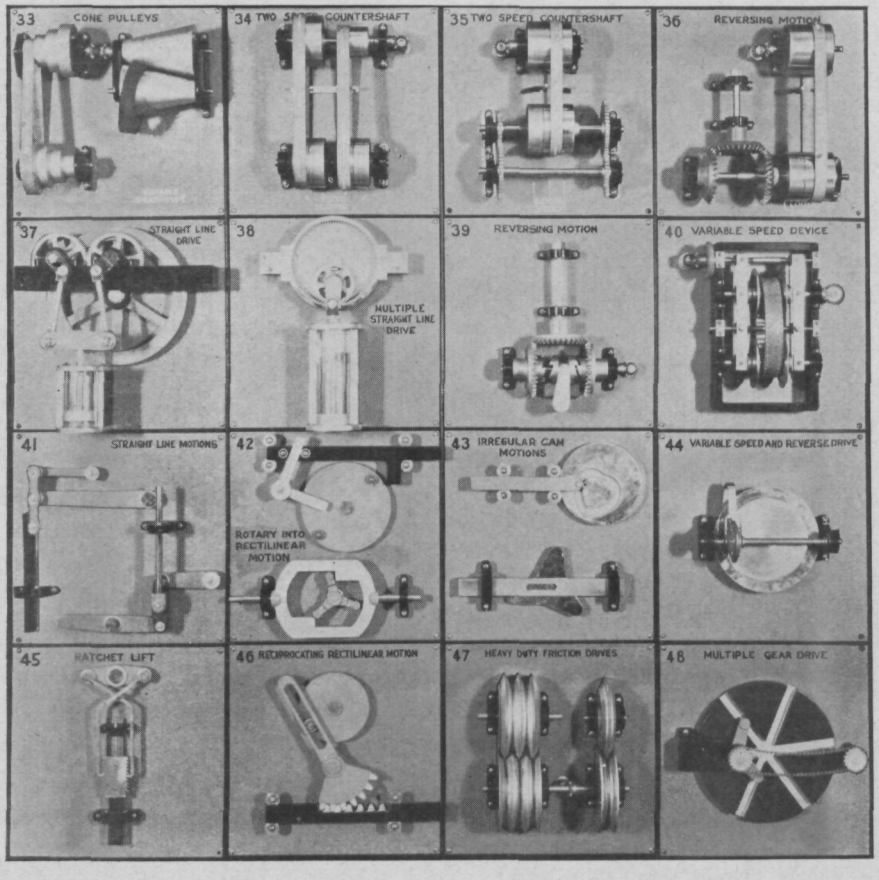

SECTION III Nos. 33—48

Countershafts, straight line motions, variable speed devices, cam and miscellaneous motions.

Section III

33. Cone pulleys. Step type. The top pulley is the driver. The rate of speed depends upon the diameter of the pulleys. The lower shaft revolves the slower because the belt is on the small pulley of driver and large pulley of the lower or driven shaft. The speed is reversed when belt is on large pulley at top and small pulley below.

Variable speed type. The upper cone pulley is the driver and has a constant speed. The position of the belt regulates the speed of the lower cone, making it variable. When the belt is on the left, the speed is minimum and, as it travels along the cone to the right, it increases proportionally as the diameter of the lower cone.

34. Two speed counter shaft. This model is so constructed that two speeds may be transmitted by means of belts, the speed being directly proportional to the diameter of the driving pulley. The upper shaft, with a constant speed, is the driver and has two tight pulleys of varying diameters, A being twice that of B. On the lower or countershaft are four pulleys, the two outer ones are loose and the two inner ones are fixed to the shaft. When the belt on the left is on the loose pulley and is idle, the one on the right is in driving position; therefore a slow motion is transmitted to the lower shaft because the speed obtained is that of the smaller driving pulley above. By shifting the belts, the speed is doubled, because it takes that of the larger driving pulley.

35. Two speed countershaft. No. **35** achieves the same result as No. **34** though the construc-

tion is different. The upper shaft is again the driver with a constant speed. On the countershaft are three pulleys, A, B, and C. A and C are fixed, B is loose. Pulley A is connected with the small gear on the left and pulley C with the large gear on the right. When the belt is on pulley B, there is no motion transmitted because the pulley is loose from shaft. When on C, the large gear rotates and the smaller one below meshes with it. Since the small gear has only one fourth as many grooves as the larger, it must go four times as fast to make a complete revolution with the larger gear. Therefore the speed transmitted to the bottom shaft is maximum. When the belt is on pulley A, the small gear on left rotates, causing the large gear below to mesh with it. Now the speed is reversed because of the relation of these two gears. Gears used are the spur type with grooves parallel to shaft. The use for this arrangement is the same as that in No. **34** where power is transmitted by belts and change in speed is needed.

36. Reversing motion. Pulleys A, B and C are arranged like those in No. **35,** center loose, and two others fixed. Belt is driven by upper shaft and when it drives pulley A, the vertical shaft travels clockwise. Watch meshing of gears. When belt is on pulley B, there is no transmitted motion, and action of belt on pulley C produces a counter clockwise rotation of the vertical shaft. Left hand gear is connected with pulley C, and right hand gear with pulley A. All three gears are miter gears, having grooves at a 45° angle to the shaft.

37. Straight line drive. Large fly wheel is on

driving shaft, small gear at its center meshes with large gear above which in turn meshes with another gear of equal size. The motion of the two connecting rods attached to these by means of crank arms, brings about a straight line drive on the piston rod. This motion is very powerful, due to the transformation of high speed to low speed. This mechanism is used where great pressure is needed and in high power pumps. It was patented by Dr. Cartwright in 1787 and was used mostly on steam engine piston rods.

38. Multiple straight line drive. This straight line drive is not as forceful as that of No. **37.** The small gear driven by crank pin in red disk, meshes with the large internal gear, thus increasing the speed. An added advantage of this motion is the great multiplication of the distance traveled by piston rod.

39. Reversing motion. By the use of a toothed clutch, motion is reversed as in No. **36.** The lower shaft is driving, and as the clutch member guided by the red arm engages with gear A, the vertical shaft goes clockwise. As gear B is engaged, the motion of vertical shaft is reversed.

40. Variable speed device. This device is used extensively in variable speed machines where change of speed is desired by simply adjusting red wheel by hand. This turns the right and left hand screw, which adjusts the distance between the upper set of conical flanges. The leather belt is faced with wooden strips, having edges cut to fit the angle of the conical flanges. The upper shaft is the driver and when the flanges riding on this are close together, the belt

is forced to a larger diameter on the upper set, but to a correspondingly smaller diameter on the lower set. This transmits a higher speed to the lower shaft. To slacken speed, it is only necessary to turn hand wheel and change position of upper flanges.

41. Straight line motions. With slight variation in construction, two oscillating horizontal arms, if pinned in a straight line with the vertical rod, produce a straight line motion of this rod. This linkage maintains straight line movement where desired.

42. Rotary into rectilinear motion. In both these models, a rotary motion is transmitted into a rectilinear motion. In the upper model, the two studs on the rotating disk strike the elbow shaped arm or bell crank (See No. **10**) in rotation and it in turn works between the two studs on the horizontal bar, pushing it back and forth across a field.

The rectilinear motion of the lower model is caused by the three projections revolving inside of the horizontal shaft. The motion in both also alternates back and forth.

43. Irregular cam motion. The definition of a cam is given on page **67.** The shape of the cam on this revolving disk determines the motion of the rod on bar. Various shapes may be used, depending upon the special motion required.

The cam in the lower model simply suggests another motion.

44. Variable speed and reverse drive. The

revolving disk is the driver, transmitting power to shaft carrying vertical wheel. This form of drive does two things—it varies the speed and reverses the motion of the driven shaft. The vertical wheel increases in speed as it is moved away from the center and reverses as it crosses center of driving disk. Such a device has been used on automobiles and does away with shifting gears, but it has not been found practical because of the high friction.

45. Ratchet lift. As the red lever oscillates, it operates two hooked pawls on the ratchet bar A and lifts the bar. The slot serves as a guide. Used in various ways where it is desirable to hold work at different levels of operation and in fixed position because ratchet only operates in one direction.

46. Reciprocating rectilinear motion. This combination gives a slow advance and quick return motion to reciprocating bar A. The pin in revolving disk as it changes position working inside the slotted arm causes this reciprocating motion.

47. Heavy duty friction drives. These drives have a large friction area so that a good grip is made between the two members. These types are used wherever friction drives are necessary.

48. Multiple gear drive. This model illustrates a method for reducing speed and obtaining an out of line or off center drive. The shaft carrying the three red arms revolves twice for one revolution of the green slotted disk.