to evolve a formula for the derivation of carrying capacity of any size of screw conveyer at any speed, expressed in terms of the square of the diameter of the screw, the pitch of the screw and the revolutions made by the screw in a given time. As the pitch and diameter of the screw are usually equal, the variable quantities are simply those of size of conveyer (diameter of screw) and speed of conveyer (revolutions of screw). Such relationship is expressed in Formulæ VI. and VII., the former giving the capacity in terms of bushels per hour and the latter in terms of tons per hour.

Table III.

Capacity of Screw Conveyers, Continuously and Uniformly Loaded.

Diameter of Screw	Speed R.P.M.	Bushels per hour	Diameter of Screw	Speed R.P.M.	Bushels per hour
4″	220	125	12″	150	2,250
5″	205	220	14″	140	3,400
6″	195	370	16″	130	4,700
7″	185	550	18″	120	6,000
8″	175	800	20″	115	8,000
9″	170	1,100	24″	100	12,000
10″	160	1,400			

Table IV.

Capacity of Screw Conveyers, Continuously and Uniformly Loaded.

Handling material weighing 100 lbs. per cu. ft.

Diameter of Screw	Speed R.P.M.	Tons per hour	Diameter of Screw	Speed R.P.M.	Tons per hour.
4″	220	4.5	12″	150	83.3
5″	205	8.3	14″	140	123.5
6″	195	13.5	16″	130	171.0
7″	185	20.4	18″	120	225.0
8″	175	28.8	20″	115	295.0
9″	170	40.0	24″	100	444.0
10″	160	51.4			

$B = 0.0088022\ d^3R$ Formula VI.

$W = 0.000003213\ d^3w'R$ Formula VII.

Where :—

B = Capacity in bushels per hour.
W = Capacity in tons per hour.
d = Diameter of screw in inches—size of Conveyer.
w' = Weight of material conveyed in pounds per cubic foot.
R = Revolutions of screw per minute.

The consumption of power by screw conveyers is naturally relatively high on account of the low mechanical efficiency of the screw; that is, the power requirements are similar to those of an ordinary flight or scraper conveyer corrected for the inclined plane action of the screw construction to which must be added the loss of power or thrust due to the mechanical inefficiency of the screw. The power consumed in running the empty conveyer is not affected by the pitch of the screw, of course, being virtually that required to revolve the screw at the required speed, but the greater power requirements for propelling the load depend directly upon the pitch of the screw and must be corrected accordingly. Theoretically there is also a difference in power consumption by screw conveyers depending upon the nature of the material handled, its weight, angle of repose, etc. Practically, however, no great variations are found in power requirements of screw conveyers handling different materials as ordinarily installed and subjected to the abuse to which such apparatus is invariably submitted. Though formulæ have been derived which provide for varying power requirements by the substitution of various constants for conveyers destined to carry specific materials, the following formula (Formula VIII.) gives approximately accurate results for ascertaining the power requirements of practically any screw conveyer handling suitable material at advisable speeds. This formula allows for an inclination to the conveyer (elevating the material) which allowance is about equal to the amount that would be required to simply raise the specified weight through a vertical distance equal to the difference in elevation between the two ends of the conveyer. Actually, some additional power might be required, owing to appreciable increase in thrust on conveyer bearings, but the capacity of the conveyer is also somewhat reduced by any inclination so that the derived horse-power is practically accurate for the load actually conveyed. As much of the material that is frequently handled by screw conveyers is customarily measured in bushels rather than in tons, Formula IX. will be found to be of convenience when such unit is the base of measure. Chart II., giving the power requirements for screw conveyers in both terms of tonnage capacity and of capacity in bushels, will also be found to be of decided assistance. The accuracy of chart reading is not as great, of course, as is attainable when relying upon formulæ, but, for all practical purposes, such readings are sufficiently accurate.

Horse-power:

W = Weight of load conveyed in tons per hour = $0.00015065\ d^3R$ (aver.)
V = Velocity (speed) of Conveyer in feet per minute = $0.2618\ dR$
d = Diameter of Conveyer (screw) in inches.
L = Length of Conveyer in feet.
H = Height to which load is elevated in feet.
R = Revolutions of screw per minute.
W_s = Weight of moving parts per foot of Conveyer in pounds.
= $0.1\ d^2$—average value.
W' = Weight of load conveyed per foot of Conveyer in pounds per minute.

$$= \frac{33\ W}{V}$$

f_s = speed factor = 0.09—from experiment.
f_l = load factor = 0.70—from experiment.
d' = diameter of screw shaft in inches = $0.15d$—average value.
V' = Velocity of screw shaft in feet per minute = $0.03927\ dR$.

Work in foot pounds per minute required to run Conveyer empty.
= $W_s \times f_s \times V' \times L = 0.00035303\ d^3RL = 2.343\ WL$—av. value.

Work in foot pounds per minute required to convey load.
= $W' \times f_l \times V \times L \times 0.3183 = 7.35\ WL$ (neglecting inefficiency).
= $20.1\ WL$ (correcting for inefficiency of screw).

Horsepower required to elevate load (inclined conveyer).

$$= \frac{WH}{1000}$$

Then :—
Total horsepower required.

$$HP = \frac{0.68\ WL + WH}{1000} \quad \text{Formula VIII.}$$

$$HP = \frac{0.017\ BL + 0.025\ BH}{1000} \quad \text{Formula IX.}$$

B = Load conveyed in bushels per hour.

The standardization of screw conveyers in the matter of pitch and the large factor of safety that must be used in proportioning the various parts of the screw, etc., in order to permit economical manufacture, has created a close relationship between the weight of the screw, hangers, bearings, driving mechanism, etc., and the size of the conveyer and correspondingly a close relationship between the average cost of such parts and the diameter of the screw, size of conveyer. Likewise, the trough is usually a comparatively heavy casing slightly larger than the screw or a relatively large box with a correspondingly light lining, so that the cost of the stationary parts of a screw conveyer also vary closely with the size of the conveyer. For rough approximations, sufficiently accurate