 |
| | Cubic Feet | 309.2 | 315.9 | 322.4 | 328.7 | 335.0 | 341.2 | 347.2 | 353.1 | 359.0 | 364.7 |
| | Revolutions | 147 | 150 | 153 | 156 | 159 | 162 | 165 | 167 | 170 | 173 |
| 48 | Horse Power | 807.2 | 860.4 | 914.8 | 970.2 | 1026 | 1084 | 1142 | 1202 | 1263 | 1324 |
| | Cubic Feet | 351.8 | 359.4 | 366.8 | 374.0 | 381.2 | 388.2 | 395.0 | 401.8 | 408.4 | 415.0 |
| | Revolutions | 137 | 140 | 143 | 146 | 149 | 152 | 154 | 157 | 160 | 162 |
| 51 | Horse Power | 911.3 | 971.3 | 1032 | 1095 | 1159 | 1224 | 1290 | 1357 | 1426 | 1495 |
| | Cubic Feet | 397.2 | 405.7 | 414.1 | 422.3 | 430.3 | 438.2 | 446.0 | 453.6 | 461.1 | 468.5 |
| | Revolutions | 129 | 132 | 135 | 137 | 140 | 143 | 145 | 148 | 150 | 153 |
| 54 | Horse Power | 1021 | 1089 | 1157 | 1227 | 1299 | 1372 | 1446 | 1522 | 1598 | 1676 |
| | Cubic Feet | 445.3 | 454.8 | 464.2 | 473.4 | 482.4 | 491.3 | 500.0 | 508.5 | 516.9 | 525.2 |
| | Revolutions | 122 | 125 | 127 | 130 | 132 | 135 | 137 | 139 | 142 | 144 |

# THE HERCULES TURBINE

## Table of Type "D" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 |
| 15 | Horse Power | 129.1 | 135.0 | 141.0 | 147.1 | 153.3 | 159.6 | 165.9 | 172.3 | 178.8 |
| | Cubic Feet | 41.10 | 41.72 | 42.33 | 42.93 | 43.52 | 44.10 | 44.68 | 45.25 | 45.81 |
| | Revolutions | 528 | 536 | 543 | 551 | 559 | 566 | 574 | 581 | 588 |
| 18 | Horse Power | 185.9 | 194.5 | 203.1 | 211.9 | 220.8 | 229.8 | 238.9 | 248.2 | 257.5 |
| | Cubic Feet | 59.18 | 60.07 | 60.95 | 61.81 | 62.67 | 63.51 | 64.34 | 65.16 | 65.97 |
| | Revolutions | 440 | 446 | 453 | 459 | 466 | 472 | 478 | 484 | 490 |
| 21 | Horse Power | 253.1 | 264.7 | 276.5 | 288.4 | 300.5 | 312.8 | 325.2 | 337.8 | 350.5 |
| | Cubic Feet | 80.55 | 81.77 | 82.96 | 84.14 | 85.30 | 86.44 | 87.56 | 88.69 | 89.79 |
| | Revolutions | 377 | 382 | 388 | 393 | 399 | 404 | 410 | 415 | 420 |
| 24 | Horse Power | 330.6 | 345.8 | 361.1 | 376.7 | 392.5 | 408.5 | 424.8 | 441.2 | 457.9 |
| | Cubic Feet | 100.0 | 101.6 | 103.0 | 104.5 | 105.9 | 107.4 | 108.8 | 110.2 | 111.5 |
| | Revolutions | 342 | 347 | 352 | 357 | 362 | 367 | 372 | 377 | 381 |
| 27 | Horse Power | 434.5 | 454.4 | 474.6 | 495.1 | 515.8 | 536.9 | 558.2 | 579.9 | 601.7 |
| | Cubic Feet | 136.6 | 138.7 | 140.7 | 142.7 | 144.7 | 146.6 | 148.5 | 150.4 | 152.3 |
| | Revolutions | 293 | 297 | 302 | 306 | 310 | 314 | 319 | 323 | 327 |
| 30 | Horse Power | 556.3 | 581.8 | 607.6 | 633.9 | 660.5 | 687.4 | 714.7 | 742.4 | 770.4 |
| | Cubic Feet | 167.8 | 170.3 | 172.8 | 175.3 | 177.7 | 180.1 | 182.4 | 184.7 | 187.0 |
| | Revolutions | 266 | 270 | 274 | 278 | 281 | 285 | 289 | 293 | 296 |
| 33 | Horse Power | 664.3 | 694.8 | 725.6 | 757.0 | 788.7 | 820.9 | 853.5 | 886.6 | 920.0 |
| | Cubic Feet | 204.1 | 207.2 | 210.2 | 213.2 | 216.1 | 219.0 | 221.9 | 224.7 | 227.5 |
| | Revolutions | 240 | 243 | 247 | 250 | 254 | 257 | 260 | 264 | 267 |
| 36 | Horse Power | 780.3 | 816.1 | 852.4 | 889.2 | 926.5 | 964.3 | 1002 | 1041 | 1080 |
| | Cubic Feet | 233.7 | 237.2 | 240.7 | 244.1 | 247.5 | 250.8 | 254.1 | 257.3 | 260.5 |
| | Revolutions | 219 | 222 | 225 | 228 | 231 | 235 | 238 | 241 | 244 |
| 39 | Horse Power | 915.8 | 957.8 | 1000 | 1043 | 1087 | 1131 | 1176 | 1222 | 1268 |
| | Cubic Feet | 278.2 | 282.4 | 286.5 | 290.5 | 294.6 | 298.5 | 302.4 | 306.3 | 310.1 |
| | Revolutions | 203 | 206 | 209 | 212 | 215 | 217 | 220 | 223 | 226 |
| 42 | Horse Power | 1062 | 1110 | 1160 | 1210 | 1261 | 1312 | 1364 | 1417 | 1471 |
| | Cubic Feet | 322.6 | 327.5 | 332.3 | 337.0 | 341.6 | 346.2 | 350.8 | 355.2 | 359.6 |
| | Revolutions | 188 | 191 | 194 | 196 | 199 | 202 | 205 | 207 | 210 |
| 45 | Horse Power | 1219 | 1275 | 1331 | 1389 | 1446 | 1506 | 1566 | 1627 | 1688 |
| | Cubic Feet | 370.4 | 376.0 | 381.4 | 386.8 | 392.2 | 397.4 | 402.6 | 407.8 | 412.8 |
| | Revolutions | 176 | 178 | 181 | 184 | 186 | 189 | 191 | 193 | 196 |
| 48 | Horse Power | 1387 | 1450 | 1515 | 1580 | 1647 | 1714 | 1782 | 1851 | 1921 |
| | Cubic Feet | 421.4 | 427.8 | 434.0 | 440.2 | 446.2 | 452.2 | 458.1 | 464.0 | 469.7 |
| | Revolutions | 165 | 167 | 170 | 172 | 174 | 177 | 179 | 181 | 184 |
| 51 | Horse Power | 1566 | 1638 | 1710 | 1784 | 1859 | 1935 | 2012 | 2090 | 2169 |
| | Cubic Feet | 475.7 | 482.9 | 489.9 | 496.9 | 503.8 | 510.5 | 517.2 | 523.8 | 530.3 |
| | Revolutions | 155 | 157 | 160 | 162 | 164 | 166 | 169 | 171 | 173 |
| 54 | Horse Power | 1755 | 1836 | 1917 | 2000 | 2084 | 2169 | 2255 | 2343 | 2431 |
| | Cubic Feet | 533.3 | 541.4 | 549.3 | 557.1 | 564.8 | 572.3 | 579.8 | 587.2 | 594.5 |
| | Revolutions | 146 | 148 | 151 | 153 | 155 | 157 | 159 | 161 | 163 |

$N_s = 76$

$D_s = 2.3$

# THE HERCULES TURBINE

## Table of Type "D" Wheels

| Size of Wheel in Inches | Horse Power / Cubic Feet per Second / Revolutions per Minute | HEAD IN FEET | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 15 | Horse Power | 185.4 | 192.1 | 198.8 | 205.6 | 212.5 | 219.5 | 226.5 | 233.7 | 240.8 |
| | Cubic Feet | 46.37 | 46.92 | 47.46 | 47.99 | 48.52 | 49.05 | 49.57 | 50.08 | 50.59 |
| | Revolutions | 595 | 602 | 609 | 616 | 623 | 630 | 636 | 643 | 649 |
| 18 | Horse Power | 267.0 | 276.6 | 286.3 | 296.1 | 306.0 | 316.1 | 326.2 | 336.5 | 346.8 |
| | Cubic Feet | 66.77 | 67.56 | 68.34 | 69.11 | 69.88 | 70.63 | 71.38 | 72.12 | 72.85 |
| | Revolutions | 496 | 502 | 508 | 513 | 519 | 525 | 530 | 536 | 541 |
| 21 | Horse Power | 363.4 | 376.5 | 389.7 | 403.1 | 416.6 | 430.3 | 444.1 | 458.0 | 472.1 |
| | Cubic Feet | 90.88 | 91.95 | 93.02 | 94.07 | 95.11 | 96.14 | 97.15 | 98.16 | 99.16 |
| | Revolutions | 425 | 430 | 435 | 440 | 445 | 450 | 454 | 459 | 464 |
| 24 | Horse Power | 474.7 | 491.9 | 509.1 | 526.5 | 544.1 | 562.0 | 580.0 | 598.2 | 616.6 |
| | Cubic Feet | 112.9 | 114.2 | 115.5 | 116.8 | 118.1 | 119.4 | 120.7 | 121.9 | 123.2 |
| | Revolutions | 386 | 391 | 395 | 400 | 404 | 408 | 413 | 417 | 421 |
| 27 | Horse Power | 623.9 | 646.3 | 668.9 | 691.9 | 715.1 | 738.6 | 762.2 | 786.2 | 810.4 |
| | Cubic Feet | 154.1 | 156.0 | 157.8 | 159.5 | 161.3 | 163.0 | 164.8 | 166.5 | 168.2 |
| | Revolutions | 331 | 334 | 338 | 342 | 346 | 350 | 353 | 357 | 361 |
| 30 | Horse Power | 798.7 | 827.4 | 856.4 | 885.8 | 915.5 | 945.6 | 975.9 | 1006 | 1037 |
| | Cubic Feet | 189.3 | 191.5 | 193.7 | 195.9 | 198.1 | 200.2 | 202.4 | 204.5 | 206.5 |
| | Revolutions | 300 | 303 | 307 | 310 | 314 | 317 | 320 | 324 | 327 |
| 33 | Horse Power | 953.9 | 988.0 | 1022 | 1057 | 1093 | 1129 | 1165 | 1202 | 1239 |
| | Cubic Feet | 230.3 | 233.0 | 235.7 | 238.4 | 241.0 | 243.6 | 246.2 | 248.7 | 251.2 |
| | Revolutions | 270 | 274 | 277 | 280 | 283 | 286 | 289 | 292 | 295 |
| 36 | Horse Power | 1120 | 1160 | 1201 | 1242 | 1284 | 1326 | 1369 | 1412 | 1455 |
| | Cubic Feet | 263.7 | 266.8 | 269.9 | 272.9 | 275.9 | 278.9 | 281.9 | 284.8 | 287.7 |
| | Revolutions | 247 | 250 | 253 | 255 | 258 | 261 | 264 | 267 | 269 |
| 39 | Horse Power | 1315 | 1362 | 1410 | 1458 | 1507 | 1556 | 1606 | 1657 | 1708 |
| | Cubic Feet | 313.8 | 317.6 | 321.2 | 324.9 | 328.4 | 332.0 | 335.5 | 339.0 | 342.4 |
| | Revolutions | 229 | 231 | 234 | 237 | 239 | 242 | 244 | 247 | 249 |
| 42 | Horse Power | 1525 | 1579 | 1635 | 1691 | 1748 | 1805 | 1863 | 1922 | 1981 |
| | Cubic Feet | 364.0 | 368.3 | 372.6 | 376.8 | 380.9 | 385.0 | 389.1 | 393.2 | 397.1 |
| | Revolutions | 212 | 215 | 217 | 220 | 222 | 225 | 227 | 229 | 232 |
| 45 | Horse Power | 1750 | 1813 | 1877 | 1941 | 2006 | 2072 | 2139 | 2206 | 2274 |
| | Cubic Feet | 417.8 | 422.8 | 427.7 | 432.5 | 437.3 | 442.0 | 446.7 | 451.3 | 455.9 |
| | Revolutions | 198 | 200 | 203 | 205 | 207 | 210 | 212 | 214 | 216 |
| 48 | Horse Power | 1992 | 2063 | 2135 | 2209 | 2283 | 2358 | 2433 | 2510 | 2587 |
| | Cubic Feet | 475.4 | 481.0 | 486.6 | 492.1 | 497.6 | 502.9 | 508.2 | 513.5 | 518.7 |
| | Revolutions | 186 | 188 | 190 | 192 | 194 | 196 | 199 | 201 | 203 |
| 51 | Horse Power | 2248 | 2329 | 2411 | 2493 | 2577 | 2662 | 2747 | 2833 | 2921 |
| | Cubic Feet | 536.7 | 543.1 | 549.3 | 555.5 | 561.7 | 567.8 | 573.8 | 579.7 | 585.6 |
| | Revolutions | 175 | 177 | 179 | 181 | 183 | 185 | 187 | 189 | 191 |
| 54 | Horse Power | 2521 | 2611 | 2703 | 2795 | 2889 | 2984 | 3080 | 3177 | 3274 |
| | Cubic Feet | 601.7 | 608.8 | 615.8 | 622.8 | 629.7 | 636.5 | 643.2 | 649.9 | 656.5 |
| | Revolutions | 165 | 167 | 169 | 171 | 173 | 175 | 176 | 178 | 180 |

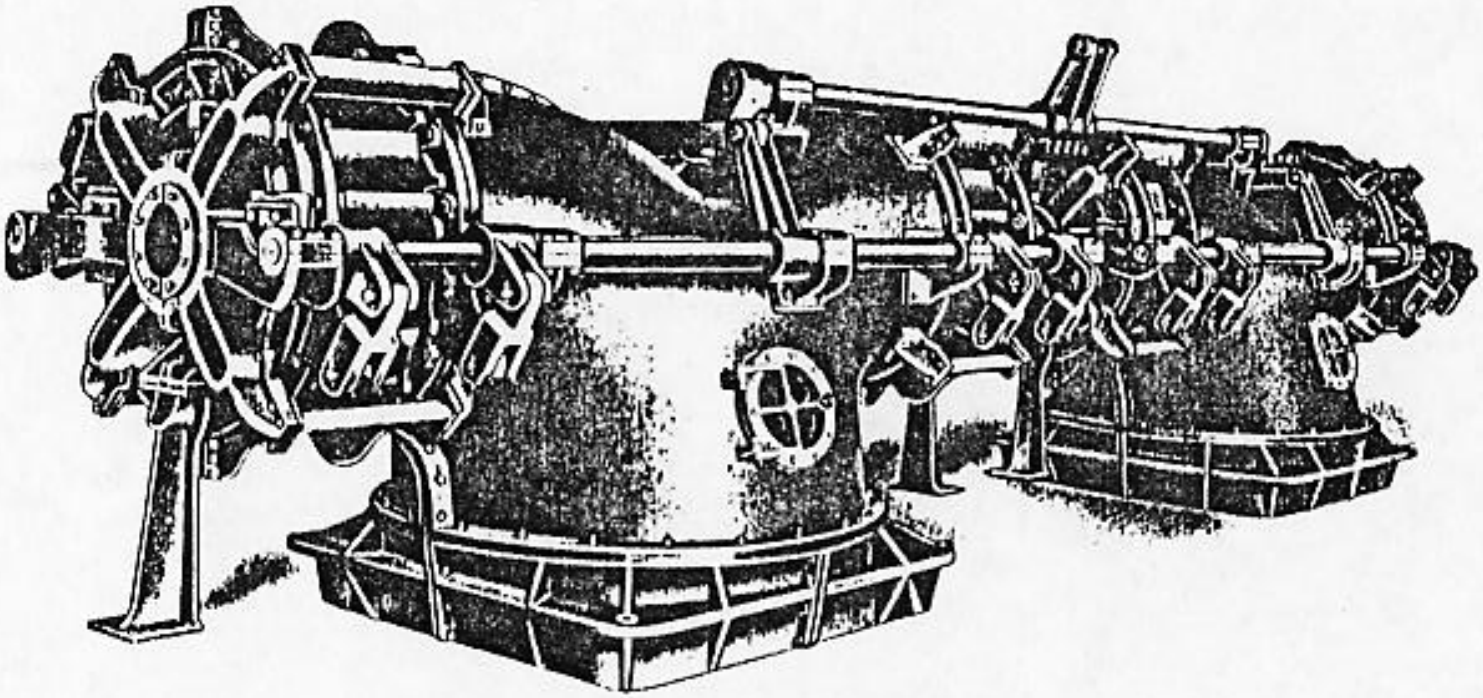


Plate No. 16

Two pairs Type C Swing Gate Hercules Turbines. Four units with a capacity of 28,000 H. P. under 60 feet head, for the Spokane & Inland Empire Railway Co.

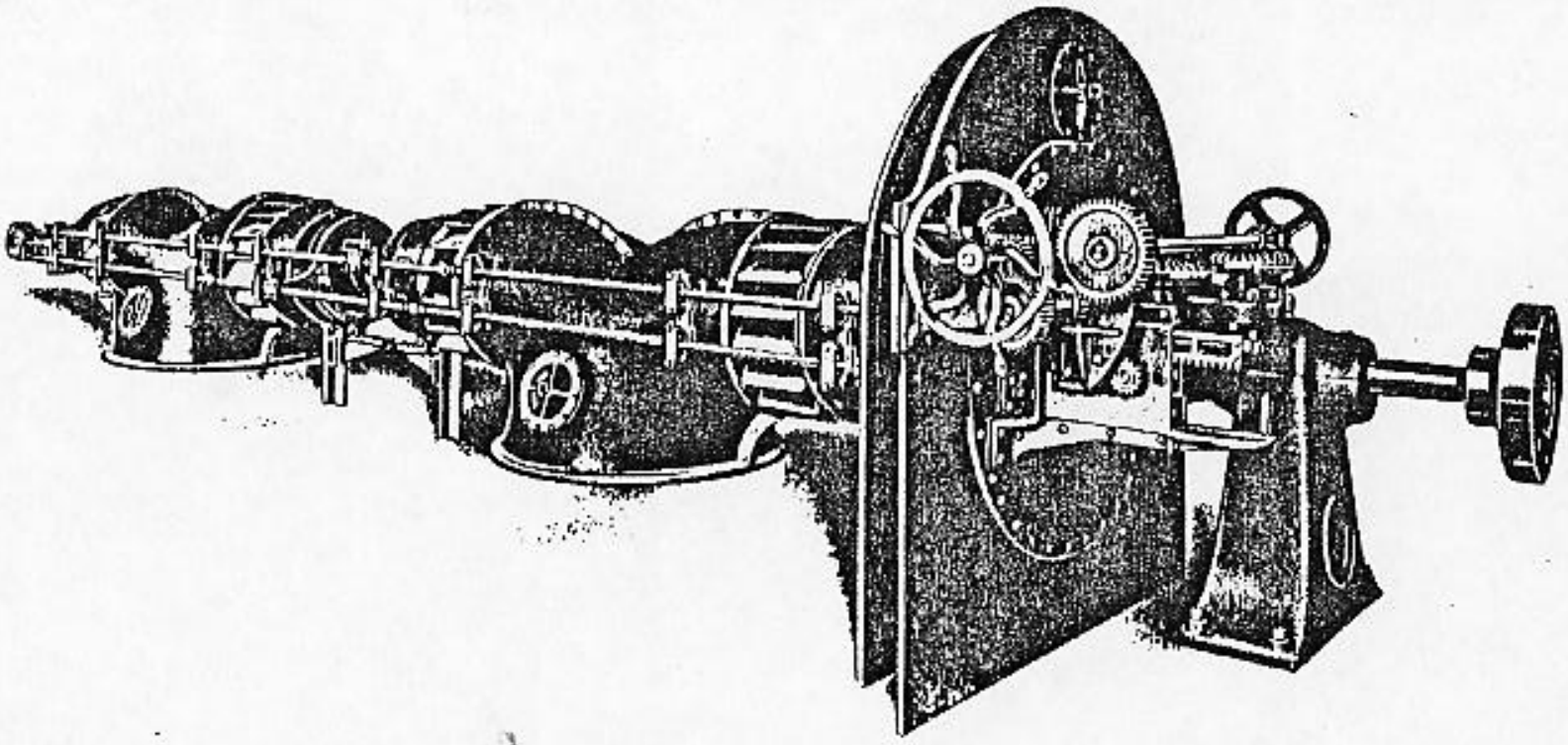


Plate No. 17

One of four units Type C Cylinder Gate Hercules Turbines. Capacity 3000 H. P. under 20 feet head.
Part of fifty-one Hercules Turbines for the Brompton Pulp & Paper Co., East Angus, P. Q.

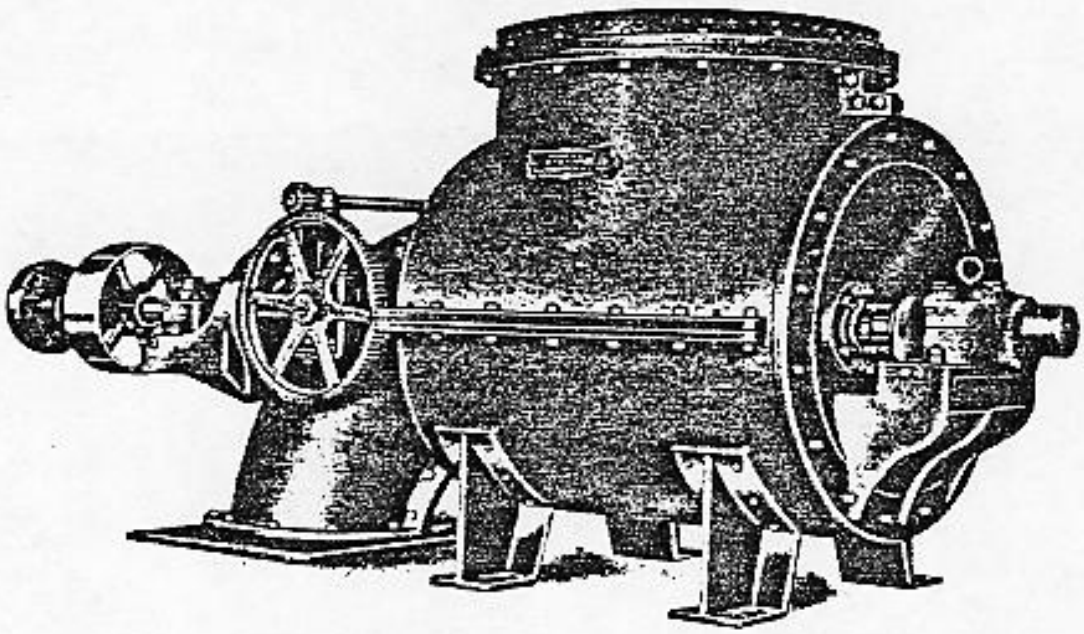


Plate No. 18

Small Cylinder Gate Hercules Turbine in cast iron case with inlet on top Easily assembled, compact, durable. Modifications of this design to suit individual requirements

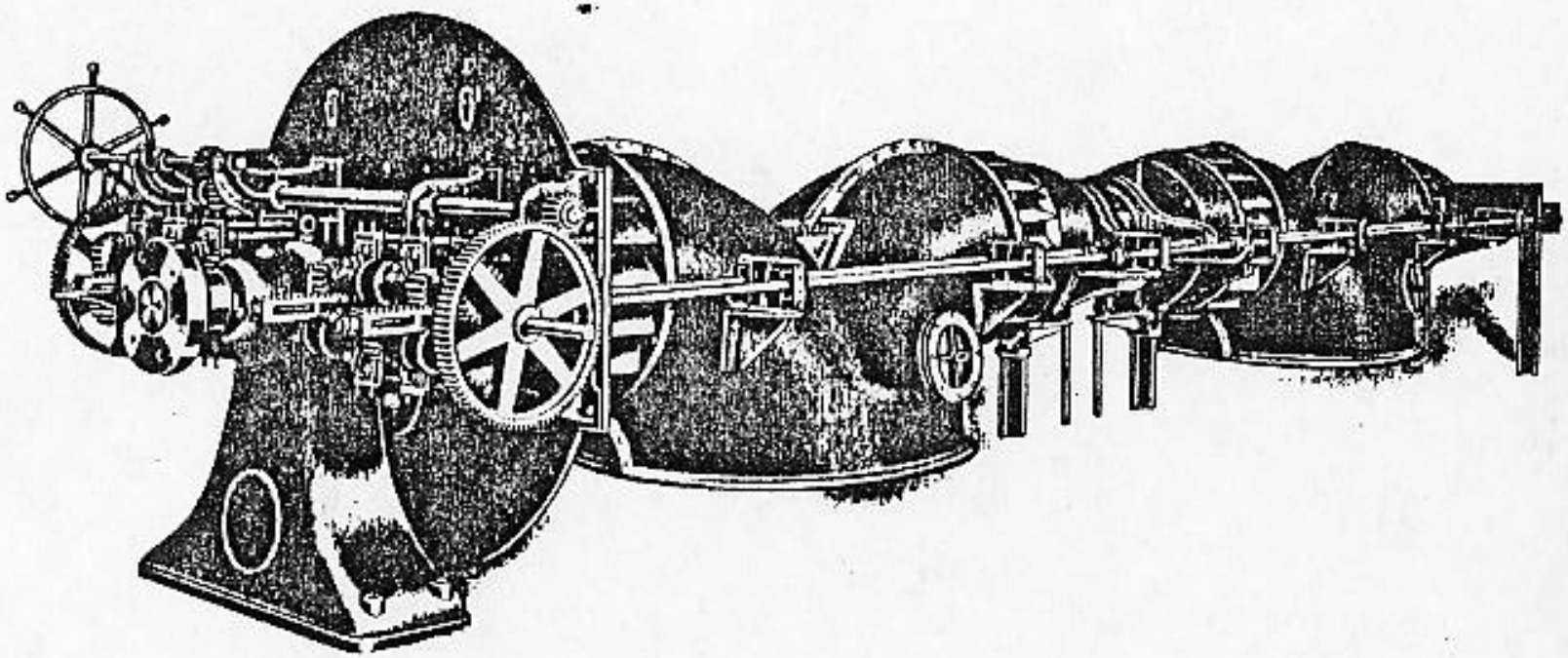


Plate No. 19

Two Type C and two Type D Cylinder Gate Hercules Turbines filling requirements for power and revolutions. Three units for the Bigelow Carpet Co., Lowell, Mass.

## WEIR TABLE

From one-eighth inch in depth to twenty-five inches in depth, giving the discharge of a weir one inch in length, in cubic feet per minute, by the Francis formula for weirs without end contractions

| Inches | 0 | 1-8 | 2-8 | 3-8 | 4-8 | 5-8 | 6-8 | 7-8 |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.02 | 0.05 | 0.09 | 0.14 | 0.20 | 0.26 | 0.33 |
| 1 | 0.40 | 0.48 | 0.56 | 0.65 | 0.74 | 0.83 | 0.93 | 1.03 |
| 2 | 1.14 | 1.24 | 1.35 | 1.47 | 1.58 | 1.71 | 1.82 | 1.96 |
| 3 | 2.08 | 2.21 | 2.35 | 2.48 | 2.63 | 2.76 | 2.90 | 3.06 |
| 4 | 3.20 | 3.36 | 3.51 | 3.67 | 3.82 | 3.98 | 4.15 | 4.31 |
| 5 | 4.48 | 4.65 | 4.81 | 4.99 | 5.16 | 5.35 | 5.52 | 5.71 |
| 6 | 5.89 | 6.06 | 6.26 | 6.44 | 6.64 | 6.83 | 7.01 | 7.22 |
| 7 | 7.41 | 7.62 | 7.82 | 8.03 | 8.23 | 8.42 | 8.64 | 8.85 |
| 8 | 9.07 | 9.27 | 9.48 | 9.71 | 9.92 | 10.15 | 10.36 | 10.60 |
| 9 | 10.81 | 11.03 | 11.27 | 11.49 | 11.74 | 11.96 | 12.18 | 12.43 |
| 10 | 12.66 | 12.91 | 13.14 | 13.39 | 13.63 | 13.86 | 14.12 | 14.36 |
| 11 | 14.62 | 14.86 | 15.10 | 15.37 | 15.61 | 15.88 | 16.13 | 16.40 |
| 12 | 16.65 | 16.90 | 17.18 | 17.43 | 17.71 | 17.97 | 18.22 | 18.51 |
| 13 | 18.77 | 19.05 | 19.31 | 19.60 | 19.87 | 20.13 | 20.43 | 20.69 |
| 14 | 20.99 | 21.26 | 21.53 | 21.83 | 22.11 | 22.41 | 22.68 | 22.99 |
| 15 | 23.27 | 23.55 | 23.86 | 24.14 | 24.45 | 24.74 | 25.02 | 25.34 |
| 16 | 25.62 | 25.94 | 26.23 | 26.55 | 26.85 | 27.14 | 27.46 | 27.76 |
| 17 | 28.08 | 28.38 | 28.68 | 29.01 | 29.31 | 29.64 | 29.95 | 30.28 |
| 18 | 30.59 | 30.89 | 31.23 | 31.54 | 31.88 | 32.19 | 32.50 | 32.85 |
| 19 | 33.16 | 33.51 | 33.82 | 34.17 | 34.49 | 34.81 | 35.16 | 35.48 |
| 20 | 35.84 | 36.16 | 36.48 | 36.84 | 37.17 | 37.53 | 37.85 | 38.22 |
| 21 | 38.55 | 38.88 | 39.24 | 39.57 | 39.94 | 40.28 | 40.61 | 40.98 |
| 22 | 41.32 | 41.69 | 42.03 | 42.41 | 42.75 | 43.09 | 43.47 | 43.81 |
| 23 | 44.19 | 44.54 | 44.89 | 45.27 | 45.62 | 46.00 | 46.35 | 46.74 |
| 24 | 47.09 | 47.45 | 47.84 | 48.19 | 48.58 | 48.94 | 49.30 | 49.69 |

## MEASUREMENT OF WATER POWERS

The weir table is used to ascertain the quantity of water passing over a weir or dam. The above table for weirs gives the number of cubic feet per minute that will pass over a weir, *without end contractions*, one inch wide and from one-eighth inch to twenty-four and seven-eighths inches deep.

By multiplying the number of cubic feet that one inch in width will discharge, as stated in table, by the width of the weir in inches, the result will be the total discharge of the weir per minute. The depth on the weir should be measured at a point just back of where the curve on the surface of the water commences.

Where it is not convenient to construct a weir, an estimate sufficiently correct for ordinary purposes may be obtained by multiplying the area of the cross-section of the stream by its average velocity.

The area of the cross-section is the width of the stream multiplied by the average depth.

# Table

Showing the theoretical spouting velocity of water in feet per second and number of cubic feet discharged per minute, through an orifice of one inch area, under different heads, from one to forty feet, computed from Francis' formula

| Head in feet | Velocity per second in feet | Cubic feet per minute, area of orifice, 1 in. | Head in feet | Velocity per second in feet | Cubic feet per minute, area of orifice, 1 in. | Head in feet | Velocity per second in feet | Cubic feet per minute, area of orifice, 1 in. | Head in feet | Velocity per second in feet | Cubic feet per minute, area of orifice, 1 in. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8.02 | 3.34 | 11 | 26.60 | 11.08 | 21 | 36.75 | 15.31 | 31 | 44.65 | 18.60 |
| 2 | 11.34 | 4.73 | 12 | 27.78 | 11.57 | 22 | 37.62 | 15.66 | 32 | 45.37 | 18.90 |
| 3 | 13.89 | 5.78 | 13 | 28.91 | 12.05 | 23 | 38.46 | 16.02 | 33 | 46.07 | 19.20 |
| 4 | 16.04 | 6.68 | 14 | 30.00 | 12.49 | 24 | 39.29 | 16.36 | 34 | 46.76 | 19.48 |
| 5 | 17.93 | 7.47 | 15 | 31.06 | 12.94 | 25 | 40.10 | 16.71 | 35 | 47.45 | 19.76 |
| 6 | 19.64 | 8.18 | 16 | 32.08 | 13.36 | 26 | 40.89 | 17.04 | 36 | 48.12 | 20.05 |
| 7 | 21.22 | 8.84 | 17 | 33.06 | 13.77 | 27 | 41.67 | 17.36 | 37 | 48.78 | 20.33 |
| 8 | 22.68 | 9.45 | 18 | 34.02 | 14.18 | 28 | 42.43 | 17.68 | 38 | 49.44 | 20.60 |
| 9 | 24.06 | 10.02 | 19 | 34.90 | 14.57 | 29 | 43.19 | 17.98 | 39 | 50.08 | 20.87 |
| 10 | 25.36 | 10.57 | 20 | 35.87 | 14.94 | 30 | 43.93 | 18.30 | 40 | 50.72 | 21.13 |

The above table gives the theoretical discharge where the sides of the orifice are supposed to conform to the shape of the contracted vein. In ordinary practice through orifices having parallel sides, the actual velocity and discharge will be about sixty-four per cent. of the table.

There are many instances in powers already improved where the quantity of water in a stream can be ascertained by using the above table, without resorting to measurement by weir.

In ascertaining the head of water under which an orifice is discharging, measure from the surface of the water to the center of the orifice.

## Areas and Circumferences of Circles

| Diam. in Inches | Circ'm in Ft. In. | Area in Square Inches | Diam. in Ft. In. | Circ'm in Ft. In. | Area in Square Feet | Diam. in Ft. In. | Circ'm in Ft. In. | Area in Square Feet |
|---|---|---|---|---|---|---|---|---|
| 1 | 3⅛ | .7854 | 1 7 | 4 11⅝ | 1.9847 | 3 6 | 10 11⅛ | 9.621 |
| 1¼ | 3⅞ | 1.227 | 1 7½ | 5 1¼ | 2.0904 | 3 6½ | 11 1½ | 9.852 |
| 1½ | 4⅝ | 1.767 | 1 8 | 5 2⅞ | 2.1990 | 3 7 | 11 3 | 10.084 |
| 1¾ | 5⅜ | 2.405 | 1 8½ | 5 4⅜ | 2.3103 | 3 7½ | 11 4⅝ | 10.320 |
| 2 | 6¼ | 3.141 | 1 9 | 5 5⅞ | 2.4244 | 3 8 | 11 6¼ | 10.559 |
| 2¼ | 7 | 3.976 | 1 9½ | 5 7½ | 2.5412 | 3 8½ | 11 7¾ | 10.800 |
| 2½ | 7¾ | 4.905 | 1 10 | 5 9⅛ | 2.6608 | 3 9 | 11 9⅜ | 11.044 |
| 2¾ | 8⅝ | 5.939 | 1 10½ | 5 10⅝ | 2.7632 | 3 9½ | 11 10⅞ | 11.291 |
| 3 | 9⅜ | 7.068 | 1 11 | 6 0¼ | 2.8903 | 3 10 | 12 0½ | 11.534 |
| 3¼ | 10¼ | 8.295 | 1 11½ | 6 1¾ | 3.0129 | 3 10½ | 12 2 | 11.793 |
| 3½ | 11 | 9.621 | 2 0 | 6 3⅜ | 3.1418 | 3 11 | 12 3⅝ | 12.048 |
| 3¾ | 11¾ | 11.044 | 2 0½ | 6 4⅞ | 3.2731 | 3 11½ | 12 5¼ | 12.305 |
| 4 | 1 0½ | 12.566 | 2 1 | 6 6½ | 3.4081 | 4 0 | 12 6¼ | 12.566 |
| 4¼ | 1 1⅜ | 14.186 | 2 1½ | 6 8⅛ | 3.5468 | 4 0½ | 12 8⅛ | 12.829 |
| 4½ | 1 2⅛ | 15.904 | 2 2 | 6 9⅝ | 3.6870 | 4 1 | 12 9⅞ | 13.095 |
| 4¾ | 1 2⅞ | 17.720 | 2 2½ | 6 11¼ | 3.8302 | 4 1½ | 12 11½ | 13.364 |
| 5 | 1 3⅝ | 19.635 | 2 3 | 7 0¾ | 3.9761 | 4 2 | 13 1 | 13.635 |
| 5¼ | 1 4½ | 21.647 | 2 3½ | 7 2⅜ | 4.1241 | 4 2½ | 13 2⅝ | 13.909 |
| 5½ | 1 5¼ | 23.758 | 2 4 | 7 3⅞ | 4.2760 | 4 3 | 13 4¼ | 14.186 |
| 5¾ | 1 6 | 25.967 | 2 4½ | 7 5½ | 4.4302 | 4 3½ | 13 5¾ | 14.465 |
| 6 | 1 6¾ | 28.274 | 2 5 | 7 7 | 4.5861 | 4 4 | 13 7⅜ | 14.745 |
| 6½ | 1 8⅛ | 33.183 | 2 5½ | 7 8⅝ | 4.7467 | 4 4½ | 13 8⅞ | 15.033 |
| 7 | 1 10 | 38.484 | 2 6 | 7 10¼ | 4.9061 | 4 5 | 13 10½ | 15.320 |
| 7½ | 1 11½ | 44.178 | 2 6½ | 7 11¾ | 5.0731 | 4 5½ | 14 0 | 15.611 |
| 8 | 2 1⅛ | 50.265 | 2 7 | 8 1⅜ | 5.2278 | 4 6 | 14 1⅝ | 15.904 |
| 8½ | 2 2⅝ | 56.745 | 2 7½ | 8 2⅞ | 5.4112 | 4 6½ | 14 3¼ | 16.200 |
| 9 | 2 4¼ | 63.617 | 2 8 | 8 4½ | 5.5850 | 4 7 | 14 4¾ | 16.498 |
| 9½ | 2 5¾ | 70.882 | 2 8½ | 8 6⅛ | 5.7601 | 4 7½ | 14 6⅜ | 16.800 |
| 10 | 2 7⅜ | 78.540 | 2 9 | 8 7⅝ | 5.9398 | 4 8 | 14 7⅞ | 17.104 |
| 10½ | 2 8⅞ | 86.590 | 2 9½ | 8 9¼ | 6.1201 | 4 8½ | 14 9½ | 17.411 |
| 11 | 2 10½ | 95.789 | 2 10 | 8 10¾ | 6.3051 | 4 9 | 14 11 | 17.720 |
| 11½ | 3 0⅛ | 104.688 | 2 10½ | 9 0⅛ | 6.4911 | 4 9½ | 15 0⅝ | 18.033 |
| 12 | 3 1⅝ | 113.990 | 2 11 | 9 1⅞ | 6.6815 | 4 10 | 15 2¼ | 18.347 |
| 12½ | 3 3¼ | 123.696 | 2 11½ | 9 3½ | 6.8738 | 4 10½ | 15 3¾ | 18.665 |
| 13 | 3 4¾ | 133.790 | 3 0 | 9 5 | 7.0688 | 4 11 | 15 5¼ | 18.985 |
| 13½ | 3 6⅜ | 144.273 | 3 0½ | 9 6⅝ | 7.2664 | 4 11½ | 15 6⅞ | 19.309 |
| 14 | 3 7⅞ | 155.160 | 3 1 | 9 8¼ | 7.4661 | 5 0 | 15 8½ | 19.635 |
| 14½ | 3 9½ | 166.593 | 3 1½ | 9 9⅞ | 7.6691 | 5 0½ | 15 10 | 19.963 |
| 15 | 3 11⅛ | 178.128 | 3 2 | 9 11⅜ | 7.8681 | 5 1 | 15 11⅝ | 20.294 |
| 15½ | 4 0⅝ | 190.195 | 3 2½ | 10 0⅞ | 8.0846 | 5 1½ | 16 1¼ | 20.629 |
| 16 | 4 2¼ | 202.665 | 3 3 | 10 2½ | 8.2951 | 5 2 | 16 2¾ | 20.965 |
| 16½ | 4 3¾ | 215.524 | 3 3½ | 10 4 | 8.5091 | 5 2½ | 16 4¼ | 21.305 |
| 17 | 4 5⅜ | 228.787 | 3 4 | 10 5⅝ | 8.7269 | 5 3 | 16 5⅞ | 21.647 |
| 17½ | 4 6⅞ | 242.438 | 3 4½ | 10 7¼ | 8.9462 | 5 3½ | 16 7½ | 21.992 |
| 18 | 4 8½ | 256.492 | 3 5 | 10 8¾ | 9.1686 | 5 4 | 16 9 | 22.333 |
| 18½ | 4 10⅛ | 270.950 | 3 5½ | 10 10⅜ | 9.3936 | 5 4½ | 16 10⅝ | 22.621 |

## Areas and Circumferences of Circles

| Diam. in Ft. In. | Circ'm in Ft. In. | Area in Square Feet | Diam. in Ft. In. | Circ'm in Ft. In. | Area in Square Feet | Diam. in Ft. In. | Circ'm in Ft. In. | Area in Square Feet |
|---|---|---|---|---|---|---|---|---|
| 5 5 | 17 0⅛ | 23.043 | 7 8 | 24 1⅜ | 46.1638 | 11 6 | 36 1½ | 103.8691 |
| 5 5½ | 17 1¾ | 23.330 | 7 9 | 24 4⅛ | 47.1730 | 11 7 | 36 4½ | 105.3794 |
| 5 6 | 17 3⅜ | 23.758 | 7 10 | 24 7¼ | 48.1926 | 11 8 | 36 7¾ | 106.9013 |
| 5 6½ | 17 4⅞ | 24.119 | 7 11 | 24 10⅜ | 49.2236 | 11 9 | 36 10⅛ | 108.4342 |
| 5 7 | 17 6½ | 24.483 | 8 0 | 25 1½ | 50.2656 | 11 10 | 37 2¾ | 109.9772 |
| 5 7½ | 17 8 | 24.850 | 8 1 | 25 4⅝ | 51.3178 | 11 11 | 37 5¼ | 111.5319 |
| 5 8 | 17 9⅝ | 25.220 | 8 2 | 25 7⅞ | 52.3816 | 12 0 | 37 8⅜ | 113.0976 |
| 5 8½ | 17 11⅜ | 25.592 | 8 3 | 25 11 | 53.4562 | 12 1 | 37 11½ | 114.6732 |
| 5 9 | 18 0¾ | 25.964 | 8 4 | 26 2⅛ | 54.5412 | 12 2 | 38 2⅝ | 116.2607 |
| 5 9½ | 18 2¼ | 26.344 | 8 5 | 26 5¼ | 55.6377 | 12 3 | 38 5¾ | 117.8590 |
| 5 10 | 18 3⅞ | 26.725 | 8 6 | 26 8⅜ | 56.7451 | 12 4 | 38 8⅞ | 119.4674 |
| 5 10½ | 18 5½ | 27.108 | 8 7 | 26 11½ | 57.8628 | 12 5 | 39 0 | 121.0876 |
| 5 11 | 18 7 | 27.494 | 8 8 | 27 2¾ | 58.9920 | 12 6 | 39 3¼ | 122.7187 |
| 5 11½ | 18 8⅝ | 27.883 | 8 9 | 27 5¾ | 60.1321 | 12 7 | 39 6⅜ | 124.3598 |
| 6 0 | 18 10⅛ | 28.274 | 8 10 | 27 9 | 61.2826 | 12 8 | 39 9½ | 126.0127 |
| 6 0½ | 18 11¾ | 28.663 | 8 11 | 28 0⅛ | 62.4445 | 12 9 | 40 0⅝ | 127.6765 |
| 6 1 | 19 1¼ | 29.065 | 9 0 | 28 3¼ | 63.6174 | 12 10 | 40 3¾ | 129.3504 |
| 6 1½ | 19 2⅞ | 29.466 | 9 1 | 28 6⅜ | 64.8006 | 12 11 | 40 6⅞ | 131.0360 |
| 6 2 | 19 4½ | 29.867 | 9 2 | 28 9½ | 65.9951 | 13 0 | 40 10 | 132.7326 |
| 6 2½ | 19 6 | 30.271 | 9 3 | 29 0⅝ | 67.2007 | 13 1 | 41 1⅛ | 134.4391 |
| 6 3 | 19 7⅝ | 30.679 | 9 4 | 29 3¾ | 68.4166 | 13 2 | 41 4⅜ | 136.1574 |
| 6 3½ | 19 9⅛ | 31.090 | 9 5 | 29 7 | 69.6440 | 13 3 | 41 7½ | 137.8867 |
| 6 4 | 19 10¾ | 31.503 | 9 6 | 29 10⅛ | 70.8823 | 13 4 | 41 10⅝ | 139.6260 |
| 6 4½ | 20 0¼ | 31.919 | 9 7 | 30 1¼ | 72.1309 | 13 5 | 42 1⅝ | 141.3771 |
| 6 5 | 20 1⅞ | 32.337 | 9 8 | 30 4⅜ | 73.3910 | 13 6 | 42 4⅞ | 143.1391 |
| 6 5½ | 20 3½ | 32.759 | 9 9 | 30 7½ | 74.6620 | 13 7 | 42 8 | 144.9111 |
| 6 6 | 20 5 | 33.183 | 9 10 | 30 11⅝ | 75.9433 | 13 8 | 42 11⅛ | 146.6949 |
| 6 6½ | 20 6½ | 33.619 | 9 11 | 31 1¼ | 77.2362 | 13 9 | 43 2¼ | 148.4896 |
| 6 7 | 20 8⅛ | 34.039 | 10 0 | 31 5 | 78.5400 | 13 10 | 43 5½ | 150.2943 |
| 6 7½ | 20 9¾ | 34.471 | 10 1 | 31 8⅛ | 79.8540 | 13 11 | 43 8⅝ | 152.1109 |
| 6 8 | 20 11¼ | 34.906 | 10 2 | 31 11¼ | 81.1795 | 14 0 | 43 11¾ | 153.9384 |
| 6 8½ | 21 0⅞ | 35.344 | 10 3 | 32 2⅜ | 82.5160 | 14 1 | 44 2⅞ | 155.7758 |
| 6 9 | 21 2½ | 35.784 | 10 4 | 32 5¼ | 83.8627 | 14 2 | 44 6 | 157.6250 |
| 6 9½ | 21 4 | 36.227 | 10 5 | 32 8⅝ | 85.2000 | 14 3 | 44 9⅛ | 159.4852 |
| 6 10 | 21 5½ | 36.674 | 10 6 | 32 11¼ | 86.5880 | 14 4 | 45 0¼ | 161.3553 |
| 6 10½ | 21 7⅛ | 37.122 | 10 7 | 33 2⅜ | 87.9697 | 14 5 | 45 3½ | 163.2373 |
| 6 11 | 21 8¾ | 37.573 | 10 8 | 33 6⅛ | 89.3608 | 14 6 | 45 6⅝ | 165.1303 |
| 6 11½ | 21 10¼ | 38.027 | 10 9 | 33 9¼ | 90.7627 | 14 7 | 45 9¾ | 167.0331 |
| 7 0 | 21 11⅞ | 38.4846 | 10 10 | 34 0⅜ | 92.1749 | 14 8 | 46 0⅞ | 168.9479 |
| 7 1 | 22 3 | 39.4060 | 10 11 | 34 3½ | 93.5986 | 14 9 | 46 4 | 170.8735 |
| 7 2 | 22 6⅛ | 40.3388 | 11 0 | 34 6⅝ | 95.0334 | 14 10 | 46 7⅛ | 172.8091 |
| 7 3 | 22 9¼ | 41.2825 | 11 1 | 34 9¾ | 96.4783 | 14 11 | 46 11¼ | 174.7565 |
| 7 4 | 23 0⅜ | 42.2367 | 11 2 | 35 0⅞ | 97.9347 | 15 0 | 47 1½ | 176.7150 |
| 7 5 | 23 2⅛ | 43.2022 | 11 3 | 35 4⅛ | 99.4021 | 15 1 | 47 4⅝ | 178.6832 |
| 7 6 | 23 6¾ | 44.1787 | 11 4 | 35 7¼ | 100.8797 | 15 2 | 47 7¾ | 180.6634 |
| 7 7 | 23 11 | 45.1656 | 11 5 | 35 10⅝ | 102.3689 | 15 3 | 47 10⅞ | 182.6545 |

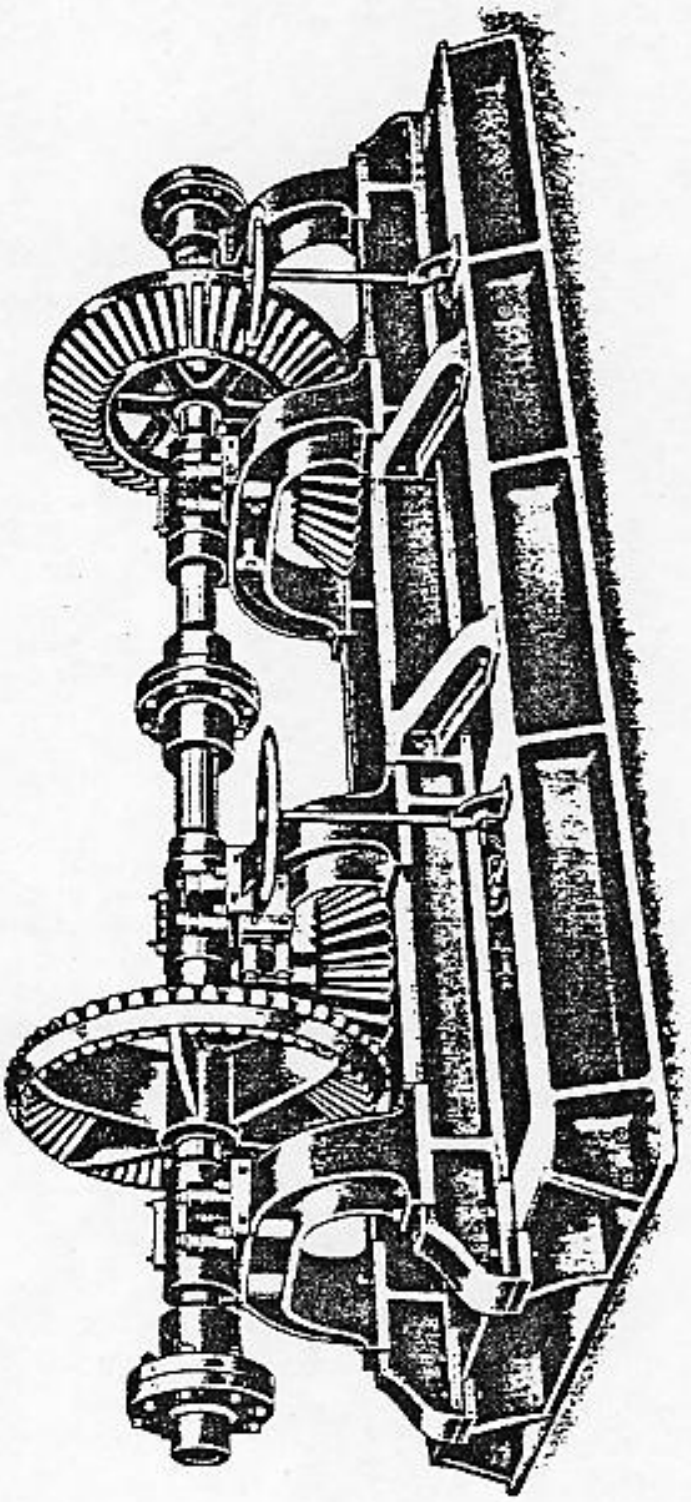


Plate No. 20

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We recommend their use wherever Gears are used as the only proper way of holding them securely.

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